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DE LOS FINES Y PROPÓSITOS DE EDUWEB, REVISTA DE TECNOLOGÍA DE INFORMACIÓN Y COMUNICACIÓN EN EDUCACIÓN

Eduweb, la revista de Tecnología de Información y Comunicación en Educación, es una publicación de carácter nacional e internacional de divulgación del conocimiento, del uso, aplicación y experiencias de las Tecnologías de la Información y Comunicación (TIC) en ambientes educativos. Con la revista se pretende divulgar las innovaciones que en materia de TIC están siendo implementadas y ensayadas en los diferentes niveles y modalidades del sistema educativo venezolano e iberoamericano. De igual manera contribuir a proyectar las experiencias de estudiantes de pre y postgrado, docentes, investigadores y especialistas en TIC en educación en la Universidad de Carabobo y en otras universidades de Venezuela y de otros países de Iberoamérica. Es una revista arbitrada e indexada adscrita al programa de la especialización en Tecnología de la Computación en Educación, de la Facultad de Ciencias de la Educación de la Universidad de Carabobo, registrada bajo el ISSN 1856-7576. Editada en formato impreso y digital.

Visión

Ser un espacio académico-científico de difusión y divulgación de las distintas tendencias del pensamiento universal ubicadas en el área de TIC en ambientes educativos, con altos niveles de calidad académica.

Misión

Promover y facilitar la difusión y divulgación de los productos de las investigaciones y experiencias de los docentes e investigadores de la Universidad de Carabobo y otras universidades del país y del mundo en el área de TIC en ambientes educativos; motivar la participación en redes comunes de información y publicación nacional e internacional; coordinar esfuerzos y velar por la calidad de las publicaciones a fin de procurar elevar el nivel académico del personal docente y de investigación mediante el desarrollo de trabajos de investigación como función esencial en su crecimiento académico.

Objetivos

Servir como órgano de divulgación de las TIC y su influencia en ambientes educativos. Estimular la producción intelectual no solo en los docentes e investigadores de la Universidad de Carabobo, sino también en otros centros de educación e investigación nacional e internacional.

Propiciar el intercambio cultural, académico, científico y tecnológico con otros centros de educación superior en Venezuela y el mundo.

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Editorial

Con la publicación del Volumen 19, Número 4, último ejemplar de este año 2025, celebramos el cierre de un ciclo editorial, como la continuidad de una tradición intelectual que se renueva en cada página.

Este número representa la culminación de un trayecto de reflexión compartida, donde el conocimiento se ha desplegado como un tejido vivo que enlaza pasado y presente, memoria y porvenir. Al ofrecer un resumen de los contenidos que nutrieron nuestros números anteriores, reafirmamos la vocación de este espacio como lugar de encuentro crítico y diálogo fecundo, en el que la palabra escrita se convierte en huella y promesa de nuevas búsquedas.

La educación, en su tránsito por las transformaciones tecnológicas de las últimas décadas, ha encontrado en la Inteligencia Artificial un horizonte de posibilidades inéditas. Lo que comenzó como la incorporación de herramientas digitales para ampliar el acceso y diversificar los recursos, hoy se despliega como un ecosistema inteligente capaz de acompañar procesos de aprendizaje personalizados, potenciar la reflexión crítica y abrir nuevas rutas de diálogo entre saberes humanos y capacidades algorítmicas. Este paso hacia la Inteligencia Artificial ha fortalecido la labor pedagógica, situando al conocimiento en un espacio dinámico donde la creatividad, la ética y la autonomía se entrelazan con la innovación tecnológica para redefinir el sentido mismo de educar en el siglo XXI.

Este recorrido editorial del Volumen 19, Nro. 1, 2 y 3 celebra la construcción de un horizonte crítico y humanista frente a los desafíos tecnológicos contemporáneos. La Revista Eduweb ha consolidado en el transcurso de este año 2025 un itinerario temático que refleja la transformación de la educación en diálogo con la tecnología digital y la Inteligencia Artificial.

Los tres primeros números se configuran como un mosaico de reflexiones críticas, investigaciones aplicadas y propuestas pedagógicas que ponen en evidencia la necesidad de repensar los modelos educativos frente a los desafíos de la era digital. Así podemos ver que en el Volumen 19, Número 1: en su primer número del año abrió con un énfasis en la innovación pedagógica y la integración de recursos digitales en los procesos de enseñanza-aprendizaje. Los artículos destacaron la importancia de las plataformas virtuales, el diseño de entornos colaborativos y la evaluación formativa mediada por tecnologías. Se subrayó cómo la educación híbrida y los recursos multimedia permiten ampliar la participación estudiantil y fomentar la autonomía en el aprendizaje. Mientras que el Volumen 19, Número 2, es decir, el segundo número profundizó en la ética digital y la formación docente frente a la Inteligencia Artificial. Aquí la revista reunió investigaciones sobre el impacto de los algoritmos en la educación, la necesidad de desarrollar competencias críticas en los estudiantes y la responsabilidad de los educadores en la mediación tecnológica. Se discutió la dicotomía entre automatización y humanismo, planteando la urgencia de marcos éticos que acompañen la incorporación de IA en las aulas. Por su parte el Volumen 19, Número 3 constituye el tercer número que se orientó hacia la transformación institucional y la cultura digital en la educación superior. Los artículos exploraron la gestión académica apoyada en sistemas inteligentes, la internacionalización de la investigación mediante plataformas digitales y la construcción de comunidades de aprendizaje globales. Se destacó la relevancia de la analítica de datos para la toma de decisiones y la necesidad de políticas inclusivas que garanticen acceso equitativo a la tecnología.

Temática predominante: educación digital y ética de la IA

La temática central de los números publicados se orientó hacia la educación digital como escenario de innovación pedagógica. En este marco, la Inteligencia Artificial aparece como catalizador de nuevas formas de aprendizaje y gestión académica.

Todo ello se articula con una reflexión crítica sobre la ética digital, que asegura inclusión, responsabilidad y humanismo en la práctica educativa. En conjunto, los tres números configuran un eje temático predominante: la convergencia entre educación y tecnología, con especial atención a la Inteligencia Artificial como catalizador de cambio. La revista ha insistido en que la innovación no puede desligarse de la reflexión ética, ni la digitalización de la educación puede reducirse a un mero uso instrumental de herramientas. Se trata de un proceso de reconfiguración epistemológica y pedagógica, donde la tecnología se convierte en mediadora de nuevas formas de aprender, enseñar y gestionar el conocimiento. Podemos resumir que el Número 1 tuvo como eje central la innovación pedagógica digital, representado en palabras clave tales como: Hibridación, multimedia y autonomía. Por su parte el Número 2 se centró en la ética y formación docente en IA, cuyas palabras clave predominantes fueron: Algoritmos, responsabilidad y humanismo. Finalmente, el Número 3 incorpora como eje central la cultura digital e institucional cuyas palabras clave fueron distribuidas en: Analítica de datos, inclusión y globalización

Como conclusión editorial expresamos que el recorrido por los tres primeros números del Volumen 19 muestra cómo la Revista Eduweb se ha convertido en un espacio de referencia para pensar la educación en clave digital. La temática predominante se relaciona en torno a la innovación pedagógica, la ética de la Inteligencia Artificial y la transformación institucional. De tal manera que celebramos la coherencia y la profundidad de las reflexiones publicadas, reafirmando el compromiso de la revista con una educación que, al integrar tecnología y ética, se proyecta hacia un futuro más inclusivo, crítico y humanista. Con el cierre de este año 2025, renovamos nuestra vocación editorial y damos la bienvenida a un nuevo ciclo de ideas, investigaciones y propuestas que seguirán contribuyendo al fortalecimiento de la educación en entornos digitales. Que el próximo año nos encuentre con renovado entusiasmo, creatividad colaborativa y una mirada estratégica para seguir construyendo conocimiento al servicio de la transformación educativa.

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Pensamiento Computacional: Impacto en el desarrollo de la creatividad del párvulo en contextos transcomplejos

Computational Thinking: Impact on the development of children's creativity in transcomplex contexts

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Resumen

Este artículo, analiza de forma narrativa y con una concepción epistemológica, la relación entre pensamiento computacional, desarrollo cognitivo y creatividad infantil en contextos transcomplejos de la educación parvularia en las salas interactivas sensoriales de la Universidad Autónoma de Chile. Cuyo propósito general fue Generar un eje socioeducativo basado en pensamiento computacional para el desarrollo de la creatividad de párvulos en contextos transcomplejos. El método utilizado fue el círculo hermenéutico de Gadamer. Además del apoyo de documentos clásicos empleados como base fundamental para evidenciar de forma sapiente las evidencias documentales la cual esboza su importancia, basándose en tres grandes categorías como son pensamiento computacional, desarrollo creativo del infante y desarrollo cognitivo del párvulo, donde emergieron varias subcategorías, axiomas subcategoriales y relación entre las categorías, llegando a la conclusión que el pensamiento computacional en el infante, desde una representación transcompleja, transige como una estrategia fundamental para el desarrollo integral del párvulo, vinculando habilidades cognitivas, creativas y socioemocionales con experiencias de aprendizaje interactivas, multisensoriales y contextualizadas.

Palabras clave: Aprendizaje, creatividad, enseñanza, pensamiento computacional, transcomplejidad.

Abstract

This article analyses in a narrative way and with an epistemological conception, the relationship between computational thinking: cognitive development and children's creativity in transcomplex contexts of kindergarten education in the interactive sensory rooms of the Universidad Autónoma de Chile. The method is Gadamer's hermeneutic circle. In addition to the support of classical documents used as a fundamental basis for sapiently evidencing the documentary evidence which outlines its importance in the need to understand the cohesion between computational thinking in the infant and cognitive development in different transcomplex contexts arising in the SIMS. It is concluded: computational thinking in the infant, from a transcomplex representation, transpires as a fundamental strategy for the integral development of the infant, linking cognitive, creative and socioemotional skills with interactive, multisensory and contextualised learning experiences.

Keywords: Learning, Creativity, teaching, computational thinking, transcomplexity.

Introducción

En la actualidad en el mundo, la tecnología ofrece mejorar la enseñanza al subsanar las deficiencias en materia de calidad, aumentar las oportunidades para practicar y el tiempo disponible. Además, persigue captar la atención de los estudiantes al variar el modo de presentar el contenido, estimular la interacción y fomentar la colaboración, tal como lo plantea la UNESCO (2023) en su informe "Tecnología en la Educación: ¿Una herramienta en los términos de quién?" donde hace énfasis en 5 competencias digitales que buscan la evolución de la educación de la mano con la tecnología digital, como son: "búsqueda y gestión de información y datos, comunicación y colaboración, creación de contenidos digitales, seguridad y resolución de problemas" (p.9).

Por otra parte, es insoslayable el hecho de que en todas partes del mundo incluso en los países más desarrollados existe desigualdades en cuanto a la tecnología y educación, como lo muestra la UNICEF (2017) con respecto al aprendizaje en la primera infancia, cuyas carencias en la estimulación cognitiva y en la mediación de procesos fundamentales, que sirven como base para el desarrollo de las funciones ejecutivas en el párvulo: nociones infra lógicas, lógica-matemáticas, lenguaje oral y escrito: aspectos fundamentales para el aprender a conocer, a hacer, convivir y crear establecidas por la UNESCO (2021) y Chile no escapa de dicha realidad. En esta época, también surge la necesidad y el interés de enseñar y aprender competencias relacionadas con el desempeño digital desde muy temprana edad a partir de las Tecnologías de Información y Comunicación (TIC), cuya aplicabilidad debe ser muy ecuánime, pero que a su vez colabora con el pensamiento computacional, en donde el impacto en el desarrollo cognitivo y la creatividad en los niños de 4 a 7 años tiene efectos importantes, entendiendo que no implica su uso exclusivo.

En virtud de ello, lo antes planteado conduce a los autores a la siguiente pregunta de investigación: ¿cómo el pensamiento computacional puede coadyuvar al desarrollo de la creatividad de párvulos en las salas interactivas sensoriales de la Universidad Autónoma de Chile? y el subsiguiente propósito general de investigación, el cual es: Generar un eje socioeducativo basado en pensamiento computacional para el desarrollo de la creatividad de párvulos en contextos transcomplejos.

Relevancia del estudio

En la Universidad Autónoma de Chile donde se conciben las competencias del siglo XXI para los estudiantes, los niños (as) del nivel de educación parvularia no son la excepción, producto de las diferentes demandas que se están presentando en el mundo actual como producto de los cambios estrepitosos y rápidos de las sociedades actuales. De tal forma**,** que la resolución de problemas como parte de la cotidianidad diaria implica, el cubrir la necesidad de poder formar un ser humano, cuyas formas interpersonales e intrapersonales tienen incidencia sobre la toma de decisiones asertiva y pertinente.

En esta misma línea, entran competencias relacionadas con la colaboración como forma espontánea de participación e interrelación y que tienen incidencia importante con las experiencias de aprendizaje cuyas actividades se enmarcan en el pensamiento computacional, porque marcan la pauta con aspectos esenciales relacionados no solamente con el desarrollo cognitivo; sino, además con la funcionalidad y regulación emocional de los niños (as). Ahora bien, es evidente que los procesos mentales pueden ser potenciados a través de la estimulación de experiencias de aprendizaje de la ingeniería computacional, la cual define muy el funcionamiento de las ciencias cognitivas (Frawley, 1999).

Es por ello, que el panorama educativo del siglo XXI ha experimentado transformaciones profundas y aceleradas que llevan a repensar constantemente los modelos pedagógicos tradicionales. En este contexto como plantea Torres Pernia (2024) "…las metodologías innovadoras han surgido como una respuesta a los cambios socioculturales y tecnológicos que definen la época (pp. 27-28). Bajo dicho esquema, el socio "computacionalismo" puede ser tomado en cuenta, sobre los detalles del control delimitado sobre el entorno vinculado al pensamiento, incluyendo ciertos aspectos del lenguaje, el cual

pudiera entenderse como parte de la integración lingüística, compuesta por la mente computacional y social en correspondencia al lenguaje de control mental, todo ello depende en su forma y funcionamiento. Se puede decir entonces, que sobre una posición de la analogía humana, sobre las diferentes funciones cerebrales, se puede estimular con experiencias de aprendizaje con control específico computacional.

Finalmente, se puede decir que el cerebro se desarrolla de forma rápida en los primeros años de vida del ser humano, es a través de la educación parvularia formada y trabajada con experiencias de aprendizaje con estrategias del pensamiento computacional, las cuales incluyen: descomposición, abstracción, algoritmos, patrones, depuración, revisión y corrección (Selby & Woolland, 2013). En este mismo sentido, se ha podido observar que, con la enseñanza multisensorial en paralelo a la aplicación de experiencias de pensamiento computacional se potencia el aprendizaje profundo y significativo, en correspondencia a las demandas de los estudiantes, en donde a su vez puedan vivenciar experiencias inclusivas y enriquecedoras con prácticas innovadoras, las cuales impacten efectivamente la calidad educativa en general.

Desarrollo cognitivo en la edad infantil

La educación es la base del desarrollo de un país porque el individuo a través de esta desenvuelve sus capacidades cognitivas y físicas para irse integrando a la sociedad que lo rodea, consolidando el proceso de progreso integral del ser humano, el cual inicia en el hogar generando destrezas adecuadas al medio, para el avance de la sociedad, buscando la calidad de vida. Se puede decir también que la educación es una acción social en donde se transmite los valores y los conocimientos pertinentes un conjunto de representaciones sociales y mentales como eje integrador de la sociedad. Es un hecho que, al interactuar con otras personas, hay transmisión de conocimientos, valores, lo que las instituciones educativas lo refuerzan y desarrollan, incluyendo las habilidades y destrezas presentes en los individuos (Peruzzo et al., 2023).

Entoces, una educación de calidad es lo que se anhela en cada país, en donde a partir de del desarrollo evolutivo se consolidan las capacidades del educando, teniendo en cuenta el conocimiento mutuo para una efectiva convivencia institucional como propósito fundamental de la educación y representa uno de los primordiales desafíos para los sistemas educativos presentes (UNESCO, 2021) Por consiguiente, se amerita el uso de diversos recursos, manuales y guías que permitan alcanzar esta finalidad esencial de la educación, siendo un desafío en la etapa de inicial la cual exige consolidar el desarrollo cognitivo del niño, incluyendo las múltiples actividades focalizadas del cerebro en donde se generan conocimientos más profundos y significativos en los infantes, donde como plantea Guanipa (2008) “el docente juega un importante papel pues él quien planifica las actividades de aprendizaje las cuales deben aplicarse en forma sistematizada tomando en consideración los procesos naturales y espontáneos de cómo el estudiante construye o reconstruye su conocimiento y puede creativamente integrarlo a nuevas situaciones” (101).

Desarrollo cognitivo y la teoría de los campos conceptuales

El desarrollo infantil, según una perspectiva Latinoamericana y vanguardista, se entiende como un proceso integral que se extiende a lo largo de todo el ciclo vital. En los primeros años de vida se establecen las bases cognitivas, conductuales, sociales y afectivas que fundamentan el desarrollo posterior del individuo, como un… "proceso de cambios que se dan a lo largo del ciclo vital, en interacción con factores orgánicos, ambientales, instruccionales y personales" (León de Viloria, 2007, p. 81).

De igual forma, el desarrollo cognitivo en la infancia implica una progresión en las habilidades cognitivas desde la infancia hasta la adolescencia. En el contexto del juego, la teoría de los campos conceptuales de Gérard Vergnaud resulta especialmente relevante, porque propone que el aprendizaje no ocurre de forma aislada, sino que se organiza en "campos conceptuales", que son redes de conceptos, procedimientos, situaciones y representaciones. En el juego, estas redes se activan cuando los niños resuelven problemas, exploran su entorno y utilizan el pensamiento simbólico. Entonces, cuando se relaciona esta concepción con el pensamiento computacional y su estimulación en el párvulo queda claro, que la vía más pertinente

para la intervención de experiencias de aprendizaje asertivas y significativas es con el diseño de estrategias lúdicas con el juego estableciéndolo como estructura de estimulación cognitiva sistematizada y planificada.

Pensamiento computacional y su impacto en la educación infantil

Desde el año 2017, el Fondo de las Naciones Unidas para la Infancia (UNICEF) ha señalado que "los niños ya representan un porcentaje considerable de la población mundial en red, y su participación aumentará en un futuro próximo, ya que la penetración se extiende cada vez más a las regiones donde crece con mayor rapidez la proporción de niños y jóvenes" (UNICEF, 2017, p. 3). Esta afirmación pone de manifiesto la creciente presencia de los niños en entornos digitales y la importancia de comprender los efectos del acceso temprano a la tecnología en su desarrollo.

En este contexto, surgen los desafíos en correspondencia a las competencias del siglo XXI: resolución de problemas, la colaboración, la creatividad, la comunicación, alfabetización y la ciudadanía digital, afianzando habilidades para enfrentar problemas ofreciendo soluciones innovadoras, así como un aspecto esencial relacionado con los estados de incertidumbre, que ahora más que nunca está presente, lo cual prepara al infante para los cambios y transformaciones, con todas estas habilidades se generan soluciones y que dentro de los desafíos y efectos del pensamiento computacional en la primera infancia y de manera ventajosa sin requerir dispositivos digitales para ubicarlo en una posición de recursos opcionales (Bers, 2020).

Con todo lo expuesto, se infiere que a través del pensamiento computacional, se puede potenciar, la capacidad de formular problemas y resolverlos a través de estrategias analíticas y algorítmicas, promoviendo un aprendizaje basado en el pensamiento crítico y la resolución de problemas y en el caso particular de los infantes, se promueve desde muy temprana edad, dando apertura a un entramado del pensamiento el cual va generando conocimientos de forma significativa, duradera, con sentido propio y motivacional hacia la creatividad (Wing, 2006).

Ahora bien, específicamente en Chile la enseñanza del pensamiento computacional se ha efectuado en niveles educativos avanzados, dejando de lado el nivel de educación parvularia (Ministerio de Educación de Chile, 2019). Dicho esto, es importante subrayar que el desarrollo de experiencias de aprendizaje con el pensamiento computacional en los primeros años de vida de los niños (as) no se circunscribe a la programación y la robótica, sino que amplía su radio de acción en el desarrollo de habilidades para la solución de problemas de forma crítica-constructiva, a través de actividades cognitivas y creativas.

Sobre este contexto, se puede inferir, que, las habilidades desarrolladas con pensamiento computacional pueden estimularse mediante el uso de recursos tecnológicos y, al mismo tiempo, a través de estrategias empleando recursos desconectados (sin pantallas digitales). Al respecto, se puede decir, que las actividades sin el uso de pantallas, como juegos manipulativos y actividades colaborativas con intencionalidad lúdica, benefician el desarrollo de la creatividad del pensamiento en los niños en sus primeros años de vida. Estas experiencias de aprendizaje permiten que los párvulos, desarrollen competencias primordiales sin las distracciones vinculadas al uso extremo de dispositivos digitales.

En este sentido, la educación con estrategias enmarcadas en el pensamiento computacional promueve el desarrollo de destrezas: razonamiento lógico, identificación de patrones, abstracción y la descomposición de problemas. Además, potencia competencias como el pensamiento crítico, la creatividad, la comunicación y la colaboración, en la educación parvularia (Bocconi et al, 2016).

En concordancia, se han determinado los factores clave para la integración y el empoderamiento de recursos tecnológicos, en donde se puede emplear el pensamiento computacional como parte de ello, en la educación (UNESCO, 2021):

- Alfabetización en información y datos
- Comunicación y trabajo colaborativo digital
- Creación de contenido digital
- Seguridad digital y bienestar en línea
- Uso de la tecnología para la resolución de problemas

Estos elementos evidencian la importancia del pensamiento computacional y la necesidad de promover su enseñanza desde los primeros años de escolarización. En este escenario, el rol del educador parvulario es primordial para promover el empleo significativo y consciente de los recursos tecnológicos en el aula.

Los educadores deben guiar a los niños (as) en la elección de información confiable y en el progreso para la adquisición de competencias de análisis y reflexión (Resnick, 2017).

En esta misma línea, la creación de estrategias que potencien el pensamiento computacional en los niños (as) desarrolla la confianza en la resolución de problemas abstractos, promueve la permanencia en el compromiso intelectual y perfecciona sus habilidades de comunicación y colaboración (Denning, 2017). Considerando que estas competencias son esenciales para la generación y gestión del conocimiento actual, deben tomarse acciones necesarias para que a través de la intervención en el aula se fortalezcan todos estos elementos de la educación parvularia.

Es así como, con el pensamiento computacional aplicado en párvulos, se pueden potenciar los siguientes aspectos (Vieira, et al., 2024):

- Secuenciación: impulso en las habilidades para establecer acciones en un orden lógico.
- Concentración: afianzar la capacidad de mantener la atención en una operación focalizada.
- Pensamiento lógico: empleo de raciocinio organizado para resolver problemas.
- Comunicación de ideas: presentación de conceptos de manera clara y concisa.
- Aprendizaje colaborativo: trabajo en equipo para la resolución de problemas.

Además, el pensamiento computacional involucra la unificación de conceptos: pensamiento algorítmico, modelización, deducción de datos y la refinación de errores. Estos conocimientos permiten a los niños (as) desarrollar habilidades cognitivas fundamentales para afrontar retos en diferentes espacios de su vida (Bers, 2020). Tomando en cuenta todo lo anterior, se puede decir que el empleo de recursos tecnológicos es preciso en la educación parvularia. Sin embargo, es importante que su uso sea regularizado y que los educadores desarrollen estrategias que inciten el pensamiento computacional sin depender únicamente de dispositivos digitales. Muestra de ello, es la aplicación de estrategias con recursos desconectados, en donde se genera y gestiona el conocimiento con el desarrollo del pensamiento crítico y la formación en habilidades que fortalezcan la resolución de problemas, bajo la convicción de la formación integral en la educación inicial.

Creatividad infantil y su relación con el pensamiento computacional.

La creatividad es algo natural que nace del hombre, y lo desarrolla de acuerdo con su interés y capacidad; por medio de ella, el niño (a) busca constantemente respuestas a interrogantes que el mismo se hace de todo lo que observa en el mundo natural y los elementos que lo integra; (Ferreiro, citado por Medina-Sánchez et al, 2017):

> Las influencias del ambiente y los estímulos mediadores de otros niños más capaces y del docente, favorecen los saberes previos, las actividades lúdicas y la socialización porque la colaboración posibilita que unos imiten a los otros más capaces propiciándose condiciones que fomentan el desarrollo de la creatividad (p.157).

Entonces, la creatividad es una capacidad del ser humano, desencadenarla depende del elemento cultural y muy especialmente de una pedagogía de la diversidad, de los métodos comunicacionales, de la socialización y la participación del sujeto ante el contexto en el que el niño se desenvuelve, donde son capaces de decidir cuáles son su interés y expresar libremente lo que no es favorable para él. En función a ello, es importante entender que el desarrollar las experiencias de aprendizaje en la educación parvularia, sin emplear dispositivos digitales, promueve las competencias de secuenciación lógica lo cual brinda bases para la creatividad en los niños (as) al momento de la resolución de problemas.

Método

Dentro del Método se encuentra el "Círculo Hermenéutico" donde: “El análisis comprensivo de las fuentes y su interconexión con las localidades problemáticas permitirá hacer congruente el hilo discursivo, en el razonamiento interpretativo y de aplicación de los contenidos a obtenerse” (Gadamer, 1993, p. 193). Cabe destacar, que en la investigación se realizó una triangulación del corpus (textos y teorías), de los sujetos abordados (Docentes) y la reflexión de los investigadores. De esa triangulación surgieron las siguientes categorías: Pensamiento computacional, Desarrollo creativo del infante, Desarrollo cognitivo del párvulo.

Luego, para el desarrollo de las matrices categoriales se desarrolló una codificación axial que “es comenzar el proceso de reagrupar los datos que se fracturaron durante la codificación abierta. En la codificación axial, las categorías se relacionan con sus subcategorías para formar unas explicaciones más precisas y completas sobre los fenómenos” (Strauss & Corbin, 2002, p. 135). Desarrollándose de la siguiente manera: Categorías, subcategoría, Axiomas Subcategoriales y Relaciones categoriales (Strauss & Corbin, 2002, p.124)

Tabla 1.
Matriz Categorial.

Categorías	Subcategorías	Axiomas Subcategoriales	Relaciones Categoriales
Pensamiento Computacional	Habilidades	Experiencias de aprendizaje, secuenciación y lógica	Pensamiento computacional, desarrollo creatividad del infante y desarrollo cognitivo del párvulo.
	Destrezas	Comprensión de conceptos básicos de programación y resolución de problemas.	
	Robótica educativa	Promueve las interacciones, fomenta autonomía y conciencia.	
Desarrollo creativo del infante.	Juego Simbólico	Estimula la exploración espontánea, potencia creatividad incluyendo la colaboración con tecnologías innovadoras.	
	Investigación Docentes	Genera resultados objetivos de originalidad y fluidez creativa mediante Inteligencia Artificial.	
Desarrollo creativo del infante.	Animación digital	Estimula pensamiento computacional y expresión creativa, potencia la secuenciación, lógica y expresión narrativa infantil.	
Desarrollo cognitivo del párvulo.	Actividades lúdicas	Estimula pensamiento computacional junto con funciones ejecutivas, optimizan la flexibilidad cognitiva, incrementa participación y transferencia de aprendizaje.	
	Idiomas	La lengua no es barrera cuando se integran juegos y pictogramas.	
	Calidad Educativa	Los primeros años de vida del párvulo son esenciales para el desarrollo creativo óptimo.	

Resultados y discusión

El pensamiento computacional en el infante en contextos transcomplejos

De acuerdo con el abordaje hermenéutico, como parte de análisis se pueden establecer las siguientes categorías, dentro de los diferentes contextos transcomplejos, los cuales armonizan de forma equilibrada y polisémica habilidades y destrezas en el pensamiento computacional, desarrollando la creatividad y pensamiento cognitivo en los párvulos, bajo un entramado conceptual, el cual dentro de la dinámica educacional en la primera infancia, presenta un proceso transformacional progresivo, aplicando experiencias de aprendizaje, con actividades que estimulen el pensamiento computacional:

Habilidades y destrezas alcanzadas en el pensamiento computacional en los párvulos

En este primer análisis, se establece que el desarrollo de habilidades de pensamiento computacional en educación infantil a través de actividades desconectadas (García-Peñalvo & Cruz-Benito, 2016), con la aplicación de experiencias de aprendizaje en el nivel parvulario, con actividades sin dispositivos digitales, pueden estimular el desarrollo de habilidades de secuenciación y lógica en los niños (as). Así mismo, cuando el educador diseña experiencias de aprendizaje con PC basado en fortalezas centrado en las capacidades previas de los niños (modelo *asset-based*), potencia la participación de grupos historialmente excluidos en (Bers, 2020)

La intervención con experiencias de aprendizaje incluyendo el *Scratch* para iniciar el pensamiento computacional en niños (as) (Moreno-León et al., 2015), evidencia que promociona la comprensión de conceptos básicos de programación y permite la progresividad en el desarrollo de la competencia para la resolución de problemas en niños (as). De igual manera, Modelo *didáctico Coding as a Playground* donde la codificación es vista como juego simbólico, aumenta la motivación, autoestima y colaboración entre niñas/os, especialmente en entornos diversos (Bers, 2020)

La aplicación de la robótica educativa como instrumento para el desarrollo del pensamiento computacional en la infancia (Sáez-López et al., 2019), demuestra cómo en el proceso formativo, a través de su introducción, como una estrategia efectiva, promueve el pensamiento computacional en los párvulos. En correspondencia, el empleo de recursos tangible y de dispositivos como Cubetto en párvulos, promueve las interacciones, fomentan autonomía y conciencia espacial en programación. De tal forma que se puede concretar que los educadores, necesitan formación en juego dirigido.

Desarrollo de la creatividad en el infante

En este análisis se puede determinar que el juego simbólico en el desarrollo de la creatividad en niños parvularios, es esencial para el impulso de la creatividad y la imaginación en el nivel de educación de la primera infancia (Castro et al., 2024). Además, estimula la exploración espontánea de conceptos como bucles y condicionales. Por ejemplo, el juego autónomo con bloques o cartas admite apropiación del PC sin necesidad de una instrucción concreta. También potencia la creatividad incluyendo la colaboración con tecnologías innovadoras empleando actividades *STEAM* (Tsortanidou et al., 2019). Aquí, la creatividad en ambientes colaborativos potencia el pensamiento computacional como experiencia social (Tsortanidou et al., 2019), en donde junto con bilingüismo y creatividad infantil, manifiestan más fluidez verbal e ideación abierta, correlacionado con habilidades del pensamiento computacional.

Los análisis surgidos infieren, que las estrategias pedagógicas para fomentar la creatividad en educación infantil (Juárez Ruiz et al., 2021) se vincula la investigación por parte de los educadores parvularios en donde deben generar diagnósticos que les permita detectar creatividad en ambientes como *Scratch* el cual, genera resultados objetivos de originalidad y fluidez creativa en los párvulos a través de la IA. Un ejemplo de ello es el diseño de robot el cual potencia, la resolución creativa de problemas, en donde los niños (as) manifiestan mayor ideación autónoma y flexible cuando interactúan con agentes empáticos,

como por ejemplo Robot YOLO en donde, además, potencian la creatividad divergente (Espinoza Arroyo & García Espinoza, 2024).

En este análisis se destaca lo importante que es, la aplicación de las actividades artísticas en la estimulación de la creatividad en niños (Espinoza Arroyo, & García Espinoza, 2024) así como, la intervención con animación digital para estimular el pensamiento computacional y expresión creativa. Se dilucida que el arte animado potencia la secuenciación, lógica y expresión narrativa infantil, en donde a través de una sola experiencia multimodal, se potencia el pensamiento computacional.

Desarrollo cognitivo en el párvulo

En este conjunto de investigaciones se evidencia que existe un impacto relevan la inclusión de actividades lúdicas en el desarrollo cognitivo de niños(as). De igual manera, se evidencia que las experiencias de aprendizaje, las cuales involucran actividades lúdicas, favorecen significativamente en el desarrollo de funciones cognitivas en niños(as). Zhang et al. (2025). En esta misma temática, el contraste entre *unplugged* comparando con la robótica, se determina que ambos estimulan el pensamiento computacional junto con las funciones ejecutivas, desatacando que los *unplugged* optimizan más la abstención y flexibilidad cognitiva Desde estas premisas, se determina que es culturalmente importante la inclusión del PC manejados como parte de los saberes previos, historias locales y diversidad cultural, incrementando la participación, pertenencia y transferencia de aprendizajes STEM (Quinn et al., 2023).

Sobre la base del presente análisis se puede decir que existe una correspondencia entre el desarrollo del lenguaje y las funciones ejecutivas en los párvulos (Abellán Roselló, 2022). Es decir, se determina cómo el desarrollo del lenguaje está relacionado con el desarrollo de funciones ejecutivas en niños (as). Baghiro et al. (2025) ScratchJr en aula preescolar Aplicación guiada de ScratchJr y Code.org. Mejora en lógica secuencial y lenguaje simbólico en 4 semanas. Requiere mediación adulta frecuente. Krause et al. (2022).

CT integrado en inglés/español. La lengua no es barrera cuando se integran juegos y pictogramas. CT apoya la alfabetización temprana.

Dentro de las investigaciones abordadas**,** se hace énfasis en la evaluación con *TechCheck-K* donde se crea y valida una herramienta para evaluar el pensamiento computacional sin pantallas. Con ello, se mide con fiabilidad CT elemental (algoritmos, secuencia) en niños de 4-7 años (Relkin & Bers 2021). Dicho instrumento de evaluación es de gran beneficio diagnóstico en los párvulos, en donde se pueden determinar desde conocimientos previos, historias particulares, pluralidad cultural, incrementando así, participación espontánea, sentido de pertenencia y transferencia de aprendizajes (Quinn et al., 2023).

Indicadores de interpretación y análisis

Ventajas en el pensamiento creativo: Acentúan que el desarrollo de experiencias de aprendizaje con actividades como el juego simbólico y el arte incrementan la creatividad en los infantes.

- **Desarrollo de las funciones ejecutivas en relación con el desarrollo cognitivo:** Las triangulaciones 7 y 8 establecen que actividades lúdicas para el desarrollo del lenguaje, están relacionados con el fortalecimiento de funciones ejecutivas, fundamentales para el desarrollo cognitivo.
- **Estimulación mediante la aplicación de estrategias relacionadas con el pensamiento computacional:** Demuestran que la aplicación de experiencias de aprendizaje con actividades de pensamiento computacional, como la programación y la robótica, potencian competencias cognitivas y creativas en los niños (as).
- **Competencias requeridas para el siglo XXI:** Resaltan que el pensamiento computacional y la robótica educativa preparan a los niños en competencias esenciales como la resolución de problemas,

el pensamiento crítico y la colaboración. De allí surgen la triangulación teórica de las categorías como se muestra a continuación:

Figura 1. Infografía triangulación teórica de categorías.
Fuente: Autores (2025)

Conclusiones

Sobre el análisis antes presentado, se puede inferir que el pensamiento computacional establece una capacidad clave para el desarrollo integral de los párvulos en el siglo XXI, al promover competencias cognitivas: resolución de problemas, la creatividad, el pensamiento lógico y el trabajo colaborativo. Es así como, su combinación en la educación parvularia, incluyendo recursos digitales además del empleo de actividades desconectadas, acepta potenciar la creatividad, la autonomía y la motivación en la generación y gestión del conocimiento desde los primeros años de vida de los niños (as). Por lo tanto, el rol del educador en nivel parvulario y es fundamental para la creación de experiencias de aprendizaje que se relacionen con la tecnología, el juego y el pensamiento crítico.

De igual manera, se puede acotar que al tomar en cuenta el desarrollo integral del niño (a), se debe planificar y evaluar sobre sus capacidades cognitivas, físicas y sociales, para así, fortalecer como una práctica social que forma en valores, saberes y destrezas para la proporcionada integración en la sociedad. En este entramado, el pensamiento computacional surge como una estrategia pedagógica clave para potenciar la lógica, la secuenciación y la toma de decisiones, amalgamando las funciones cognitivas y creativas en un proceso educativo, para la formación de personas autónomas, críticas y comprometidos con su realidad desde sus primeros años de vida.

En conclusión, el pensamiento computacional en la educación parvularia, enfocado desde una representación transcompleja, se conforma como un instrumento esencial para potenciar el desarrollo integral del infante, articulando habilidades cognitivas, creativas y socioemocionales mediante experiencias de aprendizaje activas, multisensoriales y contextualizadas. En definitiva, las teorías la del “sociocomputacionalismo” y la analogía mente-computadora, examina la calidad de la interacción entre lenguaje, cultura y pensamiento superior, colocando al educador parvulario como un actor transformador el cual, con el diseño de experiencias innovadoras de aprendizaje, promueva un aprendizaje profundo, inclusivo y significativo, en congruencia con la educación multimodal, la globalización y la educación polisémica de la sociedad transformacional actual.

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Actitud hacia el aprendizaje de la química mediante el uso de la plataforma virtual Biomodel

Attitude towards learning chemistry using the Biomodel virtual platform

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Resumen

El presente artículo tuvo como objetivo analizar la actitud hacia el aprendizaje de la química orgánica mediante el uso de la plataforma virtual Biomodel en estudiantes de quinto año de la UE Colegio Joseph Lancaster durante el año escolar 2023-2024, ubicado en el municipio San Diego del Estado Carabobo. Se utilizó una metodología cuantitativa, bajo el paradigma positivista, con un diseño no experimental, de campo y de tipo descriptivo. La población y muestra estuvo representada por 30 estudiantes. Para la recolección de datos se utilizó la técnica de la encuesta y como instrumento un cuestionario valido y altamente confiable. Los resultados obtenidos de la aplicación del instrumento se tabularon tomando en cuenta los porcentajes de las respuestas dadas a cada pregunta y fueron sometidos a un análisis porcentual, donde se determinó que la mayoría de los estudiantes muestra una actitud favorable o positiva hacia el aprendizaje de la química mediante el uso de la aplicación Biomodel ya que les resulta sencillo aprender química orgánica utilizando la plataforma y perciben la necesidad de utilizarla para comprender los contenidos, aumentando el interés o la motivación a explorar y aprender a través de la información visual disponible en Biomodel.

Palabras clave: actitud, aprendizaje, enseñanza, química orgánica, plataforma virtual Biomodel.

Abstract

The present article aimed to analyze the attitude toward learning organic chemistry using the Biomodel virtual platform in fifth-year students at U.E. School Joseph Lancaster during the 2023-2024 school year, located in the San Diego municipality of Carabobo State. A quantitative methodology was used, under the positivist paradigm, with a non-experimental, field-based, and descriptive design. The population and sample consisted of 30 students. For data collection, the survey technique was used, and a valid and highly reliable questionnaire was used as an instrument. The results obtained from the application of the instrument were tabulated taking into account the percentages of the answers given to each question and were subjected to a percentage analysis, where it was determined that the majority of students show a

favorable or positive attitude toward learning chemistry through the use of the Biomodel application since it is easy for them to learn organic chemistry using the platform and they perceive the need to use it to understand the contents, increasing the interest or motivation to explore and learn through the visual information available in Biomodel.

Keywords: attitude, learning, teaching, organic chemistry, Biomodel virtual platform.

Introducción

El tema central de este artículo son las actitudes, las cuales se consideran imprescindibles para el aprendizaje de los estudiantes, ya que afectan su conducta y percepción (ya sea positiva o negativa) hacia las actividades de estudio. La preocupación por las actitudes hacia el estudio ha adquirido relevancia en el ámbito educativo, pues estas pueden ser tanto una causa como una consecuencia de las creencias, pensamientos, percepciones, emociones y comportamientos que los estudiantes desarrollan durante su proceso de aprendizaje.

Por otra parte, la química es una disciplina fundamental que proporciona una base sólida para comprender los procesos complejos que ocurren en la naturaleza y la tecnología moderna. Como ciencia natural de carácter experimental, su objeto de estudio incluye la materia, sus transformaciones, reacciones y la generación de energía, sustentándose en principios, teorías y leyes que explican los fenómenos químicos aplicados. Su enseñanza se caracteriza por su componente teórico-práctico, diseñado para mejorar la comprensión de conceptos abstractos y contribuir a una educación integral. Por ello, es necesario desarrollar estructuras curriculares que no solo promuevan de la adquisición de conocimientos, sino también el desarrollo de actitudes científicas, fomentando así el interés y la curiosidad de los estudiantes por los contenidos vinculados a su contexto.

Estudios previos encontraron que, en ciertas disciplinas o asignaturas vinculadas a las ciencias (matemáticas, química, biología, etc.), los estudiantes suelen tener actitudes negativas. Vera-Medranda & Castro-Bermúdez (2024), señalan que la falta de recursos y la ausencia de experiencias prácticas han contribuido a un desinterés de esta área. Como consecuencia, manifiestan comportamientos adversos, como el incumplimiento de tareas, rechazo al estudio y apatía en clase. Estas actitudes pueden verse influenciadas por el valor que los estudiantes atribuyen a las ciencias y a la labor docente, lo que puede afectar tanto su formación actitudinal como su desempeño académico (Corona Salazar et al., 2022).

En este contexto, a través de la praxis docente durante el año escolar 2023-2024 en la Unidad Educativa Colegio Joseph Lancaster (institución privada ubicada en el sector Villas de la Cumaca, municipio San Diego del Estado Carabobo), se observó que los estudiantes cursantes de quinto año de bachillerato presentan dificultad para visualizar los compuestos orgánicos en 3D y muestran una actitud de desinterés en la asignatura de química orgánica. Esto se evidencia con comportamientos como conversaciones constantes durante la clase, uso del celular, irresponsabilidad en la entrega de actividades y falta de participación. Estas actitudes reflejan creencias negativas sobre la asignatura, lo que afecta su disposición hacia el aprendizaje y genera frustración en el docente.

Ante esta situación, se planteó implementar una solución que transforme dichas percepciones y fomente actitudes positivas. Considerando que la mayoría de los estudiantes poseen dispositivos móviles con acceso a internet (herramientas que ofrecen nuevas posibilidades pedagógicas), se decidió implementar la plataforma virtual denominada Biomodel como una herramienta digital para la enseñanza de la química orgánica, ya que proporciona un entorno interactivo donde los estudiantes pueden acceder a recursos educativos, realizar actividades prácticas y colaborar entre compañeros, aprovechando el impacto de las Tecnologías de la Información y Comunicación (TIC) en la educación.

Cabe destacar que la comprensión de la química orgánica es esencial para áreas como la medicina, la farmacología y la industria química. La visualización tridimensional de estructuras moleculares es una herramienta clave para analizar su función y propiedades. Biomodel, facilita este proceso mediante

representaciones visuales y simulaciones interactivas, permitiendo a los estudiantes explorar conceptos complejos (como la estructura molecular) de manera intuitiva. Esto no solo mejora su capacidad para aplicar conocimientos en contextos reales, sino que también promueve el aprendizaje colaborativo y la integración de las TIC en el aula.

La importancia de este estudio radica en el uso de Biomodel como herramienta digital para la enseñanza-aprendizaje de hidrocarburos saturados e insaturados en estudiantes de quinto año de bachillerato (modalidad presencial durante el primer lapso del año escolar 2023-2024), con el objetivo de analizar su impacto en las actitudes hacia la asignatura (considerando las dimensiones cognitivas, afectivas y conductuales) e identificar los distintos tipos de aprendizaje desarrollados. Con esto se buscó: mejorar la calidad de la enseñanza en química, aprovechar recursos tecnológicos para facilitar las clases, fomentar la adopción de nuevas herramientas educativas en docentes y estudiantes y, determinar si Biomodel (editor de estructuras orgánicas) favorece actitudes positivas dado que la compresión teórica se complementa con la actividad interactiva.

Referentes teóricos

Como referentes teóricos de este estudio, tenemos en primer lugar la Teoría del aprendizaje significativo de Ausubel (2000), la cual sostiene que el aprendizaje significativo ocurre cuando se relacionan los nuevos contenidos o informaciones con los conocimientos previos del estudiante. En el caso de la enseñanza de la química, esto implica partir de los conceptos más simples y conocidos para ir construyendo progresivamente un conocimiento más complejo, por lo que es importante considerar lo que el estudiante ya sabe, para establecer una relación con aquello que debe aprender. Este proceso tiene lugar si el estudiante tiene en su estructura cognitiva conceptos, estos son ideas, proposiciones, estables o definidas, con las cuales la nueva información puede interactuar. En efecto, cuando se hace referencia a un material potencialmente significativo, se dice que este material debe ser lógico al interpretar algún aspecto del mundo real y debe existir en la estructura cognoscitiva del estudiante en particular.

Esta teoría se relaciona con el estudio al señalar la importancia de la organización del conocimiento en estructuras y el uso de materiales multimedia (Biomodel) como herramienta para simular y descubrir conceptos que puede facilitar la conexión entre conocimientos previos como nomenclatura de hidrocarburos saturados e insaturados y nuevos contenidos como las estructuras y formas de enlaces moleculares de los hidrocarburos saturados e insaturados de cadena abierta o cerrada promoviendo un aprendizaje significativo.

En segundo lugar, tenemos la Teoría de la carga cognitiva, desarrollada por Sweller (1994), la cual se enfoca en la cantidad de esfuerzo cognitivo que un estudiante necesita para procesar la información. Esta teoría parte del concepto de que la mente humana tiene una capacidad limitada para procesar información y que, por lo tanto, el aprendizaje puede ser mejorado si se regula la cantidad de información que se presenta a los estudiantes en un momento dado. Según Sweller, hay tres tipos de carga cognitiva: la carga intrínseca, la carga extrínseca o extraña y la carga germana o relevante. La carga intrínseca se refiere a la complejidad inherente de una tarea de aprendizaje. La carga extrínseca se refiere a la cantidad de información o estímulos externos que se presentan al estudiante durante el aprendizaje y, por último, la carga relevante, se refiere a la cantidad de recursos cognitivos que el estudiante debe utilizar para procesar y almacenar la información.

Además, Van Merrienboer & Sweller (2010), señalan que la carga extraña se reduce con tareas sin objetivos, ejemplos resueltos y tareas de finalización, integrando diferentes fuentes de información, utilizando múltiples modalidades y reduciendo la redundancia. La intrínseca se gestiona ordenando las tareas de simples a complejas y la carga germana se optimiza aumentando la variabilidad entre las tareas, aplicando interferencia contextual y evocando la autoexplicación.

Esta teoría se utiliza en el diseño de materiales educativos para maximizar la eficacia del aprendizaje y minimizar la carga cognitiva para los estudiantes al evitar sobrecargar la memoria de trabajo. En 1988 Sweller concluyo: “las teorías y prácticas frecuentemente asumen que la resolución de problemas es un medio eficaz de aprendizaje y, en consecuencia, pueden requerir modificaciones”. (p.284). Por ello, consideramos que el uso de Biomodel puede optimizar el aprendizaje reemplazando la resolución de problemas por una exploración guiada, al facilitar al estudiante un modelo 3D que puede manipular, se elimina la necesidad de esforzarse mentalmente para lograr una visualización de las estructuras, lo cual reduce la carga extrínseca (evitando saturar al estudiante con información irrelevante) y potenciar la carga relevante al enfocarse en el procesamiento de conceptos claves, como los enlaces químicos. Dicha exploración puede hacer que la información se adquiera de manera más intuitiva y con menos procesamiento abstracto.

En tercer lugar, se encuentra la Teoría cognitiva del aprendizaje multimedia**,** propuesta por Mayer (2005), la cual sostiene que que la combinación de información visual y verbal es útil para lograr aprendizajes más profundos y efectivos, ya que cuando se presentan los contenidos de manera visual y auditiva, se evita la sobrecarga cognitiva de la memoria de trabajo. De esta manera, el aprendizaje multimedia puede mejorar la capacidad de retener y recuperar información. No se trata de que una imagen valga más que mil palabras, sino que parece que combinar imágenes con palabras, tanto si se leen como si se escuchan, hace que la información que se quiere aprender sea más potente y se asimile con más facilidad.

Es importante señalar, que lo multimedia en sí no garantiza un mejor aprendizaje, lo que resulta fundamental es el diseño y la manera como se usa la plataforma virtual para lograr una adquisición más eficaz del contenido enseñado, por lo que se debe tomar en cuenta los indicadores de atención, resolución de problemas, interés, participación y comprensión, los cuales están relacionados con el aprendizaje multimedia de diferentes maneras:

- Atención: El aprendizaje multimedia necesita capturar la atención del estudiante para que pueda comprender y retener la información que se presenta. Por lo tanto, los materiales multimedia deben ser atractivos, visualmente agradables y tener elementos interactivos para mantener la atención del estudiante.
- Resolución de problemas: Los materiales multimedia pueden ayudar a los estudiantes a resolver problemas al proporcionarles información y herramientas para comprender los conceptos. Además, algunos materiales multimedia pueden presentar desafíos y pruebas que los estudiantes deben resolver para demostrar su comprensión.
- Interés: Los materiales multimedia pueden despertar el interés de los estudiantes al presentar la información de una manera atractiva y emocionante. Al mismo tiempo, el contenido debe ser relevante y estar relacionado con los intereses de los estudiantes para mantener su compromiso y motivación.
- Participación: Los materiales multimedia pueden involucrar activamente a los estudiantes en el proceso de aprendizaje a través de actividades interactivas y dinámicas. Esto puede mejorar la retención de información y proporcionar una experiencia más valiosa y significativa para el estudiante.
- Comprensión: El aprendizaje multimedia puede ayudar a los estudiantes a comprender conceptos complejos de una manera más clara y accesible. Además, algunos materiales multimedia pueden tener elementos interactivos y visuales que pueden ayudar a los estudiantes a retener la información de manera más efectiva.

En resumen, esta teoría plantea la efectividad de integrar imágenes y texto para retener información, así como la necesidad de captar la atención del estudiante, involucrarlo activamente y mantener su interés, con el fin de mejorar la comprensión y resolver problemas de manera efectiva.

Cabe señalar que las plataformas virtuales son herramientas tecnológicas diseñadas para facilitar la comunicación, la colaboración, la enseñanza y el aprendizaje en línea, permitiendo a los usuarios interactuar con los contenidos de manera virtual a través de internet. Estas herramientas favorecen la interacción efectiva y eficiente entre educadores y estudiantes, lo que puede potenciar tanto el aprendizaje como la retención de la información.

En el ámbito de química, destaca el editor Biomodel, una página web gratuita y de uso intuitivo (Ertl, 2013). Esta herramienta funciona como un editor de moléculas, facilitando la representación gráfica y la edición interactiva de estructuras moleculares y mecanismos de reacción, lo que contribuye a una mejor comprensión de los conceptos teóricos. Además, fomenta el trabajo colaborativo, ya que los estudiantes pueden compartir sus modelos y discutir hallazgos con sus compañeros. Biomodel incluye un menú de sustitución incorporado y atajos de teclado que agilizan las funciones de edición, permitiendo la creación rápida de moléculas grandes y complejas.

Asimismo, puede emplearse como herramienta de consultas para buscar en bases de datos moleculares, gracias a su capacidad para crear y traducir automáticamente consultas de subestructuras complejas. Por otro lado, el sitio Biomodel.uah.es ofrece diversos materiales complementarios para la docencia y el aprendizaje autónomo en bioquímica y biología molecular. La interacción dinámica que promueve esta plataforma enriquece la experiencia de aprendizaje, superando las limitaciones de los medios impresos. Por ello, consideramos que Biomodel puede mejorar tanto la actitud hacia el aprendizaje de la química orgánica como la comprensión de sus conceptos clave.

Por otra parte, según el psicólogo Santrock (2002), la actitud, es *"el conjunto de razones por las que las personas se comportan de la forma que lo hacen. El comportamiento motivado es vigoroso, dirigido y sostenido"* (p. 433). Afirma que la actitud implica una disposición para actuar con entusiasmo, interés y diligencia, ya que refleja estados internos que orientan al individuo hacia metas específicas. En otras palabras, son los impulsos que llevan a una persona a realizar acciones y persistir en ellas hasta culminarlas. Así, la actitud resulta fundamental en el aprendizaje, pues está directamente relacionada con la voluntad y el interés del estudiante.

Para Robbins (2004), la actitud es un juicio valorativo, favorable o desfavorable, sobre objetos, personas o acontecimientos, por lo tanto, manifiesta la opinión de quien habla acerca de algo, y es importante porque influye en el comportamiento en el trabajo. En cambio, Freiría (2004), la define como una predisposición que se forma y puede modificarse en relación con un objeto o situación. Una actitud recién aprendida es más susceptible al cambio, especialmente cuando el conocimiento sobre el objeto en cuestión es limitado. Sin embargo, el proceso de modificación puede ser lento y progresivo, ya que las actitudes arraigadas son más resistentes. Por esta razón, un factor clave para el cambio actitudinal es la alteración de alguno de sus componentes. Este aspecto es crucial en la enseñanza: al identificar los factores asociados a las actitudes, es posible intervenir para modificarlas o fortalecerlas.

Este autor establece tres componentes de la actitud: cognitivo, afectivo y conativo o conductual. El componente cognitivo se relaciona con las ideas, opiniones, categorías, atributos y conceptos sobre el objeto, de allí que la disposición de una persona dependerá de la información que posea al respecto. El componente afectivo incluye las emociones o sentimientos vinculados al objeto actitudinal, manifestándose en valoraciones positivas o negativas, en expresiones de agrado/desagrado, aceptación/rechazo, o estados como miedo, felicidad, ira o ansiedad. El componente conductual corresponde a la inclinación o predisposición a actuar de cierta manera frente al objeto.

Sobre este particular, Rodríguez et al. (2012, citado en Reyes Narváez et al., 2023), señala que el componente afectivo se refiere a los sentimientos de la persona hacia el objeto en términos de simpatía o antipatía. El componente cognitivo se refiere al conocimiento o información de la persona sobre el objeto; mientras el componente conductual se refiere a la conducta o tendencia hacia el objeto.

En cuanto a la formación de actitudes, Vázquez Rodríguez et al. (2022) expresa: "resulta de una síntesis entre lo individual y el medio social en el que está inmerso el sujeto" (p.130). En otras palabras, las actitudes tienen sus raíces en el aprendizaje social, ya que se aprenden, se expresan y modifican en contextos sociales. En tal sentido, para medir la actitud hacia la química mediante Biomodel, se evaluó la percepción de la utilidad de la plataforma, las emociones al usar Biomodel y la participación en las actividades.

Metodología

La investigación se enmarcó en el paradigma cuantitativo, fundamentado en el positivismo, con un diseño no experimental, de campo y de nivel descriptivo. Según Palella & Martins (2003), este enfoque "se caracteriza por privilegiar el dato como esencia sustancial de su argumentación" (p.29), el cual simboliza una realidad mediante la medición de variables. Sus resultados se sustentan en números o datos estadísticos, analiza ndo los hechos sin manipular ni controlar las variables. Además, los datos se recolectan directamente de la realidad objeto de estudio para describirla o caracterizarla con base en el análisis e interpretación de los resultados obtenidos, haciendo énfasis en los datos predominantes.

La población estuvo representada por la totalidad de los estudiantes cursantes de quinto año de la U.E. Colegio Joseph Lancaster durante el primer lapso del año escolar 2023- 2024, es decir, 30 estudiantes. Por tratarse de una población pequeña, finita y manejable por los investigadores, no se utilizaron técnicas de muestreo, ya que la muestra fue censal; es decir, se trabajó con la totalidad de los estudiantes.

Se empleó una encuesta como técnica para recoger los datos, y como instrumento un cuestionario politómico conformado por 30 ítems con cinco alternativas de respuesta según la escala de Likert. Este instrumento resultó ser altamente confiable ($\alpha = 0,72$) según el coeficiente de confiabilidad Alpha de Cronbach, y válido según el juicio de tres expertos, especialistas en el área de la docencia, tecnología de la computación en educación y metodología de la investigación, los cuales realizaron sus aportes en cuanto a la pertinencia, claridad y coherencia de los ítems.

El instrumento se aplicó a los estudiantes en un solo momento después de dos clases impartidas sobre el tema hidrocarburos aromáticos en el primer lapso del año escolar 2023-2024 (sin acompañamiento), primero se abordó el contenido teórico sobre hidrocarburos y los tipos de enlaces, luego se realizó una sesión en el laboratorio de computación para resolver los ejercicios propuestos de una guía didáctica empleando la aplicación Biomodel para realizar las estructuras solicitadas, finalmente se aplicó el cuestionario con el propósito analizar la actitud hacia el aprendizaje de la química mediante el uso de la aplicación Biomodel, buscando mejorar la praxis docente y la formación de los estudiantes.

Para el procesamiento de los datos se empleó la estadística descriptiva,apoyada en un análisis porcentual. Se utilizó el programa el programa Microsoft Excel para generar los diagramas de barras por dimensión centrándose en las variables "actitud del estudiante" y "aprendizaje de la química orgánica mediante el uso de la plataforma virtual Biomodel". Finalmente, se interpretaron los resultados en función de los indicadores definidos en el cuadro de operacionalización de variables, lo que permitió establecer conclusiones y recomendaciones alineadas con los objetivos planteados en la investigación.

Tabla 1.
Operacionalización de las variables

VARIABLE	DEFINICIÓN CONCEPTUAL	DIMENSIONES	INDICADORES	ÍTEMS	INSTRUMENTO
Actitud del estudiante	Son creencias y cogniciones en general, dotada de una carga afectiva a favor o en contra del aprendizaje de la química orgánica mediante la plataforma virtual Biomodel. que predispone a una acción coherente con las cogniciones y afectos relativos a dicho aprendizaje.	Cognitivo	Facilidad Necesidad Utilidad	1, 2 3,4 5,6,	Cuestionario politómico con 5 alternativas de respuesta tipo Likert
		Afectivo	Gusto Inseguridad Disfrute Frustración Ansiedad	7 8 9 10 11	
		Conductual	Distracción Llamado de atención Sudoración Errar Rapidez Aplicación	12 13 14 15 16 17,18	
Aprendizaje de la química orgánica mediante el uso de la plataforma virtual Biomodel.	Implica adquirir nuevos significados, que son el resultado final de dicho aprendizaje. Es decir, la aparición de nuevos significados en el estudiante refleja la finalización exitosa de un proceso previo de aprendizaje significativo. Para lograr la significatividad, es necesario relacionar los nuevos conocimientos con los que el estudiante ya posee (Ausubel, 2000, p. 122).	Tipo de aprendizaje desarrollado	Teórico Práctico Visual Colaborativo Significativo	19 20 21 22 23	
		Dimensiones implicadas	Atención Resolución de problemas Interés Participación Comprensión	24 25 26 27 28,29,30	

Objetivo General: Analizar la actitud hacia el aprendizaje de la química orgánica mediante el uso de la plataforma virtual Biomodel en los estudiantes de 5to año de la Unidad Educativa Colegio Joseph Lancaster durante el primer lapso del año escolar 2023-2024.

Resultados y discusión

En relación con la variable de actitud del estudiante, evaluada a través de la dimensión componente cognitivo (indicadores: facilidad, necesidad y utilidad), se observó que la mayoría de los estudiantes encuestados manifestaron su total acuerdo o acuerdo con las siguientes afirmaciones: les resulta sencillo aprender química orgánica utilizando la plataforma Biomodel (100%), y consideran que la química es una asignatura complicada (93%). Respecto al indicador necesidad, se identificó que la mayoría de los estudiantes estuvo totalmente de acuerdo o de acuerdo en que es necesario utilizar la aplicación para comprender la asignatura y reconocen que la asignatura química es un requisito de su formación como bachiller en ciencias.

En cuanto a la utilidad, existe una moderada tendencia a considerar que la química orgánica tiene aplicaciones en la vida cotidiana. Esto se relaciona con la teoría del aprendizaje significativo (Ausubel, 2000), ya que demuestra que los estudiantes buscan construir conexiones entre los contenidos académicos y su realidad personal. Estos hallazgos respaldan lo planteado por Sweller (1994) y Mayer (2005), el uso de herramientas digitales como Biomodel mejora la percepción de facilidad, necesidad y utilidad en el aprendizaje, ya que el combinar elementos visuales (modelos moleculares 3D) y verbales (explicaciones teóricas) se reduce la carga cognitiva de la memoria de trabajo y se favorece la compresión y/o retención de información, lo que explica la actitud cognitiva positiva hacia la química mediante Biomodel. De igual manera, concuerdan con Corona Salazar et al., (2022), en que los estudiantes desarrollan una disposición intelectual y emocional favorable cuando se emplean estrategias didácticas innovadoras (simulaciones, demostraciones interactivas y experimentación).

En referencia al componente afectivo, evaluado con cinco indicadores: gusto, inseguridad, disfrute, frustración y ansiedad. Los resultados mostraron una actitud mayoritariamente positiva: 100% aumento su gusto por la química al usar Biomodel, 87% se sintió seguro utilizando la plataforma, 80% disfruto las clases, 64% experimento incomodadas durante las evaluaciones y solo un 7% sintió ansiedad en las clases. En este sentido, Biomodel demostró ser una herramienta efectiva para mejorar el gusto y la seguridad, aunque persisten desafíos como el estrés en las evaluaciones. Ello coincide con los aportes de Andrade Lotero (2012), quienes consideran que los laboratorios virtuales son favorables para la construcción de conocimientos ya que les permite a los estudiantes mejorar el entendimiento y/o compresión de la temática vista en clase.

Con respecto al componente conductual, evaluado con los indicadores: distracción, llamado de atención, sudoración, errores, rapidez y aplicación, se encontró que existe una moderada tendencia por parte de los estudiantes a observar una disposición a actuar o reaccionar favorablemente hacia el aprendizaje de la química empleando la plataforma Biomodel, ya que 90% sigue distrayéndose en clase, 54% requiere llamados de atención del docente, solo 10% manifestó síntomas físicos de ansiedad (sudoración, palpitaciones, entre otros), 60% comete errores al resolver ejercicios, 90% reconoció que Biomodel les permite formular hidrocarburos con rapidez y entre 17% a 27% aplica los conocimientos de química fuera del aula. Estos resultados demuestran un nivel promedio en el componente conductual, pero positivo o favorable en lo afectivo. Persisten desafíos conductuales como distracción y errores, por lo que se recomienda complementar su uso con estrategias para mejorar la concentración y la aplicación práctica de los conocimientos.

En lo que respecta a los tipos de aprendizajes en química orgánica mediante la plataforma Biomodel, evaluados con los indicadores: teórico, práctico, visual, colaborativo y significativo, se encontró que los estudiantes perciben un aprendizaje altamente práctico (67%), visual (80%) y significativo (73%), pero moderadamente teórico (47%) y colaborativo (60%). Estos datos indican que los estudiantes valoran especialmente las representaciones visuales, la aplicación práctica de los conocimientos, la relación con situaciones reales y el trabajo colaborativo para resolver problemas. Además, reconocen que el docente fomenta el uso de diagramas estructurales, la discusión de conceptos y la aplicación del conocimiento.

En relación con el impacto de la plataforma Biomodel en la actitud hacia el aprendizaje de la química orgánica, analizando las dimensiones implicadas, se encontró una tendencia muy alta a que los estén de acuerdo o totalmente de acuerdo en la mejora significativa en: la atención (83%), la resolución de problemas (80%), el interés o motivación (80%), pero, sobre todo, la comprensión de las fórmulas químicas por la visualización en 3D de la estructura de diferentes hidrocarburos (100%). Cabe señalar que la única dimensión que no se vio tan favorecida fue la participación, ya que el grado de participación de los estudiantes durante la clase fue bajo (33%). En tal sentido, Biomodel demuestra ser efectivo para: despertar el interés y curiosidad científica, facilitar la comprensión mediante representaciones visuales y promover el aprendizaje autónomo guiado.

Estos resultados coinciden con (Betancourt Ramos et al., 2023), quienes concluyeron que el rol del docente siempre será un aspecto clave en los procesos de enseñanza aprendizaje, así como su capacitación e interés por llegar a sus estudiantes de una manera novedosa aprovechando el potencial que ofrecen las TIC como es el caso de los laboratorios virtuales en las ciencias naturales, destacando que la propuesta fue implementada con éxito y los estudiantes demostraron interés, participación, trabajo colaborativo y compromiso en el desarrollo de las actividades, de hecho, expresaron que fue de su agrado y contribuyó de una manera amena y dinámica al mejor entendimiento y/o compresión de la temática abordada, lo cual genera un aprendizaje significativo.

Igualmente concuerdan con Vera-Medranda, & Castro-Bermúdez (2024), quienes destacan la necesidad de implementar estrategias innovadoras para fomentar actividades significativas y consolidar aprendizajes en el área de ciencias, además de cultivar la exploración y el pensamiento crítico, así como promover el aprendizaje activo y la aplicación significativa de conocimiento para fortalecer habilidades científicas y actitudes, para enfrentar desafíos y aprovechar oportunidades mediante la enseñanza. En el caso de la enseñanza de la química, esto implica partir de los conceptos más simples y conocidos para ir construyendo progresivamente un conocimiento más complejo. Por tal razón, se recomienda: continuar usando Biomodel durante las clases de química orgánica, desarrollar estrategias para incrementar la participación y articular progresivamente conceptos desde lo simple a lo complejo.

Es importante señalar que el usar Biomodel en la enseñanza de la química puede ayudar a gestionar la carga cognitiva de los estudiantes al facilitar la comprensión de conceptos como la geometría molecular o enlaces químicos que son abstractos y complejos (alta carga intrínseca) pero al rotar, construir y comparar modelos, los estudiantes construyen esquemas mentales que pueden favorecer el aprendizaje significativo, de allí que el docente al diseñar la clase evite detalles irrelevantes que aumenten la carga extrínseca e incluya una guía didáctica con instrucciones claras, en concordancia con Montagud (2020).

Conclusiones

Se encontró en los estudiantes una actitud favorable hacia el aprendizaje de la química orgánica mediante la plataforma Biomodel, mejorando su percepción de facilidad, utilidad y motivación. Aunque algunos consideran la asignatura compleja, la mayoría valora la herramienta por su impacto positivo en la comprensión, especialmente gracias a la visualización en 3D de las estructuras químicas. En lo afectivo, los estudiantes mostraron emociones positivas (seguridad, disfrute) y baja ansiedad, aunque persisten nervios durante las evaluaciones. En lo conductual, se observó una disposición favorable, pero continúan distrayéndose durante la clase y cometiendo errores al resolver los ejercicios propuestos.

Por otra parte, respecto a determinar las dimensiones cognitivas, afectivas y conductuales implicadas en el aprendizaje de la química orgánica a través del uso de la plataforma virtual Biomodel, se determinó que mejoró notablemente la atención, la resolución de problemas de química orgánica, el interés y la comprensión de los conceptos y fórmulas químicas, excepto en la participación, que sigue siendo baja. Los tipos de aprendizajes más desarrollados fueron el práctico, visual y significativo, mientras que el teórico y colaborativo tuvo un avance moderado.

Se recomienda promover el uso continuo de Biomodel con más actividades prácticas, brindar apoyo en evaluaciones como sesiones de repaso, ejercicios de práctica y retroalimentación constante, fomentar la participación con debates, trabajos en grupo y discusiones en clase. Explorar herramientas complementarias como simuladores PHET y Labxchange, videos educativos y materiales didácticos adicionales. Futuras investigaciones podrían incluir entrevistas a los docentes para profundizar en su percepción sobre el uso de la tecnología en la enseñanza de la química.

Este trabajo contribuye al campo educativo al evidenciar que las herramientas digitales interactivas, como Biomodel, pueden potenciar el aprendizaje significativo (Ausubel, 2000), reducir la carga cognitiva (Sweller, 1988) y favorecer la comprensión multimedia (Mayer, 2005) en química orgánica, reforzando la importancia de integrar recursos visuales 3D en la enseñanza de contenidos abstractos para mejorar la actitud de los estudiantes, la retención y la transferencia de conocimientos.

Finalmente, en cuanto a las limitaciones del estudio, tenemos en primer lugar que la muestra de 30 estudiantes se circunscribe a un contexto específico, por lo que la generalización de los resultados no es válida estadísticamente a otras poblaciones sin replicación. En segundo lugar, los factores como el nivel previo de conocimientos en química, la familiaridad con herramientas digitales o el diseño instruccional empleado pueden influir en los resultados en otros entornos. Además, la percepción positiva hacia Biomodel no necesariamente mejora el rendimiento académico de los estudiantes, por lo que futuras investigaciones podrían estudiar este aspecto. Se recomienda replicar el estudio en diversos contextos educativos y con diseños mixtos que combinen datos cualitativos y cuantitativos para enriquecer la discusión.

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Educational psychology of teachers and students in crisis-driven innovation environments

Psicología educativa de docentes y estudiantes en entornos de innovación impulsados por la crisis

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Abstract

Educational innovation holds promise for transforming learning systems; however, it has also introduced significant emotional and psychological challenges for both students and teachers, particularly in contexts of rapid systematic reform and digital transformation. This study investigates the psychological effects of educational transformation in Ukraine, with comparative insights from Latin American countries such as Brazil and Colombia. Anchored in Lazarus and Folkman's Transactional Model of Stress and Coping and Bronfenbrenner's Ecological Systems Theory, the research adopts a qualitative approach to examine experiences of stress, anxiety, and coping strategies within school environments. Using thematic analysis of semi-structured interviews, the study reveals shared struggles of emotional uncertainty, institutional neglect, and cognitive overload among educational stakeholders. Nevertheless, evidence of adaptive resilience emerged, with some participants leveraging peer relationships and intrinsic motivation as buffers against reform-related stress. The findings highlight a critical gap in the emotional preparedness of

educational policy and practice. The study advocates for the integration of emotional readiness, psychological support mechanisms, and targeted training into reform agendas. By re-centering human experience within educational innovation, this research offers actionable insights for policymakers and educators navigating transformation across diverse global contexts.

Keywords: educational innovation, emotional burnout, emotional resilience, institutional support, professional self-realization, psychosocial adaptation.

Resumen

La innovación educativa es prometedora para transformar los sistemas de aprendizaje; sin embargo, también ha introducido importantes retos emocionales y psicológicos tanto para los estudiantes como para los profesores, especialmente en contextos de reforma sistemática rápida y transformación digital. Este estudio investiga los efectos psicológicos de la transformación educativa en Ucrania, con perspectivas comparativas de países latinoamericanos como Brasil y Colombia. Basándose en el modelo transaccional de estrés y afrontamiento de Lazarus y Folkman y en la teoría de los sistemas ecológicos de Bronfenbrenner (1979), la investigación adopta un enfoque cualitativo para examinar las experiencias de estrés, ansiedad y estrategias de afrontamiento en el entorno escolar. Mediante el análisis temático de entrevistas semiestructuradas, el estudio revela las dificultades comunes de incertidumbre emocional, negligencia institucional y sobrecarga cognitiva entre los actores del ámbito educativo. No obstante, surgieron pruebas de resiliencia adaptativa, ya que algunos participantes aprovecharon las relaciones con sus compañeros y la motivación intrínseca como amortiguadores frente al estrés relacionado con la reforma. Los resultados ponen de relieve una laguna crítica en la preparación emocional de las políticas y prácticas educativas. El estudio aboga por la integración de la preparación emocional, los mecanismos de apoyo psicológico y la formación específica en los programas de reforma. Al volver a centrar la experiencia humana en la innovación educativa, esta investigación ofrece ideas prácticas para los responsables políticos y los educadores que navegan por la transformación en diversos contextos globales.

Palabras clave: innovación educativa, agotamiento emocional, resiliencia emocional, apoyo institucional, autorrealización profesional, adaptación psicosocial.

Introduction

A crucial component in any country's educational reform or adjustment is the professional self-realization of teachers, whereby they become more resilient and perceive reforms as opportunities for growth and creativity (Yemelyanova et al., 2022). This enables them to fully utilize their knowledge, skills, abilities, creativity, and potential in the teaching profession, thereby overcoming academic workload and mental stress (Kurebay et al., 2023). It also strengthens their autonomy and control over their work, reducing feelings of helplessness (Nevojna et al., 2024). Addressing teachers' emotional well-being is essential for their continued professional development and long-term success. The interconnected challenges of emotional stress and the need for self-realization require innovative strategies for training education seekers, enabling them to effectively harness their potential, integrate creative thinking with research competencies, adapt swiftly to changing conditions, and realize professional opportunities Deroncele-Acosta et al., 2021).

In recent years, the Ukrainian educational system has experienced major reforms due to the need to meet up with global educational standards and digital transformation (Ivanenko et al., 2023). These reforms like competency-based curricula, digitalized classrooms, and hybrid learning models have redefined both the purpose and delivery of education. However, such reforms have also been found to generate institutional and emotional strain on educators, particularly when expectations outpace institutional support (Tkachenko et al., 2024). Evidence from Latin America illustrates this trend. In Uruguay, for instance, López García et al. (2021) reported that 13.49% of teachers experienced moderate to severe stress during the COVID-19 pandemic. Similarly, studies in Ecuador and Peru revealed alarmingly high rates of teacher

stress, with 90% in Ecuador and 91.95% in Peru presenting moderate to severe levels of stress (Flores-Paredes et al., 2021; Párraga-Párraga & Escobar-Delgado, 2020), highlighting the widespread psychological burden as a result of the introduction of educational reforms. These progressive reforms require educators and learners to continuously adapt, and the urgency of these reforms has been intensified by sociopolitical factors, including war-related displacement, which has forced schools and universities to implement remote and hybrid learning under constrained conditions.

Lazarus and Folkman's (1984) Transactional Model of Stress and Coping offers a useful theoretical framework for comprehending the emotional aspects of this shift. According to this paradigm, stress results from the dynamic interplay between people and their surroundings, where emotional outcomes are determined by how difficulties (stressors) are perceived and coping resources are available. According to this concept, the Ukrainian setting is characterized by digital changes, teacher workload, technical disparities, and wartime disruptions. These stressors can result in maladaptive effects like burnout, anxiety, and disengagement if they are not adequately addressed by institutional and emotional support.

Several studies, specifically in Ukraine shows that educators are not only expected to swiftly adopt new technologies but also expected to act as both pedagogues and digital facilitators to students who are coping with trauma and displacement (Kurapov et al., 2023; Londar & Pietsch, 2023). In similar contexts, digitalisation efforts in Brazil have highlighted the challenges of inequitable access and increased mental burden among educators (Carneiro, & Lima, 2022). The digitalization drive, although necessary, is not evenly distributed because under-resourced schools and vulnerable learners are often found struggling to meet up. The psychological impact of these changes is rising, and educators, who are expected to act as both pedagogues and digital facilitators, frequently report stress linked to inadequate training and workload.

Also research from Peru has shown that rapid digital transitions, when implemented without strong emotional support, negatively affect teacher wellbeing and, by extension, student experiences (Deroncele-Acosta et al., 2023). Moreover, emotional well-being is often not considered in the rush toward innovation, with teachers rarely given time to reflect on their own mental health in the pursuit of performance metrics and digital transitions (Lemon & Turner, 2024). Students, especially those from low-income or conflict-affected backgrounds, frequently report anxiety, alienation, and burnout (Kurapov et al., 2023). Evidence suggests that the intensity of academic stress increases in environments that adopt new learning systems without sufficient psychosocial scaffolding.

Importantly, while emotional wellbeing has been recognized as crucial to effective learning, ignoring the emotional well-being of learners risks distorting the very objectives that innovation seeks to fulfil. A study by Vovchenko et al. (2022) emphasized that emotional intelligence significantly influences the academic performance of students and highlights the need to incorporate mental health supports as essential to educational reforms. According to Iskakova et al. (2023), socio-emotional resilience among educators is essential to create an environment where both teaching and learning can thrive. Therefore, ensuring psychological preparation is important to meaningful educational reform.

Despite several policy initiatives and digital reforms in Ukraine, there is a lack of qualitative research that captures lived emotional experiences of students and educators during these reforms. Existing research, such as the study by Lim (2024) on psychological stress during Brazil's digital education transitions, and the work of Vovchenko et al. (2022) on emotional intelligence in Ukraine, tend to focus on outcomes rather than lived emotional processes experiences. This indicates a broader pattern across both Ukrainian and Latin American contexts where emotional experiences of educators and students remain underexplored. Studies with qualitative methods into teachers' burnout (Lavrysh et al., 2025) and students' emotional distress (Lopatovska et al., 2022) reveal the human cost of crisis-driven innovation. Also, research into wartime distance learning (Londar & Pietsch, 2023) and the role of institutional factors (Head et al., 2023) show ethical dilemmas and fractured support networks. However, none explore lived stress and anxiety among secondary-school educators and university students navigating rapid reform in Ukraine.

This study aims to explore the emotional impact of innovative educational practices on students and educators by examining stress and anxiety levels, identifying key psychological, social, and institutional factors influencing these responses, and assessing the coping and support mechanisms currently in use. Specifically, the study seeks to answer these questions:

RQ 1. How do students and educators feel the impact of innovative educational practices on their stress and anxiety levels?
RQ 2. What are the main psychological, social, and institutional factors contributing to their emotional responses?
RQ 3. What coping and support mechanisms are currently adopted by the educators and students?

Now that there is technological transformation in Ukraine's educational system, this study offers relevant and crucial perspectives into an ignored aspect of emotional impact of this digital advancement on both the students and educators. Although recent research has examined technology integration and learning outcomes quantitatively, and some qualitative studies have examined burnout and distress, little is known about the lived emotional experiences of secondary school teachers and college students navigating rapid innovation. This study aims to bridge that gap by qualitatively investigating the stress, anxiety, and coping strategies associated with these changes in education. The qualitative examination of the coping mechanisms, stress, and anxiety related to these instructive shifts will fill this research gap. Furthermore, the growing concerns about psychological overload, unequal access, and emotional estrangement in reformed learning environments by focusing on human experience, which offers a fresh perspective on educational success. The study enhances understanding of reform outcomes and provides psychological recommendations for future educational policy in Ukraine and other crisis-affected contexts by recording first-hand experiences of stakeholders.

The study focuses on Lazarus and Folkman’s model as theoretical frameworks of explaining stress and coping due to educational changes. It then examines stress and anxiety as core responses to reform. It explores the impact of educational innovation on emotional well-being globally and in Ukraine context. The study also highlights the value of qualitative methods in capturing lived experiences, and stresses the need for Ukraine-focused research amid the pandemic and war.

Literature Review

As Ukraine’s education system experience rapid innovation from digitalisation to competency-based models, stress and anxiety have quietly intensified among educators and learners. These emotional responses are not side effects but central to understanding how reforms impact real lives. This section reviews key concepts of stress, anxiety, and educational innovation, then reviews global and Ukrainian research on the effect of reforms on psychological well-being. Lazarus and Folkman’s Transactional Model of Stress and Coping provides a useful lens to look into how individuals appraise and respond to educational demands that exceed their perceived resources. It helps frame the psychological toll of reform as a dynamic interaction between person and environment. It also identifies a gap: while reforms are well-documented structurally, the lived emotional experiences of those affected are still underexplored. This review sets the stage for a study that seeks to centre those voices and contribute needed insight into the human cost of change.

Theoretical Framework for Stress and Coping in the Context of Educational Change

Scholars have adopted several theoretical frameworks to understand how individuals respond to educational change and psychological strain. Some of the widely used theories are: lazarus and folkman’s transactional model of stress and coping, Bronfenbrenner’s Ecological Systems Theory, bandura’s social cognitive theory, the job demands-resources model, and meichenbaum’s behavioural stress inoculation framework. Each provides a solid view for examining how environmental demands, cognitive appraisals, and individual resources interact. This study will be utilising a primary model which is; Lazarus and

Folkman's Transactional Model of Stress. The framework was selected because of how it centre on individual perception and response and also contextualise those experiences within the educational systems making them suitable for analysing the Ukrainian educational landscape. A shift toward holistic education that make use of technology, personality development, and philosophy is important to reduce the systemic stress caused by overly mechanistic learning reforms (Iskakova et al., 2023).

Lazarus and Folkman's Transactional Model of Stress and Coping

This model posits that stress arises both from external events and how individuals appraise these events and assess their resources for managing them (Lazarus & Folkman, 1984; Spătaru et al., 2024). In educational innovation, educators and learners evaluate reform-related demands, such as new teaching platforms and assessment methods to determine whether they possess the needed skills, institutional support, and time (Ghiasvand et al., 2024). Stress and anxiety is imminent when demands exceed available resources.

While trying to understand educator's burnout during reform periods, some studies have adopted these frameworks. Internationally, this model has been employed to explain emotional burnout in educators navigating hybrid or remote learning. In Peru, hybrid learning in public universities was linked to high levels of stress when institutional support was lacking, emphasizing teachers' primary appraisal of insufficient resources (Colina-Ysea et al., 2024). Similarly, research from Colombia on secondary teachers revealed both appraisal and coping strategies; inadequate preparation in remote teaching led to emotional exhaustion and maladaptive coping. A Brazilian study also revealed that sudden technology adoption without structured support increased burnout symptoms among educators, revealing secondary appraisal failures and impaired coping (Lim, 2024). In the Ukrainian context, recent qualitative findings show that students reported substantial emotional distress due to the war and a lack of institutional guidance or training, suggesting that primary appraisal of existing threats and systemic failure to offer resources leads to stress and anxiety (Kurapov et al., 2023). This model is particularly relevant in Ukraine, where teachers and students have been driven into digital reforms amid broader societal crises. Their cognitive appraisals which at the same time is shaped by uncertainty, collective trauma, and limited institutional guidance play a central role in how stress manifests and whether coping strategies are adaptive or maladaptive.

Stress and Anxiety

Stress and anxiety are deeply human responses to the pressures and unexpected change, and these are the challenges that students and teachers face in today's education systems. According to the American Psychological Association (2022), stress occurs when demands exceed one's ability to cope. Selye (1978) described it as the body's nonspecific reaction to any demand (Ghasemi et al., 2024; Szabo, 2023).

In educational contexts, stress can be triggered by academic workload, high-stakes testing, or the rapid changes in instructional methods. Research from Colombia found that teachers experienced intense stress when hybrid learning was introduced without adequate training. Similarly, a study in Peru noted increased anxiety among students where digital platforms were unreliable and teachers overwhelmed (Colina-Ysea et al., 2024).

When student expectations are not met during reform, motivation to continue online learning decreases, amplifying emotional strain. Research from Argentina showed that integrating social-emotional learning into reform processes reduced anxiety and improved student engagement.

Anxiety while often related to stress, is defined by the National Institute of Mental Health (2022) as a deeply excessive and prolonged case of worry and fear about everyday situations. In education, anxiety may arise from pressures to excel, the fear of failure, or unfamiliar technological environments (Vovchenko et al., 2022). Understanding and supporting emotional needs is vital for reforms to succeed in any educational context.

Educational Innovation and Emotional Wellbeing

Educational innovation in Ukraine has been shaped by necessity, from COVID-19's disruption of face-to-face learning to the war's destruction of physical infrastructure (Schleicher, 2020). Innovations such as digital platforms, competency-based learning, and hybrid teaching are aimed at increasing efficiency and continuity. However, these reforms often neglect the emotional readiness of those expected to implement them. Global studies demonstrate that poorly supported reforms contribute to emotional burnout. For example, Iskakova et al. (2023) noted that digital learning platforms, though innovative, exacerbated stress among educators when introduced without scaffolding. In Latin America, consistent burnout patterns across Uruguay, Peru, and Ecuador during remote teaching were identified (López García et al., 2021; Flores-Paredes et al., 2021; Párraga-Párraga & Escobar-Delgado, 2020). In Ukraine, Tkachenkor et al. (2024) and Kurapov et al. (2023) reported similar trends, with educators feeling emotionally overwhelmed and unsupported. Despite this evidence, many reforms continue to prioritize measurable performance metrics over lived experience. As Avsec et al. (2024) warns, treating educational innovation as a technical upgrade rather than a human-centered transformation undermines its sustainability and equity.

Importance of Qualitative Approaches in Capturing Nuanced Emotional and Psychological Experiences

Quantitative studies reveal valuable trends but often flatten the emotional complexity of educational change. Qualitative methods such as phenomenological interviews, focus groups, and narrative analysis allow deeper insight into emotional experience and meaning-making processes (Papajorgji & Moskowitz, 2024). Ukraine-specific research remains sparse in this domain. Although Lavrysh et al. (2025) and Lopatovska et al. (2022) examined educator burnout and student anxiety, these studies did not center lived emotional narratives. Therefore, qualitative research is crucial for informing responsive policy and targeted interventions

Justifying the Need for Ukrainian-Contextualized Research in a Post-Pandemic, War-Affected Educational Environment

Teachers and students are navigating educational innovations amid trauma, displacement, and infrastructural collapse due to the COVID-19 pandemic and ongoing war (Mayer et al., 2023). This delicate landscape necessitates research that centers emotional survival alongside institutional functionality. UNESCO (2023) projects a surge in youth requiring psychological support, and Tkachenko et al. (2024) emphasize creative resilience-building among teachers as a protective factor. However, as Ikwuka et al. (2024) note, educators are growing resistant to digital surveillance and weary of technocratic mandates. These overlapping crises reveal a deep policy gap: reforms continue while the psychological cost is ignored. These unique challenges demand a pressing need for research that is tailored on the Ukrainian educational experience, focusing on the psychological impacts of these crises and leading to informed and specific interventions to support learners and educators in managing well in this complex and fast changing system.

Rationale for Conducting This Study and Its Contribution to Existing Knowledge

This study aims to fill a critical gap in the literature by exploring the psychological experiences of Ukrainian students and educators amid the dual crises of the pandemic and war. While previous research has addressed mental health challenges within these groups, there remains a lack of qualitative studies that capture the emotional depth of their lived experiences (Schulze-Hagenest et al., 2023). By using qualitative methodologies, this research provides a rich understanding of how educational reforms affect the emotional well-being of both students and teachers. These findings are important for developing sustainable support systems and mental health policies within the Ukrainian educational community.

Thiis study also contributes to international education research by offering insights into coping strategies and the institutional role in supporting psychological resilience during crises. Although this research is contextualized within Ukraine, the methodology and findings are transferable and may be replicated in other conflict-affected or reform-intensive contexts, particularly across Latin American countries. In summary, this study enhances our understanding of the psychological toll of reform in crisis and supports future education reform initiatives both locally and globally.

Methodology

Research Design

This study employed a qualitative research design using semi-structured interviews, effectively explores complex psychological phenomena like stress and anxiety in specific sociocultural and institutional contexts. This approach supports the interpretivism approach, capturing the depth, texture, and meaning of lived experiences.

Semi-structured interviews provide flexibility, focus, and openness for researchers to guide discussions, allowing participants to share personal narratives and insights, ensuring richness and consistency in data (Naeem, et al., 2023). The study employed methodological transparency, careful coding procedures, and ongoing researcher reflexivity to ensure trustworthiness and reliability. Inter-coder reliability was also utilized to increase the legitimacy of the thematic analysis. Given its contextual sensitivity and adaptability, this methodology can be replicated in Latin American countries facing similar educational and psychosocial challenges, offering cross-regional insights into how students and teachers experience reforms during crisis.

Participants

This study involved 10 secondary school educators and 12 students from public schools and universities across Ukraine, and all of them have direct experience with innovative educational practices e.g. blended learning, digital platforms and project-based instruction. Purposive sampling method was employed to select participants who were actively engaged in and affected by recent educational reforms and this approach ensures that the data gathered are from informed perspectives (Palinkas et al., 2015; Campbell et al., 2020).

Ethical protocols were strictly observed as all participants provided informed consent, and they were assured of anonymity and confidentiality in handling their data. Ethical approval was obtained from the relevant institutional review boards before collection of data.

Data Collection

Data were collected using semi-structured interviews, conducted either in person or via Zoom, depending on participants' availability, safety, and preferences. This method was chosen for its ability to capture rich, narrative-driven data, allowing participants to articulate their emotional experiences in their own words, while also giving the interviewer the flexibility to probe for depth and clarification where necessary (Adams, 2015; Naeem et al., 2023).

Participants were selected through purposive sampling, with an emphasis on relevance to the research objectives. The study involved 10 secondary school educators and 12 students (from both secondary schools and universities) who had first-hand experience with innovative educational practices such as blended learning, digital platforms, and project-based instruction. Additional selection criteria included; active participation informal education in Ukraine during ongoing educational reforms, willingness and ability to reflect on emotional responses to those reforms educators have at least one year of experience teaching under new or hybrid instructional models, students with recent experience with remote or digitally enhanced instruction.

Each interview lasted between 30 to 60 minutes and was conducted in either Ukrainian or Russian, depending on participant preference, then translated into English during transcription where necessary.

The study used a semi-structured interview protocol, focusing on four core areas: emotional responses to educational innovations, coping strategies, institutional support, and emotional resilience. Participants were asked to share their initial reactions, coping strategies, perceptions of institutional support, and experiences of burnout or psychological strain. The format allowed for flexibility in exploring individual experiences.

Methodological Limitations

This study acknowledges some limitations even as it provides meaningful insights into the emotional experiences of learners and educators during educational reforms. First, the study employed a small, purposively selected sample consisting of 10 secondary school educators and 12 students. While this enabled in-depth exploration of lived experiences, it limits the generalizability of findings across the broader Ukrainian educational system (Palinkas et al., 2015). Future studies should employ larger and more diverse samples, possibly using stratified sampling to include various demographics, school types, and teaching contexts. This would allow for a more comprehensive understanding of how emotional responses vary across different segments of the education sector.

Most participants were drawn from relatively stable central and western regions of Ukraine as such, the lived experiences of learners and educators in heavily displaced regions such as Donetsk, Luhansk, Kherson, and parts of Zaporizhzhia may not be fully represented. This introduces a regional bias that must be considered when interpreting findings. Future research should aim for greater regional coverage, particularly including voices from frontline or displaced areas.

The dependence on self-reported interviews also introduces the potential for socially desirable responses, where participants may consciously or unconsciously downplay distress or exaggerate resilience (Creswell & Poth, 2018). Conducting Zoom interviews might have affected the level of emotional expression because the physical absence can limit the researcher's ability to observe non-verbal cues and deeper interpersonal rapport, which are important in sensitive psychological topics (Farrell, 2020). Future studies should consider mixed-method designs, incorporating observational techniques, longitudinal tracking, or validated psychological assessments to triangulate data.

Despite these limitations, the study serves as a valuable foundation for understanding the emotional impact of educational reforms in crisis areas. Future research should consider larger samples and mixed methods of data collection across more affected regions.

Results and Discussion

Participants' Demographic Profile

The study involved 10 educators and 12 students from public schools and universities in Ukraine, all with direct experience in innovative educational practices, as presented in Tables 1 and 2.

Table 1.
Participant's Demographic profile (Students = 12)

Participant ID	Gender	Age	Education Level	Institution Type	Digital Literacy level
Student 1	Male	16	Secondary (Grade 11)	Public School	Moderate
Student 2	Female	19	Undergraduate	Public University	High
Student 3	Female	17	Secondary (Grade 12)	Private School	Very high
Student 4	Male	21	Undergraduate	National University	High
Student 5	Female	20	Undergraduate	Public University	High
Student 6	Male	16	Secondary (Grade 10)	Public School	moderate
Student 7	Female	18	Secondary (Grade 12)	Rural School	Moderate
Student 8	Male	22	Undergraduate	Polytechnic	High
Student 9	Female	16	Secondary (Grade 11)	Boarding School	Moderate
Student 10	Female	21	Undergraduate	Private University	Very high
Student 11	Female	21	Third-Year Undergraduate	State University	High
Student 12	Female	16	Secondary (Grade 10)	Public School	high

In terms of gender representation 67% were female indicating a higher female participation. The participants range in age from 16 to 22 years, covering both secondary school students (ages 16–18) and university undergraduates (ages 19–22). 50% students were from the secondary school and 50% were university undergraduates (see Table 1).

Table 2.
Participant's Demographic profile (Educators = 10)

Participant ID	Gender	Age	Teaching Level	Institution Type	Years of Experience	Digital Training
Educator 1	Female	34	Secondary	Public School	10	Basic
Educator 2	Male	45	University	National University	20	Advanced
Educator 3	Female	29	Secondary	Private School	6	Intermediate
Educator 4	Male	39	University	Pedagogical Institute	13	Advanced
Educator 5	Female	50	Secondary	Public School	25	Basic
Educator 6	Male	31	University	Technical University	8	Advanced
Educator 7	Female	42	Secondary	Rural School	18	Intermediate
Educator 8	Male	37	University	Public University	15	Advanced
Educator 9	Female	28	Secondary	Boarding School	5	Basic
Educator 10	Male	33	University	International Program	9	Intermediate

The study includes 5 female and 5 male educators, ranging in age from 28 to 50. The years of experience range from 5 to 25 years, digital training levels are advanced (4 educators in higher education), intermediate (3 educators), and basic (3 educators in secondary schools) (see Table 2). Additionally, the study utilized open-ended questions to gather detailed accounts of participants' experiences during educational reforms, focusing on cognitive and affective aspects, stress, coping, and educational change (see Table 3).

Table 3.
Open-ended Questions and Purposes

Interview Question	Purpose of the Question
1. Can you describe any case where a new educational method increased your stress or anxiety?	To explore direct personal experiences with stress-inducing educational practices or reforms.
2. How have the ongoing changes in your school or university affected your emotional well-being?	To assess the overall emotional and psychological impact of sustained institutional changes.
3. What kinds of support (if any) have helped you manage stress during educational reforms?	To identify protective or coping resources (institutional, peer, or personal) that mitigate stress.
4. In your experience, how do students or teachers react to new educational technologies?	To examine emotional and behavioral responses to technological innovation in education.
5. Can you recall any strategies that helped you adapt emotionally during educational transitions?	To uncover adaptive coping mechanisms and personal resilience strategies.

Thematic Coding Overview

The study utilized a deductive thematic approach for qualitative data analysis, importing interview transcripts into NVivo software and generating codes using a significant information coding strategy (Adu, 2019; Allsop et al., 2022). Based on the significant information identified from participant's responses, a label was developed indicating the code representing that information. After developing the codes, the codes were categorized to form themes make meaningful connection between the data, addressing the research questions of the study as shown in Figure 1. These themes help ground the study in the realities faced by students and educators undergoing reforms under pressure.

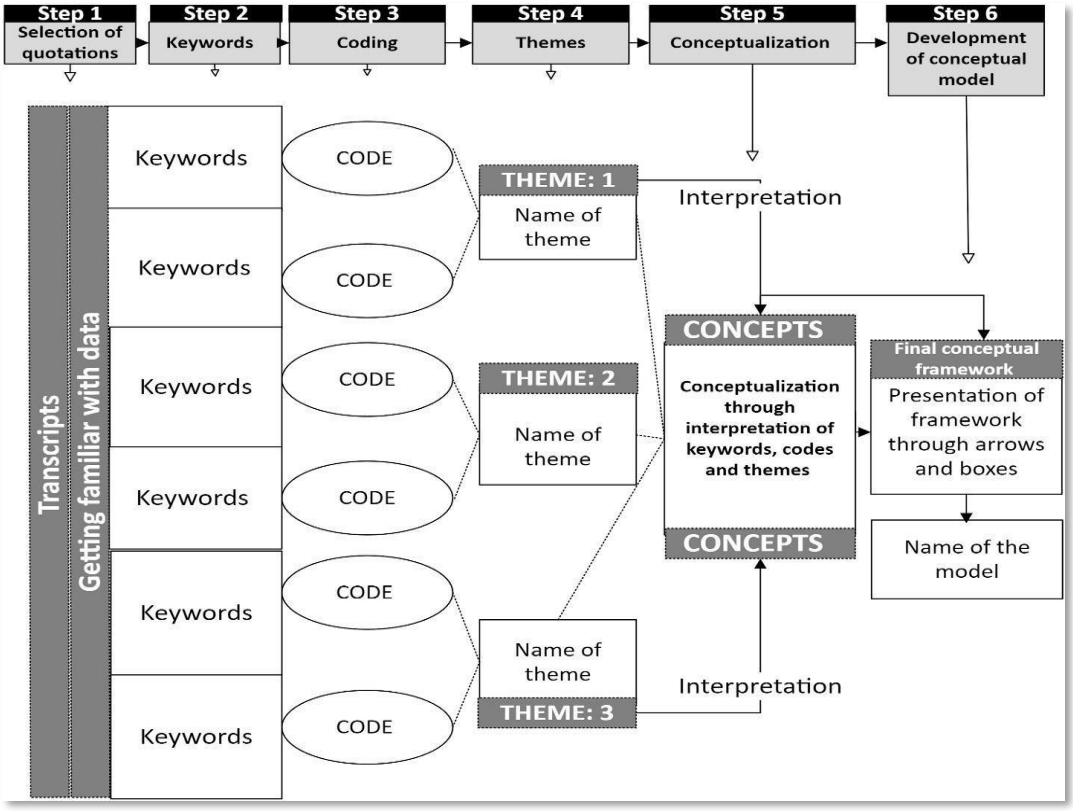

Figure 1. Thematic Analysis Six-Step Process
Source: (Naeem et al., 2023)

Table 4.
Coding Matrix (Themes × Participants)

Participant ID	Theme Perceived Pressure	Theme Emotional Exhaustion	Theme Lack of Psychological Support	Theme Coping Strategies	Theme Redefining Success
S1	2	0	2	2	0
S2	3	0	0	0	0
S3	0	0	0	3	0
S4	0	3	0	0	0
S5	0	3	2	0	0
S6	0	0	3	0	2
S7	0	2	0	0	2
S8	3	0	0	0	0
S9	0	0	3	0	0
S10	4	2	0	2	0
S11	0	0	2	0	0
S12	0	3	0	0	3
E1	0	2	3	0	0
E2	0	3	3	0	0
E3	1	0	3	0	0
E4	0	0	0	3	0
E5	0	3	3	0	0
E6	2	3	0	0	0
E7	0	2	3	2	2
E8	3	0	3	0	0
E9	0	0	3	0	0

Note:

S represent student
E represent educators
0 represent no significant information was coded from the participants.

Thematic Presentation of Findings

The in-depth interview from the participants (students and educators) resulted according to the research question resulted in five themes as visualized in Figure 2. These themes were discussed in detail and the participant's pseudo-names and quotes were randomly selected and used throughout.

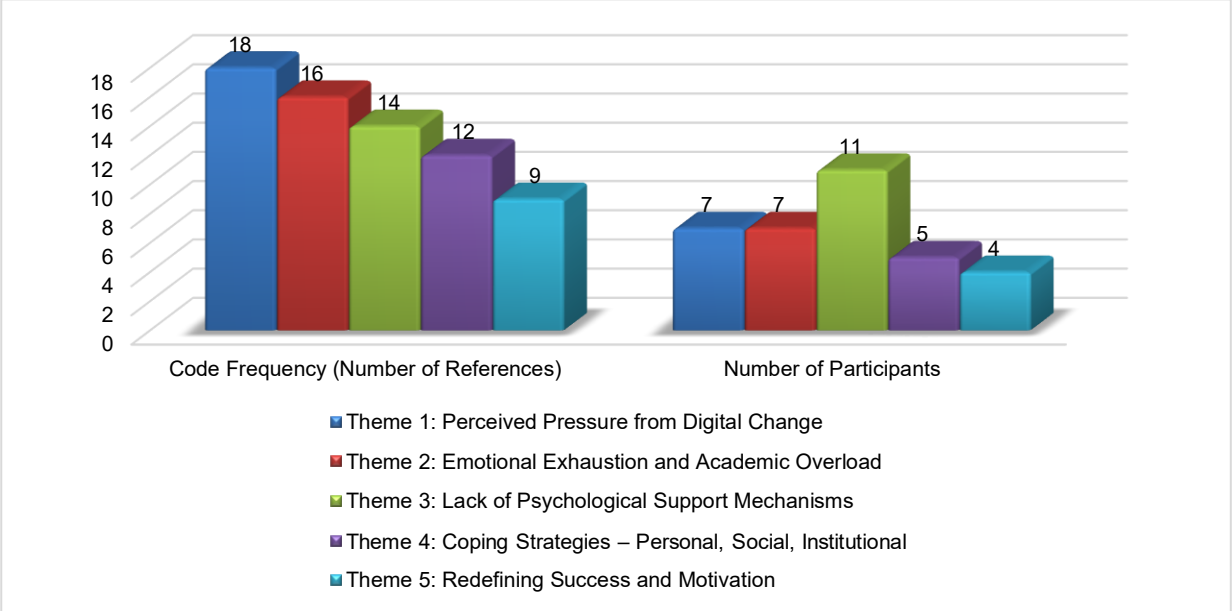

Figure 2. Participants and Code Frequency across Themes.

Theme 1: *Perceived Pressure from Constant Change and Digital Demands*

Participants frequently tagged their feelings as being 'overwhelmed' whenever the change is happening fast and there's a quick expectation to adapt to digital tools with little or no support. This overwhelming responsibility was reported by both educators and learners but from different points of view.

"I had to switch to a new platform mid-semester without training. It felt like we were expected to just know what to do" (Educator 3)

"Sometimes I just keep staring at the screen not knowing where to begin. Everything keeps changing and it's becoming much more difficult to catch up" (Student 2)

Educators face challenges with unfamiliar technologies, frequent pedagogical changes, and inadequate institutional support, while students experience confusion and stress due to inconsistent digital learning environments. The findings of this study agree with Tkachenko et al. (2024) study, where teachers faced similar burnout from reform-induced digital transitions and Vovchenko et al. (2022) study where students with limited digital literacy in reform-heavy environments felt increasingly strange and stressed. Chen (2024) also highlighted how sudden shift of pedagogical methods without emotional readiness increase stress among teachers and learners.

Theoretically, the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984; Wang et al., 2024) opines that participants' views of new implementations as threats instead of challenges reflect a resource-deficit perspective, particularly under rapid reform conditions. Bronfenbrenner's Ecological Systems Theory (1979), Joubert & Jacobs (2024) supports this theme that macro-level reform decisions disrupted micro-level teaching and learning environments, creating a mismatch between expectations and local capacity.

Practically, these findings suggest a pressing need for reform strategies that include emotional readiness and transitioning in phases so that digital innovation will not be a contributor to psychological strain in addition to war and systemic instability already being experienced in Ukraine.

Theme 2: *Emotional Exhaustion and Academic Overload*

Educational innovation for both students and educators has often meant an unrelenting stream of assignments with deadlines, and mental strain. Participants described being "always on," with little difference between study, work, and rest.

"I have a whole three separate platforms to check for one subject—Telegram, Moodle, and email. It is quite exhausting and stressful to just keep track of all platforms." (Student 4)

"I love teaching, but the constant changes now make me dread Mondays. I'm already tired even before the week begins." (Educator 2)

This emotional and cognitive distress agrees with Lazarus and Folkman's model, where stress emerges when perceived demands exceed available coping resources (Saleem & Malik, 2023). Educators lamented that increasing administrative work and constantly changing digital platforms are distressing emotionally and this finding agree with Vovchenko et al. (2022) studies, where similar burnout symptoms were reported among Ukrainian educators engaged in remote innovation efforts, while students, on the other hand are feeling helpless due to lack of structured support.

The pattern is in line with Bronfenbrenner's Ecological Systems Theory, as emotional exhaustion was shaped by institutional structures (mesosystem) and also broader societal stressors, e.g ongoing geopolitical instability (macrosystem). Majority of the participants reported that national crises multiplied their academic stress and also fueled personal and systemic anxiety (Han et a., 2023).

This theme also agrees with Tkachenko et al. (2024) observation that while reform policies encouraged digital learning, there is usually insufficient emotional preparation which left students feeling overwhelmed. Practically, there is a need to address emotional readiness within educational reforms to achieve innovations that are effective technologically and also sustainable psychologically. Schools in Ukraine could benefit from incorporating stress monitoring checkpoints, anonymous chat rooms to vent out fears, pressures and stress and peer-support systems into reform implementation plans.

Theme 3: *Lack of Psychological Support Mechanisms*

Sense of isolation and the absence of psychological safety were recurring trends across learners and educators' groups, many of the participants reported that while educational reforms were quickly implemented, the emotional wellbeing of those experiencing the change was not fully considered.

"We are told to adapt, but no one asks how we feel. There is brief training for tools, but none at all for our emotions." (Educator 5)

"Sometimes I cry after classes because I can't cope with the pressure, I feel like I'm losing it and I don't know where to go for help." (Student 6)

This gap in emotional support reflects what Bronfenbrenner (1979) and Tong & An (2023) describes as failures within the exo-system; structures like school administration and policy institutions that indirectly have effect on individuals. While students and teachers interact daily with educational tools (microsystem), their emotional responses are deeply affected by the presence or absence of supportive systems at these broader levels.

The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984; Krys & Reininger, 2025) also expatiates that when individuals lack psychological support, then, their ability to reappraise challenges constructively diminishes and as a result, what might have been manageable becomes overwhelming, leading to increased anxiety and helplessness. Vovchenko et al. (2022) emphasized on the importance of regular psychological intervention in Ukrainian education systems especially during periods of reforming

education as lack of psychosocial support during reforms lead to reduced teaching effectiveness and student disengagement. This proves that technical solutions only are not sufficient without emotional readiness.

Practical implication is that the Ukrainian education systems must integrate formal psychological services into school reform plans, this includes; regular mental health check-ins, access to trained and empathetic counsellors, and confidential reporting mechanisms as they are now important and not optional.

Theme 4: *Coping Strategies – Personal, Social, and Institutional*

In the middle of emotional toll due to ongoing reforms, many participants described their ways of coping which ranged from personal resilience to supportive relationships and, there are also institutional interventions but in rare cases. These coping strategies are different in accessibility and effectiveness and are often shaped by both individual and systemic views.

"When I feel overwhelmed, I take a stroll or journal, just to clear my head. I've learned not to rely on school systems to help me." (Student 3)

"We support each other. The only reason I haven't quit is because of my colleagues. We listen to one another, we vent and rant together, and we survive together." (Educator 4)

From Lazarus and Folkman's Transactional Model, these examples reflect problem-focused and emotion-focused coping strategies where individuals attempt to either manage the stress or regulate their emotional response. The model's emphasis on appraisal is shown as teachers and students who viewed stressors as something that could be managed often had access to informal support or personal routines that encourages resilience.

In contrast, Bronfenbrenner's Ecological Systems Theory highlights the role of the mesosystem and exosystem such as peer networks, school leadership, and external mental health services in enabling or obstructing coping. When these systems functioned well, they amplified individual efforts but when absent, even the most adaptive strategies were strained.

This theme agrees with findings from Liu, Yan & Fu (2022) that Institutional support and recognition can reduce burnout among hybrid learning teachers, but unavailability of coping mechanisms like psychological services and administrative flexibility can lead to emotional fatigue over time (Vovchenko et al., 2022).

Practical implications include the urgent need to formalize and scale supportive practices that are informal. School leaders should institutionalize mentoring programs, peer support groups, and access to counselling not as extras, but as essential features of reform implementation.

Theme 5: *Redefining Success and Motivation Amid Crisis*

For many participants, traditional notions of academic success such as grades, productivity, and constant performance have been redefined in light of ongoing crises. Both students and educators described a shift toward more internal, survival-oriented motivations.

"These days, I feel proud of myself for just showing up and staying calm. I am no longer chasing top marks like before." (Student 6)

"I have stopped pushing for perfect lessons. If my students feel safe and understood, I count that as success." (Educator 7)

This theme, in line with Lazarus and Folkman's model, where the reappraisal of what constitutes a "threat" or a "goal" leads to new emotional outcomes and coping priorities. Individuals adjusted their internal goals to shield them from chronic stress while picking emotional well-being over academic distinction.

Bronfenbrenner's theory explains that this shift reflects macrosystem-level changes, cultural reorientation, and institutional instability which deeply influence personal values and expectations. Due to the disruptions in Ukraine, traditional educational benchmarks have been subdued to embrace more adaptive, health-conscious measures of achievement and this pattern follows the findings by to Tkachenkor et al. (2024), who found that Ukrainian students in hybrid settings often prioritize their emotional stability over competition in their academics. Iskakova et al. (2023) also reported that teachers under pressures from reform changed their priorities to simply preserving their mental health. Chen (2024) observed that teachers in uncertain project-based learning redefined motivation as being able to adapt over performance metrics. These changes provide a broader psychological recalibration of what "success" means under sustained pressure.

Practically, these evolving motivations could guide educational support systems to become more responsive. Academic curricular and assessments should be more flexible to ensure psychological safety while after academic pursuits especially in war-affected and post-pandemic areas.

Cross-Analysis: Comparing the Experiences of Students and Educators

The ongoing war in Ukraine has deeply and negatively influence their educational system, especially the students and their educators, leading to greater stress and challenges emotionally, although, both groups share certain struggles but their experiences and coping mechanisms are quite different.

Shared Challenges: Both students and educators reported increase in stress and emotional exhaustion. A study by Tkachenkor et al. (2024), highlights that over half of Ukrainian educators' experience symptoms of depression and burnout while the war is ongoing. Students, also experience academic disruptions leading to anxiety and instability.

Divergent Experiences: Educators are caught in between the responsibility of managing their own stress while supporting their students' well-being. The unpredictability of teaching conditions such as shifting between online and offline modes due to safety concerns adds to their burden. Kurapov et al. (2023) discusses the increasing stress educators face from adapting to online education during wartime, emphasizing the need for psychological support that address these circumstances. Students experience isolation due to lack of routine and peer interaction in remote learning, impacting social development and engagement for both learners and educators.

Coping Mechanisms and Support Systems: To address these challenges, some initiatives have been designed to provide the needed psychological support e.g UNICEF, in collaboration with the Ministry of Education and Science of Ukraine, launched the "I Understand" online course, which has been joined by over 3,500 teachers and school psychologists. The online training provides teachers the skills they need to control their emotions and effectively help their students (UNICEF, 2022). UNESCO's Community of Modern Teachers and Psychologists is another example, it provides a forum for educators to exchange experiences and access materials on psychosocial support, assisting them in coping with the difficulties of teaching in times of war (UNESCO, 2023). This analysis explains the intertwined yet distinct experiences of students and educators in Ukraine, emphasizing the need for support mechanisms that solely address their specific needs, a priority that also resonates with educational communities in Latin America facing parallel challenges amid systemic reforms.

Conclusions

This study examines the emotional experiences of students and educators in Ukraine amid ongoing educational reforms in a context of national crisis. Drawing on semi-structured interviews with individuals directly involved in post-pandemic, war-affected education, the research highlights stressors and coping

strategies relevant not only to Ukraine but also to Latin American countries facing similar systemic challenges.

Findings reveal significant psychological strain among both teachers and learners, attributed to frequent pedagogical changes, digital demands, academic overload, and limited psychological support. Participants reported emotional exhaustion and feelings of being overwhelmed, compounded by inadequate institutional backing. Despite these challenges, many demonstrated resilience through personal, social, and institutional coping mechanisms.

The study underscores the importance of integrating emotional well-being into educational reform efforts, shifting the focus beyond academic outcomes to include the psychological realities shaping teaching and learning. Grounded in Lazarus and Folkman's transactional model of stress and Bronfenbrenner's Ecological Systems Theory, the research provides a unique perspective on how individuals adapt to systemic change.

It contributes to the growing discourse that prioritizes emotional sustainability in education and offers a foundation for future comparative research, particularly in Latin America. Based on the findings of the study, the following recommendations were made:

- Structured mental health support should be implemented in schools and universities, that include regular access to counseling and psychological first aid, particularly in regions affected by war or prolonged disruption.
- Training for educators on digital tools, emotional resilience, and digital pedagogy to better manage their own stress and support student well-being should be provided.
- Promote international models of psychological support, with institutions such as UNESCO, CEPAL, and OEI integrating emotional sustainability into educational innovation policies.
- Comparative research with Latin American education systems undergoing similar reforms, to understand regional variations in coping mechanisms and support systems should be carried out.
- Longitudinal and mixed-method studies should be carry out to track the evolution of stress and coping strategies over time in crisis-responsive and innovation-driven educational settings.

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Advancing children's media literacy: A framework for training future educators

Fomentar la alfabetización mediática infantil: Un marco para la formación de futuros educadores

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Abstract

This study analyzes the training of future educators for the development of media literacy in children, recognizing this competence as a key factor in creativity, critical thinking, and social participation in the digital era. A mixed experimental design was implemented with 78 pre-service teachers divided into an experimental group (n=40) and a control group (n=38). The research combined theoretical methods (analysis, synthesis, and systematization), empirical techniques (questionnaires, observation, and case studies), and statistical validation using the Kolmogorov–Smirnov λ-criterion. The pedagogical model developed integrates external training elements and internal motivational, cognitive, and practical factors that strengthen teachers' readiness to guide media education in early schooling. Results revealed significant improvements in the experimental group's levels of readiness—especially in motivation, conceptual understanding, and practical application of media literacy strategies—confirming the

effectiveness of the proposed system. The study concludes that media literacy training should be a central component of teacher education programs to prepare educators capable of fostering critical, informed, and responsible media engagement among children.

Keywords: media literacy, teacher education, media pedagogy, digital competence, experimental design, higher education.

Resumen

El estudio analiza la formación de futuros docentes para el desarrollo de la alfabetización mediática en niños, entendida como una competencia esencial para la creatividad, el pensamiento crítico y la participación social en la era digital. Se aplicó un diseño experimental mixto con la participación de 78 estudiantes de pedagogía, distribuidos en un grupo experimental (n=40) y un grupo control (n=38). La investigación combinó métodos teóricos (análisis, síntesis y sistematización), técnicas empíricas (cuestionarios, observación y estudio de casos) y validación estadística mediante el criterio λ de Kolmogórov–Smirnov. El modelo pedagógico propuesto integra factores externos de formación y componentes internos de tipo motivacional, cognitivo y práctico, que fortalecen la preparación de los futuros educadores para incorporar la educación mediática en el aula. Los resultados evidenciaron mejoras significativas en el grupo experimental en cuanto a motivación, comprensión conceptual y aplicación práctica de estrategias de alfabetización mediática, confirmando la eficacia del sistema diseñado. Se concluye que la alfabetización mediática debe constituir un eje transversal en la formación inicial docente, con el fin de promover en los niños una relación crítica, informada y responsable con los medios de comunicación.

Palabras clave: alfabetización mediática, formación docente, pedagogía mediática, competencia digital, diseño experimental, educación superior.

Introduction

Education plays a fundamental role in shaping citizens' personalities and fostering their ability to participate critically and responsibly in society. Within this context, **media literacy** emerges as a key set of skills and knowledge that enables individuals to evaluate media content, interpret messages analytically, and engage meaningfully with the information environment that surrounds them. In professional, academic, and everyday life, people are constantly exposed to a vast flow of media messages. Therefore, the capacity to detect false or manipulated information, distinguish reliable from unreliable sources, and separate objective facts from disinformation has become an essential competence of modern citizenship. For this reason, educators themselves must possess a high level of media literacy, allowing them to critically assess, decode, and respond to media content, while fostering the same reflective abilities in their students to counteract manipulation and harmful information influences.

The importance of developing media literacy and an informed information culture has been widely recognized by international organizations. Key policy frameworks such as the **European Parliament Resolution "Media Literacy in the Digital World"**, the **European Council's "Digital Education Plan"**, and UNESCO's **"Grunwald Declaration on Media Education"** highlight the centrality of these competences in twenty-first-century education systems. Among these, UNESCO has played a leading role in promoting and supporting media and information literacy worldwide. Through the Grunwald Declaration and subsequent initiatives, UNESCO has identified media and information literacy as an integral component of lifelong education, emphasizing free and equitable access to knowledge as a foundation for social inclusion, individual empowerment, and sustainable development.

According to UNESCO experts, **media education** encompasses multiple technological and communicative dimensions, including graphic, audiovisual, and digital media (Wilson et al., 2011). It enables individuals to understand and critically analyze how mass communication operates within social contexts, to master media tools for effective interaction, and to develop an awareness of the cultural, political, and commercial

forces shaping media production and consumption. Media literacy thus involves skills of critical reflection, analysis, and creation of media texts; identification of sources and underlying interests; interpretation of values and meanings; and the ability to produce and disseminate media responsibly. Through these capacities, media education becomes a cornerstone of democratic participation and the formation of informed, autonomous citizens in the digital age.

Literature Review

As evidenced by the analysis of scientific publications, **media literacy** has become a topic of increasing interest among researchers and educational leaders worldwide. In the United States, it is widely recognized that media literacy represents a key twenty-first-century skill essential for every individual. This is reflected in the program *Learning for the 21st Century*, which identifies media literacy as a higher-order competency fundamental to human development and success (Mistry, 2020).

The first experimental studies on media education in schools were also initiated in the United States, focusing on the use of television programs as teaching tools. One of the most influential initiatives was the *Pioneer Media Now* curriculum developed by educators in Iowa, aimed at familiarizing teachers with media issues, genres, and equipment, while introducing students to the world of media. Friesem et al. (2014) analyzed the program's content, which comprised seven modules addressing media evaluation, interpretation, aesthetics, and presentation. Similarly, Vinney (2024) emphasizes that media literacy enables individuals to understand and assess media messages critically, allowing them to make informed choices about what they read, watch, and listen to. According to this author, media literacy involves the application of critical thinking to the signs, messages, and symbols transmitted through various media platforms.

The proliferation of portable technologies and the widespread accessibility of the Internet, which allow constant exposure to media content, further underscore the need to strengthen media literacy skills. Beyond its technological dimension, media literacy intersects with fields such as media arts, health education, multiculturalism, and responsible citizenship. Thoman and Jolls (2004) describe it as a new type of literacy and a transformative mechanism for learning in a global, multimedia environment, where students must be prepared to navigate a dynamic, complex, and highly digitalized world.

In the United Kingdom, growing attention to media literacy has been evident since the 1960s. Professor Masterman (1989) highlighted the importance of introducing media literacy education at both primary and secondary school levels. Media educator Bowker (1991) later expanded on this perspective, emphasizing the need to study the typology of genres, authorial perspectives, technologies of media creation, and audience dynamics. He identified essential goals for both adult and child education, particularly the promotion of critical autonomy and a reflective stance toward mass media —the capacity to critically evaluate all media texts, whether electronic or printed.

In France, media literacy has also become a core educational objective. The Ministry for Europe and Foreign Affairs (2004) established as a priority the development of citizens' ability to analyze, interpret, and evaluate messages, in order to prevent manipulation and passive media consumption. In the French context, media literacy is closely linked to other forms of learning such as oral and written communication, personal experience, and direct practice.

At the European level, both the European Parliament & Council of the European Union (2018) have emphasized the strategic role of media literacy. The *Media Literacy in a Digital World* resolution (European Parliament, 2008) underscores the importance of fostering critical awareness toward media as a means of educating citizens capable of responsibly forming judgments, interpreting information within political, economic, cultural, and social contexts, and creating or selecting appropriate media for communication. Similarly, the European Union's *Audiovisual Media Services Directive* asserts that to

access and use information safely and responsibly, citizens must acquire sound media literacy skills, including the ability to create and evaluate media content critically.

Media literacy is also central to UNESCO's educational framework, which defines it as a set of competencies enabling learners to access, evaluate, and share information and media content ethically, critically, and effectively across formats and platforms (Wilson et al., 2011).

In summary, the review of scholarly literature and policy documents reveals that media exerts a profound influence on the education and socialization of the younger generation, functioning as both a tool of informal learning and a medium for distance education. Consequently, the preparation of future educators to cultivate media literacy among children emerges as an urgent and necessary educational priority.

Purpose of the article: training future educators for the formation of media literacy in children.

Methodology

To achieve the stated objectives, a set of complementary research methods was employed. The **theoretical methods** included systematization, analysis, generalization, and synthesis of information from diverse sources to examine the current state of research on media literacy in both theory and practice. Comparison, specification, and abstraction were applied to substantiate the structure and content of future educators' training. The **empirical methods** comprised diagnostic tools—such as questionnaires, interviews, discussions, and dialogues—to identify the features of media literacy formation among pre-service teachers. **Observational techniques** (including structured observation, educational games, project-based activities, and the case study method) were used to implement the experimental tasks. Finally, methods of **mathematical statistics** supported the quantitative and qualitative interpretation of results and the establishment of their statistical significance.

Within the framework of this study, **media literacy** was regarded as a key indicator of personal development and the ability to interact effectively with media. The **ascertaining stage** of the experiment aimed to determine the initial state of readiness of future educators to promote media literacy among children.

A total of **78 pre-service teachers** participated in the experimental research. They were divided into two groups: an **experimental group (EG)** of 40 students and a **control group (CG)** of 38 students. During the ascertaining stage, the baseline level of readiness for fostering media literacy in children was diagnosed. A **questionnaire survey** was administered to assess the perceived relevance of the topic. The results showed that 82% of participants considered the development of media culture in children highly relevant, 8% disagreed—arguing that children already spend excessive time with digital devices—and 10% found it difficult to respond. Additionally, 97% of respondents acknowledged the importance of introducing media education in schools, while 3% admitted lacking awareness of the issue. Despite the frequent use of terms such as "media culture," "media literacy," and "media education" in academic literature, most students associated them exclusively with mobile technologies and computers, overlooking the critical dimension of information processing. Nevertheless, all participants expressed interest in integrating media education into the school curriculum.

To evaluate the **readiness levels** of future educators to foster media literacy, specific **components, criteria, and indicators** were identified. Each component included corresponding criteria that reflected key aspects of the phenomenon, as well as measurable indicators used to assess them. Based on the findings from the ascertaining stage, it was concluded that structured preparation for developing media literacy in children was necessary. This phase also allowed the identification of pedagogical conditions forming part of a broader system that integrates both external learning elements and internal personal factors to ensure the effective and holistic development of students in higher education settings.

To verify the **reliability** of the results, the **Kolmogorov–Smirnov λ-criterion** was applied during the ascertaining stage.

The **formative stage** of the experiment sought to confirm the effectiveness of the developed pedagogical system, which combines external training elements and internal motivational, cognitive, and practical components that contribute to future educators' readiness to foster media literacy in children. Comparative analysis of empirical data from the EG and CG made it possible to trace the dynamics of improvement in readiness levels.

The comparative results demonstrated that the introduction of the proposed system in the EG significantly enhanced students' preparedness, producing more positive outcomes than those observed in the CG. These findings revealed measurable progress in the experimental group's motivation, conceptual understanding, and ability to apply media literacy strategies, while the control group showed no notable change.

To statistically confirm the effectiveness of the experimental system, the **Kolmogorov–Smirnov λ-test** was again applied at the formative stage. The statistical hypothesis (H_1) posited that differences between the distributions of readiness levels in the EG and CG were significant. The empirical value obtained ($\lambda\_emp = 1.31$) exceeded the critical value ($\lambda\_cr = 1.15$), thereby confirming H_1 and validating the experiment's outcomes with a confidence level of $p = 0.99$.

Based on these findings, the study concludes that the proposed system—comprising a combination of pedagogical conditions, a specialized training course, and an experimental methodology—proved effective for enhancing pre-service teachers' readiness to cultivate media literacy in children. This confirms the **efficacy and feasibility** of implementing the developed framework in higher education institutions as a means of improving teacher preparation for media education.

Results and Discussion

The content of concept of "media literacy" and the importance of the formation of media literacy in children for modern society.

Media literacy has combined traditional literacy and skills related to technological platforms and new media, that is, it has integrated the communicative development of humanity: from alphabetic traditional writing to digital information and electronic media (Mateus, 2021). The importance of media literacy was first directly addressed in the United States and Canada. The Wisconsin Association of Better Broadcasters in the 1930s sought to teach citizens to be more critical consumers of media and, by increasing media literacy, to protect students from the negative effects of media. (Leaning, 2017). The first media literacy program, "Understanding New Media," revealed the basic laws related to the sensory effects of various media (Day, 1999).

Media literacy is not limited to the study of the features of different media, i.e., media education, but focuses on the analysis, understanding, and critical reflection of media messages, dealing with the economic, social, political, cultural, and technological contexts in which these messages are distributed, created, and perceived. In order to develop the skills, habits, and knowledge necessary for understanding media messages, for creating and navigating an oversaturated media environment, media literacy is treated as a pedagogy of inquiry (Martins & Finger, 2024).

A European Union report states that media literacy reduces students' vulnerability to fake news by enabling them to identify it (McDougall et al., 2018). There is a scientific consensus on the contribution of media literacy to the conscious and responsible exercise of citizenship. The term "media literacy" refers to the perspective of active student participation and promotes a reflexive and skeptical, distanced relationship with media content (Neira et al., 2024). Media literacy, as a field of pedagogical approach and learning, is

at the intersection of two academic disciplines: educational sciences and communication sciences (called "information and communication sciences" in France) (Caro, 2018). In this approach, the student is treated as an autonomous and informed subject, capable of taking an active part in his/her learning, and media literacy here is an educational project aimed at the evolution of social relations, individual realization, emancipation of groups and communities, and social criticism.

Media literacy is regularly presented as a project in the public, educational, and social dimensions, aimed at strengthening citizenship through the development of political awareness and critical thinking of the individual.

Education in new technologies and media should play an encouraging, liberating role, helping to prepare students to acquire political awareness and act as citizens of a democracy, to think critically about the content of the media independently (Feijoo et al., 2021).

Selection of research approaches, taking into account the specifics of the problem under study, as well as the goal set in the work. Techniques and rules of work in mobile services and social networks. The main tasks of media pedagogy for the preparation of future educators in order to form media literacy in children.

The selection of research approaches was carried out by us in accordance with the goal set for the work. The scientific and methodological basis of the study is based on the following main approaches, which are analyzed below:

- The systemic approach allowed us to consider the phenomenon of media literacy as an integrative quality of the personality, which provides the ability and readiness to effectively use media resources.
- The structural-functional approach determines the structural components of media literacy and ensures their interconnection.
- The activity approach, focusing on real professional activity, provides a practical orientation to learning.
- The competency approach takes into account the individual characteristics of the personality, forms subject and key competencies, and includes the development of mechanisms for the formation of professional and general competencies that ensure the performance of professional activities.
- The personally oriented approach ensures the development and self-development of the student's personality, his self-education in the conditions of information development of society (Flandoli & Eguiguren, 2021).
- The cultural competence approach is part of a pedagogically specific approach based on practices of questioning (which are dynamic) and questioning media content and media, emphasizing the importance of using and understanding media as part of culture. Media literacy develops in the context of a rapidly changing media landscape and is non-static in this approach (Polanco-Levicán & Salvo-Garrido, 2022).

Future educators should know the rules of proper user behavior in services and networks and inform children about them. Therefore, let's consider the techniques and rules of working in social networks and mobile services that can be useful for both children and educators. Consider Facebook, Flickr, Instagram, and others.

Facebook – you can deactivate your account if you are going to go offline. This procedure, that is, deactivating the account, will not lead to its deletion. The user can reactivate it by reconnecting it and restoring all connections with their friends. When they are offline, no one can view the content, send private messages, or leave notes on the wall.

Flickr is a social service designed for reusing and storing photos and videos.

Instagram is a social network that developed due to the connection of various social networks, including Facebook and X, although its primary purpose was as a platform for exchanging photos among Internet users.

Google Locator, Foursquare – a set of identical websites, services that determine and record GPS coordinates, use the capabilities of geolocation technology, record the location of a mobile phone, photo metadata, or the place where the photo was taken, and store this data themselves (Knysh et al., 2024).

Educators should constantly involve parents in solving emerging problems. Often, the “technological gap” of generations becomes an obstacle in this matter – children are much more capable and know more than their parents. Recently, in the USA and Great Britain, many parents have registered on the same social networks that their children visit. This allows them to understand who their child communicates with and how they behave online. The main condition is contact; there is a need to establish respectful, trusting relationships with the child, because new services appear, technologies are constantly developing, and young people usually master them the fastest. Therefore, there is a need in the field of education to create services that study new services that inform the educational community; the a need to develop digital literacy of those involved in the educational process.

Let's reveal the main tasks and principles of media pedagogy for training future educators to form media literacy in children:

- The ability to create media to improve the quality of life in communities, the reproduction of the child's life values, healthy and competent self-expression of the individual, strengthening solidarity and friendly interpersonal relationships, which are the key foundations for the individual.
- The formation of media information literacy which is a set of knowledge and skills that allow the individual to safely and effectively use media. This includes a conscious choice of decision-making regarding the use of media information systems and all the possibilities of new communication technologies, understanding the nature of services and content, which allows you to protect yourself from dangerous or harmful informational influences.
- Critical thinking and reflection as psychological mechanisms for interacting with the media based on orientation in the media space, self-regulation, and conscious consumption of media products, understanding of one's own media needs, proper and multifaceted assessment, and its critical and complete analysis of the form, content, source, and quality of information, taking into account the perception of various media.
- Formation of media immunity in the individual – the ability to resist destructive media and informational influences, an aggressive media environment, which, when consuming media products, provides psychological well-being and media awareness, the ability to protect oneself from potentially harmful information, to choose the right information, taking into account hidden and direct influences.
- Creation of specialized aspects of media culture: musical and auditory media culture, visual media culture, media-mediated mass media, aesthetic taste developed in art forms, modern trends in media art, etc.

The key resources of the educational space are media literacy and media competence of the educator. They contribute to increasing the effectiveness of student learning. Only a media-competent educator is properly able to teach children of the new generation. Throughout the entire professional activity, the development of media literacy in the educator should occur, that is, constantly.

The system of training future educators to form media literacy in children was based on methodological principles that are part of the educational process. Among such principles are: the principle of fundamentality of education, the principle of modeling in the educational process of future professional activity of educators, the principle of activity in activity, the principle of integration, and the principle of pedagogical reflection (Rivera-Rogel et al., 2025).

We relied on a system of didactic general principles and specific principles: In particular, on the following general principles: systemic, scientific, consistent, visual and specific principles: unity of upbringing and life, integrativity, orientation on universal human values of education, variability and flexibility, multiculturalism and openness, creativity, problem solving, unity of self-education and learning, creation of an intellectual, emotional positive background of learning.

Experimental research on the effectiveness of the developed system, which reflects a complex of learning elements that ensure all aspects of student learning in higher education institutions in the process of forming their readiness for the formation of media literacy in children, the feasibility of implementing pedagogical conditions, a special course, the effectiveness of the experimental methodology, and the framework for training future educators.

As an indicator of the level of development of a person who has the ability to interact effectively with the media, we consider media literacy within the framework of our study. This means using media skills to process, transmit, store, search, and present information.

As a social phenomenon, media literacy is aimed at creating a new reality and a new living environment, which allows future educators to use advanced achievements of technology and science and become active participants in the educational information environment.

Determining the state of readiness of future educators for the formation of media literacy in children was the goal of the ascertaining stage of the experiment.

78 students – future educators participated in the experimental work. The work of two groups was organized: experimental (EG) – 40 students and control (CG) – 38 students, within the framework of the experiment in which the state of manifestation of the specified phenomenon was studied.

At the ascertaining stage of the experiment, the basic level of readiness of future educators for the formation of media literacy in children was diagnosed.

Students were offered a questionnaire survey to identify the relevance of our research.

EG and CG students equally confirmed that it is advisable to form media culture in children because it is important for today, 82% of respondents. We received a negative answer from 8% of respondents, who motivated their answer by the fact that children spend too much time with gadgets. 10% of students chose the option "Difficult to answer".

The majority of students are aware of the need to introduce media education in schools. There were 97% of such respondents. 3% of the surveyed respondents answered that they are not aware, because they simply do not want to consider this problem in detail in children.

During conversations with students, it was found that with the widespread use of the terms "media culture", "media literacy", "media education" in the literature, students do not have a complete and clear understanding of these concepts, associate them with mobile technologies, computers, without taking into account a critical understanding of information.

However, all future educators who participated in the study expressed interest in implementing media education in the educational process.

To analyze the readiness of future educators to form media literacy in children, we analyzed the levels of readiness and determined the indicators, components, and criteria of the phenomenon under study.

We defined the readiness of a future educator to form media literacy in children as a systemic formation, which is complex and includes motivational, cognitive, and activity components.

The motivational component includes the future educator's positive attitude toward the formation of media literacy in children, their interests, and values in media education.

The cognitive component involves familiarity with modern media, knowledge of media education, and knowledge of the requirements for organizing the media education process.

The activity component includes diagnosing the creative abilities of the individual, the ability of the future educator to plan creative media activities for children, and compliance with ethical norms in the use of media.

It is these components that ensure the readiness of a future educator to successfully form media literacy in children.

Each of the presented components has its own criteria that reflect the key aspects of the identified problem, and also has indicators that these criteria specify for measuring important aspects of the problem under study.

Let us consider in detail each of the criteria and indicators that determine the readiness of an educator to develop media literacy in children.

The motivational component includes a value criterion that contains the following indicators: positive motivation for the professional activity of a future educator regarding the formation of media literacy in primary school children; the value attitude of the future educator to media literacy, media culture, interest in the use of media technologies; interest in media technologies, understanding of the importance of media education for both adults and children, and ways of using them.

The cognitive component covers the organizational criterion aimed at the formation of knowledge about media education in future educators, their impact on children, and their awareness of modern media. Indicators of the organizational criterion of readiness include in their content knowledge about the concepts of "media competence", "media literacy", "media culture", "media education", the dangers that modern media pose to society, compliance with the rules of communication in the modern environment, professional knowledge of the program requirements for organizing the media education process by future educators.

The activity component is implemented through the performance criterion, which is aimed at the development of practical skills and abilities that are necessary for future educators in solving specific tasks. Indicators of the effective readiness criterion include: the ability of future educators to design creative activities for children and form media literacy in them using media technologies, the ability to adhere to the rules of integrity in using media and communication, and the ability to diagnose creative manifestations in a child.

The identified components, criteria, and indicators of the readiness of future educators to form media literacy in children made it possible to characterize certain levels of readiness (high, medium, low).

Results of the ascertaining stage of the study. Let us present the obtained results of the ascertaining stage of the study.

The generalized results of the readiness levels of future educators at the ascertaining stage of the experiment to form media literacy in children are presented in Table 1 and Figure 1.

Table 1.
Levels of readiness of future educators at the ascertaining stage of the experiment, to form media literacy in children according to all criteria (in %)

Criteria	Levels					
	Sufficient		Satisfactory		Low	
	EG	CG	EG	CG	EG	CG
Value	13	14	22	19	65	67
Organizational	12	14	21	22	67	64
Performance	12	14	20	23	68	63
Σ (arithmetic mean data)	12	14	21	21	67	65

Table 1 shows that according to the **Value Criterion**, 13% of EG respondents and 14% of CG respondents showed a sufficient level, 22% of EG students and 19% of CG respondents showed a satisfactory level, and a low level was recorded in 65% of EG respondents and 67% of CG respondents in future educators.

According to the **Organizational Criterion**, 12% of EG respondents and 14% of CG respondents showed a sufficient level, 21% of EG respondents and 22% of CG respondents showed a satisfactory level, and 67% of EG respondents and 64% of CG respondents showed a low level.

According to the **Performance Criterion**, 12% of EG respondents and 14% of CG respondents showed a sufficient level, 20% of EG respondents and 23% of CG respondents showed a satisfactory level, and 68% of EG respondents and 63% of CG respondents showed a low level.

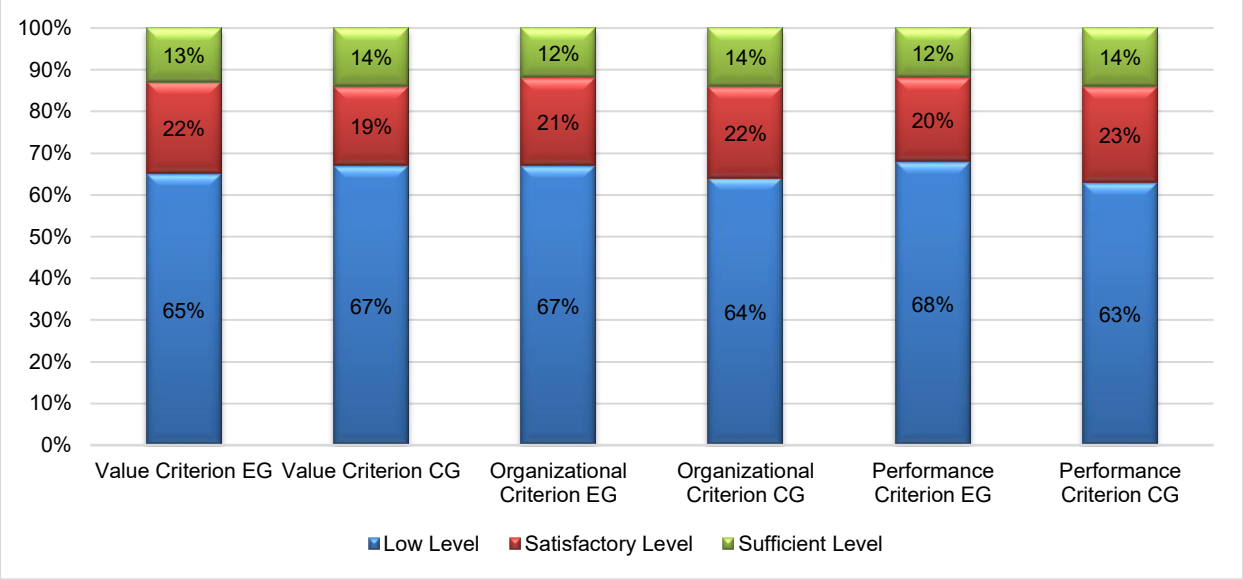

Figure 1. Readiness of future educators to develop children's media literacy: ascertaining stage results.

Based on the results of the ascertaining stage of the experiment, a conclusion was drawn about the need to prepare future educators for the formation of media literacy in children. Research at the ascertaining stage of the experiment on the levels of readiness of future educators for the formation of media literacy in children according to criteria and indicators allowed us to determine the real state of the problem and develop pedagogical conditions that are part of a system that reflects a complex of external elements of learning and internal ones that provide operational, effective, and personal aspects of student learning in higher education institutions in the process of forming their readiness for the formation of media literacy in children.

At the ascertaining stage of the experiment, to verify the reliability of the results obtained, we applied the calculation of the λ-criterion based on the Kolmogorov-Smirnov method.

The formative stage of the study. The purpose of the formative stage of the study was to verify and specify the effectiveness of the system, which reflects a complex of external elements of training and internal ones, which provide operational, effective, and personal aspects of student training in higher education institutions in the process of forming their readiness to form media literacy in children.

To teach media literacy in children, we have developed a system for training future educators for the EG in order to improve the methods, content, means, and forms of implementing pedagogical practice in higher education institutions, in order to increase the readiness of future educators to form media literacy in children. In particular, the following innovative forms were used in the EG: interactive lectures (lectures with analysis of specific situations, lecture-conversations, lecture-discussions, problem lectures, etc.); seminars and internships. Particularly effective for increasing the readiness of future educators to form media literacy in children were: problem seminars, games + discussions, master classes, individual research tasks (projects), independent and individual work (to find answers to problem tasks); educational activities.

Interactive and active teaching methods had a positive effect: "Brainstorming", "Flipped learning", "Group discussions", "Group work", case study method, case analysis, "Design thinking", role-playing games, problem tasks and topics, round table, pedagogical essay, comparison, analysis, group discussion, debates, individual electronic portfolio.

The implementation of the EG system in higher education institutions for the formation of educators' readiness to form media literacy in children was carried out during the year within the framework of the implementation of the special course "Features of training future educators to form media literacy in children" and pedagogical conditions and independent media activities in the process of pedagogical practice of future educators.

Pedagogical conditions are part of a system that reflects a complex of external elements of learning and internal ones that provide operational, effective, and personal aspects of students' learning in the process of forming their readiness to form media literacy in children.

The conducted scientific and theoretical analysis of the system of readiness of future educators to form media literacy in children and the results of the diagnostics allowed us to speak about the effectiveness of precisely such pedagogical conditions that will contribute to the effectiveness of increasing the formation of this readiness:

- Awareness by future educators of the importance of the process of forming media literacy in children.
- Development in future educators of the skills of forming media literacy in children in the process of educational activity by introducing integration approaches into the process of their professional training to ensure the effectiveness of the process of forming media literacy in children.

Therefore, the formative stage of the experiment will be conducted in order to promote the implementation of a model of training future educators to form media literacy in children of primary school age.

So, for the effective organization of the educational process at the formative stage of the study, the effectiveness of the system was verified and specified, which reflects a complex of external elements of training and internal ones, which provide operational, effective, personal aspects of student training in higher education institutions in the process of forming their readiness to form media literacy in children.

Methodological support of the educational process and purposeful pedagogical activity enable applicants for the educational space to develop media literacy.

Comparison of empirical data based on the results of the formative stage of the experiment, obtained in the experimental and control groups, made it possible to determine the dynamics of the readiness of future educators to form media literacy in children.

Let us present a comparative analysis of the quantitative data of the results on the degree of readiness of future educators to form media literacy in children at the stages of the ascertaining and formative stages of the experiment in Table 2 and Figure 2.

Table 2.
Levels of readiness of future educators to form media literacy in children (in%)

Criteria	Stages	Levels					
		Sufficient		Satisfactory		Low	
		EG	CG	EG	CG	EG	CG
Value	Ascertaining	13	14	22	19	65	67
	Formative	18	15	23	19	59	66
Organizational	Ascertaining	12	14	21	22	67	64
	Formative	19	15	32	23	49	62
Performance	Ascertaining	12	14	20	23	68	63
	Formative	17	15	28	24	55	61
Σ (arithmetic mean data)	**Ascertaining**	**12**	**14**	**21**	**21**	**67**	**65**
	Formative	**18**	**15**	**28**	**22**	**55**	**63**

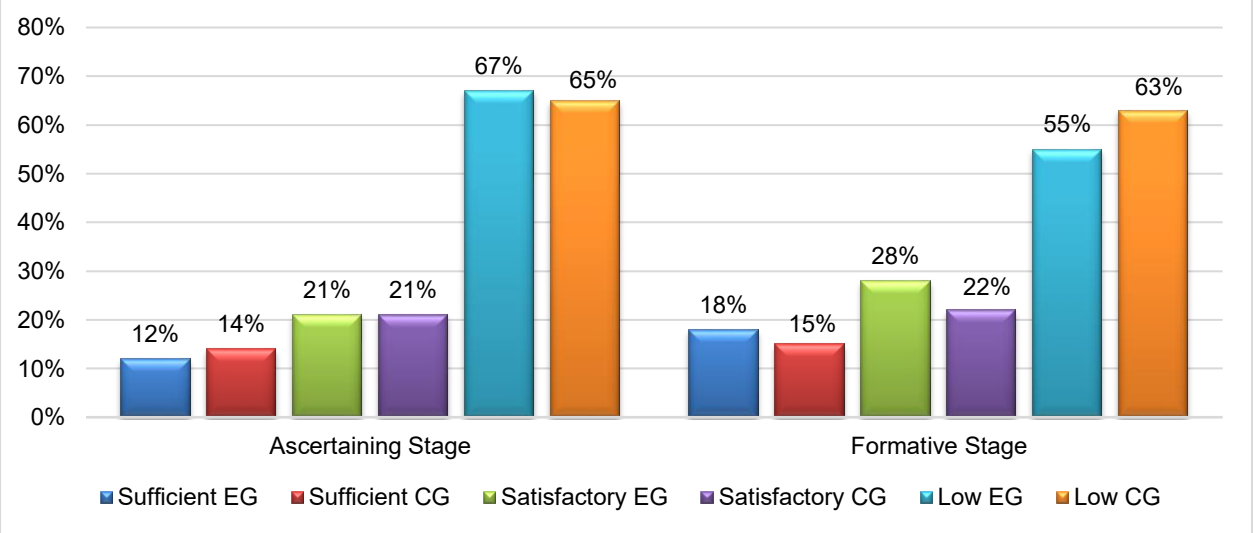

Figure 2. Comparative analysis of the levels of readiness of future educators to form media literacy in children at the ascertaining and formative stages (Σ arithmetic mean data).

The obtained comparative data indicate that the introduction of a system in the EG that reflects a complex of external elements of learning and internal ones that provide operational, effective, personal aspects of students' education in higher education institutions in the process of forming their readiness for the formation of media literacy in children and experimental methods of training future specialists provided a better result in the training of EG students and contributed to the achievement of positive dynamics in the EG more than in the CG.

The results of the study indicate positive quantitative changes in the readiness of future educators of the experimental group to the formation of media literacy in children. There were no significant changes in the control group.

In the EG, significant positive quantitative changes in the readiness of future educators for the formation of media literacy in children were observed:

The sufficient level was shown by 18% of EG respondents at the formative stage of the experiment (at the ascertaining stage, 12% of respondents were at a sufficient level).

The satisfactory level was shown by 28% of EG respondents at the formative stage of the experiment (at the ascertaining stage, 21% of respondents were at a sufficient level).

The low level was shown by 55% of EG respondents at the formative stage of the experiment (at the ascertaining stage, 67% of respondents were at a sufficient level).

There is a statistically significant positive trend in the increase in the readiness of future educators to form media literacy in children only in the experimental group.
So:

- The increase in the number of students in the experimental group with a sufficient level of training was +5.9%, and in the control group, this indicator was +1.1%.
- The increase in the number of students in the experimental group with a satisfactory level of training showed a positive impulse, which is +5.8%, and in the control group, this indicator was +1.5%.

A decrease in the number of respondents with a low level of training is observed in the experimental group, which amounted to -11.4%, and in the control group, we observe -2.5%.

Thus, the expected results of increasing readiness for the formation of media literacy in children of future educators were given by comparing the results of the study with the dynamics in the control group and the experimental group of the educational phase.

The assessment of the statistical significance of the differences was carried out on the basis of the results obtained during the training of future educators.

For statistical analysis to confirm the effectiveness of the implemented experimental system, which reflects a complex of external elements of training and internal ones that provide operational, effective, personal aspects of student training in higher education institutions in the process of forming their readiness for the formation of media literacy in children based on the results obtained during the formative experiment, the Kolmogorov-Smirnov λ-criterion was determined.

H_1 – statistical hypothesis was proposed in the formulation: the difference between the distributions of the control group and the experimental group is significant, that is, the empirical distribution of the levels of readiness we are studying is significantly different.

For the level of statistical significance at p = 0.99, the critical value is $\lambda_{cr} = 1.15$. The calculation of the λ criterion for assessing the readiness of future educators to instill media literacy in children in the control and experimental groups at the formative stage of the study was conducted using the same methods and in the same sequence as during the ascertaining stage of the experiment. At the formative stage, the empirical value $\lambda_{emp} = 1.31$ was obtained. Since $\lambda_{emp} > \lambda_{cr}$, this confirms the hypothesis H_1.

We conclude based on the results obtained about the effectiveness of the developed system, which reflects a complex of external elements of training and internal ones that provide operational, effective, and personal aspects of student training in higher education institutions in the process of forming their readiness to form media literacy in children, the feasibility of implementing pedagogical conditions, a special course, the effectiveness of the experimental methodology and framework for training future educators to form

media literacy in children, which allows us to conclude about the effectiveness of the proposed elements of the developed system.

Conclusions

The study confirmed that **media literacy** is an essential competence in the professional preparation of twenty-first-century educators. It encompasses the ability to access, analyze, evaluate, create, and communicate messages across diverse media in a critical, ethical, and responsible manner. The development of this competence not only strengthens future teachers' critical thinking and intellectual autonomy but also equips them to guide children toward reflective, informed, and conscious engagement with information in digital environments.

The experimental results demonstrated that the implementation of the proposed pedagogical system—integrating theoretical, practical, and attitudinal components—produced significant improvements in the readiness levels of the experimental group compared with the control group. The application of the Kolmogorov–Smirnov λ-criterion statistically confirmed the model's effectiveness, particularly in enhancing three key dimensions of teacher preparation: motivational, cognitive, and procedural.

In summary, the research validates the importance of integrating **media literacy** as a transversal axis within teacher education programs. It should be understood as a continuous process that promotes critical citizenship and social responsibility in the digital era. Higher education institutions are encouraged to reinforce media pedagogy within their curricula, fostering learning experiences that combine theory, practice, and critical reflection on media use. Future studies should expand this framework by exploring its long-term impact, cross-cultural applicability, and potential for adaptation to emerging technologies.

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The impact of art therapy on fostering creativity: approaches for training future educators

El impacto de la arteterapia en el fomento de la creatividad: enfoques para la formación de futuros educadores

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Abstract

The article explores the content of the studied concept, clarifies the purpose and approaches of art therapy in training future educators to develop the creative potential of learners. It demonstrates the importance of art therapy techniques in preparing future educators. The functions of art therapy are highlighted within the context of the practical activities of future specialists. The possibilities of simultaneously combining various roles of students and educators during professional training are clarified. The role of media art society in applying media art therapy, especially in light of the development of information culture, and the importance of media competence in media creativity are discussed. The initial level of readiness is identified as low. During the formative stage of the pedagogical experiment, the developed technology for training future educators to foster the creative potential of learners through art therapy was implemented, along with the proposed pedagogical conditions for such training. As a result, it was found that, following the development and application of this technology in the higher education process (in EG), the number of future educators

with a high level of certain skills significantly increased. Therefore, the technology for training future educators to enhance the creative potential of learners through art therapy is recommended for implementation in the professional training of specialists, as it has proven to be effective.

Keywords: media art society, media art therapy, media competence, media creativity, information type of culture.

Resumen

El artículo explora el contenido del concepto estudiado y aclara el propósito y los enfoques de la arteterapia en la formación de futuros educadores para desarrollar el potencial creativo de los estudiantes. Demuestra la importancia de las técnicas de arteterapia en la preparación de futuros educadores. Se destacan las funciones de la arteterapia en el contexto de las actividades prácticas de los futuros especialistas. Se aclaran las posibilidades de combinar simultáneamente diversos roles de estudiantes y educadores durante la formación profesional. Se discute el papel de la sociedad de arte mediático en la aplicación de la arteterapia mediática, especialmente a la luz del desarrollo de la cultura de la información, y la importancia de la competencia mediática en la creatividad mediática. El nivel inicial de preparación se identifica como bajo. Durante la etapa formativa del experimento pedagógico, se implementó la tecnología desarrollada para la formación de futuros educadores con el fin de fomentar el potencial creativo de los estudiantes a través de la arteterapia, junto con las condiciones pedagógicas propuestas para dicha formación. Como resultado, se observó que, tras el desarrollo y la aplicación de esta tecnología en el proceso de educación superior (en GE), el número de futuros educadores con un alto nivel de ciertas habilidades aumentó significativamente. Por lo tanto, se recomienda implementar la tecnología para capacitar a futuros educadores y potenciar el potencial creativo de los estudiantes mediante la arteterapia en la formación profesional de especialistas, ya que ha demostrado su eficacia.

Palabras clave: sociedad de arte mediático, arteterapia mediática, competencia mediática, creatividad mediática, cultura de la información.

Introduction

The European integration process, which acquires new characteristics and an innovative educational environment, is the key to the success of the modernization of education in society. We consider its main characteristics to be: the introduction of innovative technologies for organizing a modern educational process and effective models into the practice of higher education, which ensure a high level of personal qualities of the future specialist and their professional activity. This actualizes the problem of finding new methods and organizational forms of training and their rethinking to improve the quality and efficiency of education, expand and deepen the content of professional training of specialists. Such an approach to the educational space makes it possible to introduce such high-quality training of specialists in higher education, which is conditioned in the field of professional and pedagogical training of specialists by the latest trends in the development of cultural, social, and interstate relations and is a priority problem (Gallardo Saavedra et al., 2018).

The issues of comprehensive formation of a highly qualified specialist and innovative personality, at the present stage of social relations in the world, are actualized by the ability to self-development, self-education, and creative self-realization. The urgent need to solve this problem is due to pedagogical, social, and cultural factors, and causes the need to search for new means of personality formation for the future specialist. A prominent place among the arsenal of methods and techniques for the development of a creative personality is occupied by art. Special attention is attracted by a new method of forming a creative individuality, which is on the border of art, pedagogy, and psychology – art therapy (Formaiano, 2024).

Our research, aimed at high-quality training of teaching staff, sees the key to the successful functioning of the educational system as the active interaction of participants in the educational process in the modern

environment of higher education institutions, which is characterized by the development of creativity, new systems, and art technologies, the emergence of various art therapeutic areas, etc. Therefore, the result of training future educators to develop the creative potential of education seekers is the readiness in professional activity to use pedagogical art therapy, the use of media art therapy in connection with the development of the information type of culture for the formation of media competence in the process of media creativity, which is a topical problem of practice and pedagogical science. We note that the prospect of using art in the training of future specialists as a therapeutic factor does not require special medical training. The ways of training future educators to develop the creative potential of education seekers by means of art therapy have been sufficiently studied; therefore, the topic of the chosen research is relevant.

Literature Review

The features of art therapy in modern science, as a new direction, were studied by scientists from different countries.

When training future educators Itczak & Smolinske (2023) proposed ways to overcome fatigue in educators with the help of art therapy, developed pedagogical conditions for the use of art therapy, which made it possible in the context of a creative educational space to systematically investigate the specified problem, in particular, to substantiate pedagogical conditions that ensure the use of art technology in professional activities. Based on theoretical analysis, ways of applying elements of art therapy, the use of art therapeutic technologies was outlined, and a series of master classes on art therapy were held. Kindergarten educators and first-grade educators participated in monthly master classes during one academic year. Based on the needs assessment conducted by educators, master classes were developed. The results of the authors' post-seminar survey proved that art therapy was useful for overcoming compassion fatigue based on awareness.

The theoretical foundations of the use of art therapy in the process of professional training of specialists are substantiated by Formaiano (2016), and the experience of group art therapy with children in educational institutions is described; a brief overview of a new direction in science is given – the emergence of art therapy. The main approaches to defining art therapy are analyzed. The features of the creative process underlying art therapy are considered. Based on theoretical analysis, ways of applying elements of art therapy, including the use of art therapy technologies, are outlined. It is proven that it is important for an art therapist to cooperate closely with a multidisciplinary team and to work in an institutional environment.

The content of art therapy is substantiated by Cáceres-Gutiérrez & Santamaría-Osorio (2018) through the study of art therapy and spirituality, artistic and creative activity in the reconstruction of a psychotraumatic situation, the corrective and therapeutic effects of art on the subject, the birth of creative needs, and the creation of new positive experiences. The expressions of art that can contribute to the spirit-complex transformation (personal and transpersonal) are described. It is proven that art therapy eliminates excessive tension, forms constructive forms of behavior, removes human anxiety, and removes barriers to constructive and productive actions, that the creative act, therapeutic relationships, and authentic "I" are the foundations of social intervention and productive personality.

The content of art therapy is substantiated by Delgado-Fernandez-Baca et al. (2023) through artistic and creative activity in the reconstruction of a psychotraumatic situation, the corrective and therapeutic effects of art on the subject, the birth of creative needs, and the creation of new positive experiences. Phototherapy (therapeutic photography), which offers various options for techniques and materials, is presented as a section of art therapy, which is a modern, alternative psychotherapeutic approach. To promote healing, phototherapy uses art and is usually accompanied by a professional psychologist with experience in art therapy. Research by scientists from the TAE Peru Institute and Arte-terapia Peru shows how therapists perceive the therapeutic tool of using photography. Scientists have used the promotion of the use of photography in Peru as a psychotherapeutic tool. The results of the study showed that Peruvian therapists consider photography as a promising, innovative, and valuable tool that, through another language, helps patients express their emotions.

A study by Green et al. (2023) evaluated the impact of art therapy for students from Mexico, Israel, and the United States during an international online summer program on their cultural and global perspectives. Quantitative as well as qualitative instruments were used. Significant mean increases were observed across six scales across four global review scales, outlining the prospects for fostering culturally informed art therapy. Four overarching themes informed students' artistic responses and narratives: growing awareness of their own context and experiences, appreciation for global connectedness, art as a mediator of cross-cultural communication, and growing understanding of differences and similarities.

Based on the theoretical analysis of Marins et al. (2020), the ways of applying elements of art therapy, the use of art therapeutic technologies is outlined. The content of art therapy is substantiated by means of artistic and creative activity in the reconstruction of a psychotraumatic situation, the corrective and therapeutic effects of art on the subject, the birth of creative needs, and the creation of new positive experiences. The research methodology is based on the basic modern provisions of psychology, pedagogical science, and health culture, reflecting the interrelationship of methodological approaches to the formation of a healthy lifestyle. A report on the experience of the workshop developed in November 2018: "Talent Workshop: Art Therapy Unites the Group", which was held at the Family Clinic in Rio de Janeiro, was presented. The workshop was relevant for medical education, changing the understanding of the autonomy of the subject about the role in self-care, ensuring individual, comprehensive, collective health promotion of users, which allowed users to increase knowledge in their living environment. The study proved that art therapy eliminates excessive stress, forms constructive forms of behavior, removes human anxiety, and removes barriers to constructive, productive actions in personal health care, allowing the health care process to be carried out humanely and gently.

Thus, scientists have proven that art therapy eliminates excessive tension, forms constructive forms of behavior, removes human anxiety, and removes barriers to constructive and productive actions. The main approaches to defining art therapy are analyzed. The features of the creative process that underlie art therapy are considered. Based on theoretical analysis, ways of applying elements of art therapy and using art therapeutic technologies are clarified. The content of art therapy is justified through artistic and creative activity in the reconstruction of a psychotraumatic situation, the corrective and therapeutic effects of art on the subject, the emergence of creative needs, and the creation of new positive experiences.

PURPOSE OF THE RESEARCH. The use of art therapy in the process of professional training of specialists.

Methodology

To achieve the goal of the study, a set of general scientific methods was used, relating to the nature of the phenomenon being studied: **theoretical**: problem-targeted, comparative, retrospective analysis for comparing and contrasting different views in psychology, pedagogy on aspects of the problem under study; consideration of theoretical issues; justification of ways to prepare future educators for the development of the creative potential of education seekers by means of art therapy and its educational and methodological support; **empirical**: diagnostic (interviews, questionnaires), prognostic (expert assessments, ranking), observational (observation), pedagogical experiment to identify the level of readiness of future educators for the development of the creative potential of education seekers by means of art therapy; **methods of mathematical statistics** (statistical data processing, Pearson criterion) for qualitative and quantitative analysis of the results of the experiment.

Experimental work was carried out during 2022–2024.

The factors that determined the reliable results obtained in the process of experimental work were determined.

We have included components, criteria, and indicators as the basic, generally accepted components of the readiness of future educators to develop the creative potential of education seekers by means of art therapy.

The levels of formation of the components of the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the educational process are distinguished: low, medium, and high.

A characteristic of the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy is proposed.

Thus, the structure of the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the educational process consists of interconnected components, criteria, and indicators that have level characteristics and form a dynamic integrity.

When introducing art therapy technology into the work of future educators to develop the creative potential of students, we will highlight three stages that correlate with the sequence of studying professional disciplines, the structure of training future educators, and the completion of pedagogical practice, and their capabilities in forming readiness in the educational process for the use of art therapy technologies.

A pilot study preceded the experimental work. Its tasks were: to clarify the state of preparation of future educators for the development of the creative potential of education seekers by means of art therapy in the educational process in their further professional activities; to study the possibilities of the educational process of universities for the formation of the readiness of future educators for the development of the creative potential of education seekers by means of art therapy in the educational process. At the ascertaining stage of the experiment, a diagnosis of the formation of the initial level of readiness of future educators for the development of the creative potential of education seekers by means of art therapy in the experimental and control groups was carried out according to certain criteria (motivational, cognitive, activity-creative, reflective-resultative) and their indicators. The formation of the initial level of readiness is observed at a low level.

At the formative stage of the pedagogical experiment, the developed technology for training future educators to develop the creative potential of students through art therapy and the proposed pedagogical conditions for such training were implemented.

The control stage of the pedagogical experiment made it possible to state that as a result of the development and implementation of the technology for training future educators to develop the creative potential of students through art therapy in the educational process of higher education (in the EG), the number of future educators in the EG with a high level of readiness as a result of the experimental work carried out significantly increased at the formative stage of the experiment. A small increase was observed in the CG at the formative stage of the experiment.

To compare the distribution of educators by the levels of readiness of students to develop the creative potential of students through art therapy in the EG and CG samples, non-parametric methods of mathematical statistics were used. A quantitative analysis of the experimental data was performed using the Pearson χ^2 criterion.

As a result of the experiment, we proposed a null hypothesis (H0) to clarify the reliability of the results of the experiment that the difference in data in the control and experimental samples regarding the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy is caused by representativeness errors, as well as an alternative hypothesis (H1) that the difference in data in the control and experimental samples is caused by the introduction of the developed experimental factor. Hypotheses were formulated – null and alternative in order to verify the identified differences in the levels of readiness of future educators to develop the creative potential of education seekers by means of art

therapy in the control group and the experimental group. H0 – the levels of formation of skills and knowledge on the issues of forming the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the experimental and control groups do not have significant differences. H1 – the levels of formation of skills and knowledge on the issues of forming the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the experimental and control groups, in which the developed technology was implemented, differ significantly. It turned out to be appropriate to use the Pearson χ^2 criterion to test these hypotheses, since the samples of groups – CG and EG of future educators are independent and random, the members of each sample are also independent among themselves; on the order scale, the properties were measured, which has three categories: productive, creative, reproductive (c = 3). Therefore, the obtained value of the statistic $T_{exp.} > T_{cr.}$

We, therefore, accept the alternative hypothesis: the differences in the distributions of future educators of the control group and the experimental group by the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy are statistically significant with a probability of 95%.

Based on the analysis of the obtained results of the experimental work, we say that the effectiveness of the developed training technology is proven by a significant increase in the indicators of the formation of all components of the readiness of future educators to develop the creative potential of education seekers by means of art therapy.

The reliability of the obtained results of the pedagogical experiment, the conclusions, was confirmed by the methods of mathematical statistics. And the processing of experimental data using the Pearson χ^2 criterion showed the presence of statistically significant changes in the experimental group. This is what confirmed the correctness of the hypothesis put forward ($T_n > T_k$, 24.22 > 5.991). Therefore, we can say that the developed technology for training future educators to develop the creative potential of education seekers through art therapy can be proposed for implementation in the professional training process of specialists, as it is effective.

Results and Discussion

The content of the concept under study

Art therapy is a technology for using and creating various works of art in order to convey emotions, feelings, and other manifestations of the human psyche; it is a tool for harmonizing and exploring aspects of a person's inner world, in cases where words are not suitable for expression. With the help of simple means, art therapy can actualize each person's inner potential; therefore, art therapy has been increasingly used in the field of education and training of specialists in various fields (Jorquera Cox & Gómez Uriarte, 2024).

Art therapy, based on art, is a specialized form of psychotherapy, primarily creative activity, used for psychocorrection and treatment of the personality using artistic techniques such as acting, modeling, drawing, music, films, photography, books, etc.

Art therapy is an effective method for developing the psychological competence of pedagogical workers, forms faith in one's own strength, an active life position, autonomy and personal boundaries, involves the processes of finding ways to resolve internal conflicts of the personality, addresses the deep layers of the unconscious – and as a method of creative self-expression of a person is a productive direction of work for solving the problems of the personality itself (Wong et al., 2025).

The purpose and approaches to art therapy in preparing future educators for the development of the creative potential of education seekers.

Through self-expression and self-knowledge, and in harmonizing the development of the personality, is the main purpose of art therapy is to prepare future educators for the development of the creative potential of education seekers, since art therapy is a science that is on the border of therapy itself, art, psychology, and pedagogy.

In modern art therapy, there are two main approaches to therapy itself and the relationship of art in it. According to the first approach, therapeutic goals are in the first place in art therapy, and creative goals are secondary. Representing in visual form his own inner world, a person, using the main mechanism – transfer, gradually moves towards his awareness; therefore, art therapy is considered within the framework of this approach, as an addition to other therapeutic methods. The group leader encourages its members to try to find the meaning of their own free associations independently. Joint group work includes some exercises, for example, creating a group common work of art, creating group murals, etc.

According to the second approach, art itself is healing, artistic creativity makes it possible to relive internal conflicts, express oneself, and is a means of enriching subjective experience. Art therapy is considered a person's creative potential, as a means of developing personality through the main mechanisms: transformation and sublimation. The leader (lecturer, educator, art therapist, psychologist) encourages group members (students, pupils, patients) to explore their creations with the help of other group members and independently, to trust their own perception. Thus, the basis of art therapy is the process of creativity. Each person has a creative potential at different depths of the subconscious, and only relying on personal individuality can it be "pulled out" (Stiegele & Paipare, 2020).

The value of art therapy technologies in the training of future educators.

The main means of art therapy in preparing future educators for the development of the creative potential of education seekers are art therapy technologies. Among the art therapy technologies that are currently actively used by future specialists – educators, psychologists, art therapists, it is necessary to distinguish:

- **Isotherapy** – a technology of using painting techniques, graphics for treatment;
- **Animation therapy** – a modern technology of social rehabilitation to change interpersonal and collective relations, behavior, in the process of which there is: establishing trusting, warm relations; "unblocking" public relations; learning and mastering the skills of aesthetics and poetics, positive thinking.
- **Fairy tale therapy** – a technology of analyzing and playing fairy tales, which is a fairy-tale atmosphere, therapy of the environment, especially in which a dream can materialize, and a person's potential capabilities can manifest.
- **Art synthesis therapy** – a complex method of group psychotherapy that uses the synthesis of arts in its activities. This technology is considered in therapeutic and correctional work as an independent direction, which combines the mastery of technical techniques of various types of art with knowledge of psychopathology.
- **Film therapy** – a film is a metaphor, one of the directions of art therapy, where we see a reflection of a certain life situation. The plot of the film should be similar to the life situation in which a person has fallen, to help the patient and offer a way out of such a situation.
- **Sand therapy** – a technology of sand treatment during the patient's work.
- **Bibliotherapy** – a technology-based treatment and education with the help of books.

This is the treatment of a person with a book, a word. It is engaged in studying the features of reader perception during illness using specially selected literature and developing methods of psychological correction.

- **Origami** – technology of creating figures from paper.
- **Play therapy** – therapy through game situations.
- **Drama therapy** – therapy using acting and theater.
- **Music therapy** – the use of music as a therapeutic tool (Linesch et al., 2016).

Art therapy classes allow solving important psychotherapeutic tasks. Due to the fact that in the process of creative activity, an atmosphere of goodwill, emotional warmth, recognition of the value of another person's personality, empathetic communication, care for the personality, their feelings, and experiences is created, a therapeutic effect is achieved, and a person feels a sense of security, psychological comfort, success, and joy. As a result, the healing potential of human emotions is mobilized (Ciornai & Ruiz, 2016).

Art therapy technologies in the training of future educators in modern conditions accumulate: fairy tale therapy, bibliotherapy (therapeutic effect through reading); isotherapy (therapeutic effect through the means of fine arts: decorative and applied arts, modeling, drawing, etc.); music therapy (therapeutic effect through the perception of music); vocal therapy (therapy through singing); imago therapy (therapeutic effect through theatricalization, image); sand therapy (therapeutic effect through creativity), kinesitherapy (therapeutic effect through dance, through therapy, choreography, corrective rhythm, influence through movements), etc.

Art therapy technologies in the training of future educators solve the following problems:

- Adaptation of existing art therapy techniques and technologies, their use for children with developmental disorders in the system of psychocorrectional assistance (musculoskeletal, vision, hearing, speech, mental retardation, mental retardation, etc.).
- In the development of the child's personality, correction of secondary deviations, social and emotional harmonization of its adaptation using art therapy technologies in the cultural and educational space.
- To ensure the correction of developmental disorders in children with special needs – development of special art therapy technologies.
- Determination of the effectiveness and identification of the features of the use of art therapy with children in secondary education institutions in psychocorrectional work (Leigh, 2021).

Application of media art therapy in connection with the development of the information type of culture. The role of media competence in the process of media creativity.

Today, there is a need to create different types of art therapy – media art, because we live in the era of the information society, when the artist and his viewer are at a new level of communication, art means and forms are changing, and new approaches in creativity to reflecting reality are developing. And every modern person can become an artist at any moment. Media devices allow you to create videos and photos, and at the same time, share them with a large number of people and constantly communicate with the latest technologies: most of us learn about the world through the prism of gadgets, the Internet, and devices. We observe the interpenetration of virtual and objective realities. The virtual world and the real world are separated from each other and at the same time connected, and have similar features. Therefore, art therapy today needs to understand the new possibilities of the information world, as a method of healing the individual through art, through the use of media in the creative process, reaching a new level of understanding of healing mechanisms. The answer to the challenges of modern information reality is media art therapy.

Thanks to the development of the information type of culture and the globalization of the world, the development of media art therapy is possible, with its characteristic virtuality, multiculturalism, openness, plurality, and uncertainty. The use of modern media in the creative process is a defining feature of media art therapy. Let's break down the ways of using art in therapy:

- **Passive** (receptive) – perception of cinema, works of media art, photos, etc. – works have great healing potential.
- **Active** (creative) – the individual's own creativity, creative self-expression of a person using media, creation in interaction with an art therapist of media products (Rubio Machuca & Delgado García, 2024).

The development of media competence in the process of media creativity leads to the establishment of communication and increased self-esteem. An emotionally unfavorable attitude towards oneself, low self-esteem, includes the action of protective psychological mechanisms, making it difficult to perceive feedback. Positive self-esteem reduces resistance, reduces the level of psychological threat, and makes the personality more open to new information. Creativity and emotional support increase the degree of self-esteem and have a stabilizing positive effect on self-esteem. Therefore, the possibilities of using art therapy expand the media art society, help to share products with others, reduce the fear of one's own creativity, and receive support. The use of media art in the therapeutic process is modern because now we cannot exist without the media that has entered our lives (Denning et al., 2024).

There are the following types of media art from the point of view of organizing the artistic space:

- Network art or net art (network environment).
- Telecommunication art (various types of well-known cyberspaces, artistic spaces are used).
- Interactive electronic art to attract an audience.
- Media landscape art. (Zhang, 2025).

Functions of art therapy in the context of practical activities of future specialists.

To apply elements of art therapy in the training of future specialists, it is necessary to characterize the functions and clarify their possibilities of combination with the main functions of the pedagogical process in higher education.

In the context of the practical activity of educators, the functions of art therapy are primarily functions of setting tasks in the conditions of specific activity, analyzing psychological and pedagogical specific situations, regulating the process of implementing work plans, developing projects and plans for solving the specified tasks, and reflecting on the results obtained.

Let us name the main functions of art therapy used in the training of future educators to develop the creative potential of the child:

- **Diagnostic**: identifying emotional experiences, features, deviations, problems of personal development of a person; self-knowledge through artistic activity, etc.
- **Communicative**: mastering the dialectics of non-verbal and verbal communication, communication through the establishment of positive interpersonal contacts, symbols, and visual images.
- **Individualization**: preservation of individual identity, uniqueness of each individual.
- **Therapeutic**: self-realization in spontaneous creativity, gradual overcoming, and awareness of various difficulties and obstacles that arise in various types of human life.
- **Interethnic communication**: development of cultural identity, assimilation of socio-cultural universal human values, etc.
- **Correctional**: focus on group and individual positive changes in the process of art therapeutic interaction.
- **Socialization**: involvement of a person in the system of social relations, gaining social experience, assimilation of ethical norms, etc. (Kourilová et al., 2022).

Possibilities of simultaneous combination of several positions of a student and an educator in the process of professional training of specialists.

Let's analyze three categories (types) of higher education graduates that prevail in each student group, regardless of the year and age of study:

1. "**Insight-oriented**" students who are happy to engage in reflection and collective communication are inclined to discuss and express their own experiences in artistic bright images. They demonstrate the ability to be aware of their condition and the symbolic meaning of their works.
2. "**Artists**" – students have well-developed abilities for choreographic, musical, and visual activities; they strive to create aesthetically significant works, unusual and spectacular; they like the process of creation itself, have the appropriate skills; they dance, draw, and sing, getting pleasure from the creative process. A trusting, safe atmosphere in the group is the main condition for their work.
3. "**Distant observers**" – a kind of psychological defense – demonstrating indifference to events, a person simply observes the work of others – a position typical for those whose participation in group interaction is impaired or complicated for some reason (students rarely take such a position) (Shefi et al., 2025).

Let us characterize the priority positions in the art therapeutic interaction of the educator:

1. "**Partner**" – a favorable position for "insight-oriented" students who feel the need for understanding and support, cooperation, and feedback.
2. "**Interested observer**" – a position intended for such individuals who want to embody their own mental images in artistic form, for applicants-"artists" who seek to convey their experience in creativity. The educator's task: to facilitate the transformation of visual images into a finished work of art, provide positive feedback, protect from incorrect intervention, and curiosity from other group members; search for "keys" to self-knowledge; help "artists" in creative activity to realize hidden psychological meanings; and promote personal growth.
3. "**Facilitator**" – the educator's position is intended for students-"observers". The educator's function is inclusion with other participants in verbal and non-verbal interaction, care, and help in overcoming psychological barriers and obstacles.

In such an art therapeutic process, we observe a dynamic interaction between the following key components: a higher education student, an educator, and the product of his creative activity (González et al., 2020).

General issues of organizing and conducting a pedagogical experiment.

Experimental work was carried out during 2022–2024.

Let us name the factors that determined the reliable results obtained in the process of experimental work:

- In the conditions of the natural educational process, the experiment was conducted without violating the logic and flow.
- The sample studied was composed of students of the socionomic specialties of one parallel of the university.
- In accordance with the university curricula, the educational process took place in both the control and experimental groups.
- The same methods of diagnosing the formation of the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy were used in all groups.

We have included components, criteria, and indicators as the basic, generally accepted components of the readiness of future educators to develop the creative potential of education seekers by means of art therapy.

The motivational criterion corresponds to the motivational and value component of the readiness of future educators to develop the creative potential of students through art therapy.

Motivational and value component – motivational criterion – indicators:

- Positive attitude towards art therapy.
- Interest in art therapy.
- The presence of motivation to develop the creative potential of the individual through art therapy.
- Understanding of the possibilities of using art therapy tools for the development of the creative potential of each individual.

The cognitive criterion corresponds to the content component of the readiness of future educators to develop the creative potential of students through art therapy.

The content component – cognitive criterion – indicators:

- Systematicity.
- Completeness.
- Thoroughness of knowledge.

The activity-creative criterion corresponds to the process component of the readiness of future educators to develop the creative potential of students through art therapy.

The process component – activity-creative criterion – indicators:

- Presence of a complex of special skills and professional and pedagogical skills.
- The ability to use art therapy tools in their work.

The personal-reflective component of the readiness of future educators to develop the creative potential of students through art therapy corresponds to the reflective-resultative criterion.

The personal-reflective component – the reflective-resultative criterion – indicators:

- The ability to adequately evaluate one's own activities.
- The presence of creative thinking.
- For further reassessment of the results of the activities carried out – control, assessment, and self-assessment, self-control.

The levels of formation of the components of the readiness of future educators to develop the creative potential of students through art therapy in the educational process are distinguished: low, medium, and high.

A characteristic of the levels of readiness of future educators to develop the creative potential of students through art therapy is proposed.

High level – the student's desire for professional self-improvement, high motivation of the student for future professional activity; awareness of the need to develop the creative potential of the individual by means of art therapy; deep and complete knowledge of the individual-typological, age-related, psychophysiological characteristics of applicants for the educational space, upbringing and development, patterns of their learning; high preparedness (professional-pedagogical); highly developed abilities for constant self-improvement and professional self-development.

Average level – sufficient desire for professional self-improvement, sufficient motivation for future professional activity; incomplete awareness of the significance of the development and formation of the creative potential of the individual in classes by means of art therapy; lack of formation of professional knowledge regarding individual-typological, age-related, psychophysiological characteristics of the individual; have sufficient preparedness (professional-pedagogical); have the ability for constant self-improvement, professional self-development.

Low level – lack of desire for professional self-improvement, low motivation for future professional activity; lack of awareness of the significance of development and formation of creative potential by means of art therapy; have unsystematic, superficial knowledge of individual typological, age, psychophysiological characteristics of the personality, patterns of upbringing, training, development; have low preparedness (professional and pedagogical); lack of abilities for constant self-improvement and professional self-development.

Therefore, the structure of readiness of future educators for the development of creative potential of education seekers by means of art therapy in the educational process consists of interconnected components, criteria, and indicators that have level characteristics and form a dynamic integrity.

When introducing art therapy technology into the work of future educators to develop the creative potential of students, we will highlight three stages that correlate with the sequence of studying professional disciplines, with the structure of training future educators, and passing pedagogical practice and their capabilities in forming readiness in the educational process for the use of art therapy technologies.

The first, introductory stage involved the formation of clear ideas in future educators about the possibilities and essence of art therapy, and motivation to carry out art therapy activities.

The second, basic stage involved the application of art therapy competencies in practice by future educators. The experimental study aimed to develop the abilities and qualities of future educators for art therapy activities and to further motivate them to carry out such activities.

The third, constructive stage involved improving skills and abilities, systematizing art therapy knowledge, and realizing the importance of using art therapy technologies in the educational process.

Pilot study. The confirmatory stage of the experiment.

A pilot study preceded the experimental work. Its tasks were: to clarify the state of preparation of future educators for the development of the creative potential of education seekers by means of art therapy in the educational process in their further professional activities; to study the possibilities of the educational process of universities for the formation of the readiness of future educators for the development of the creative potential of education seekers by means of art therapy in the educational process.

To clarify the state of preparation of future educators for the development of the creative potential of education seekers by means of art therapy in the educational process, their understanding of the significance of this problem for the teaching profession, and students (150 respondents) were asked to answer the questions of the questionnaire.

Analysis of the survey results showed an extremely low level of ways of forming the relevant skills for the implementation of art therapy, and the respondents' understanding of the essence of creative potential (Figure 1):

- 21.1% of respondents sufficiently fully revealed the essence of the concepts of “art therapy”, “creative potential”.
- 18.5% of students did not give a specific answer to the question.

- 23.3% of respondents identified the concepts of “intelligence”, “creative potential”, “tasks”.
- 37.1% of respondents did not classify art therapy at all, which indicates that students do not understand the meaning of art therapy, its content, and its purpose for education.

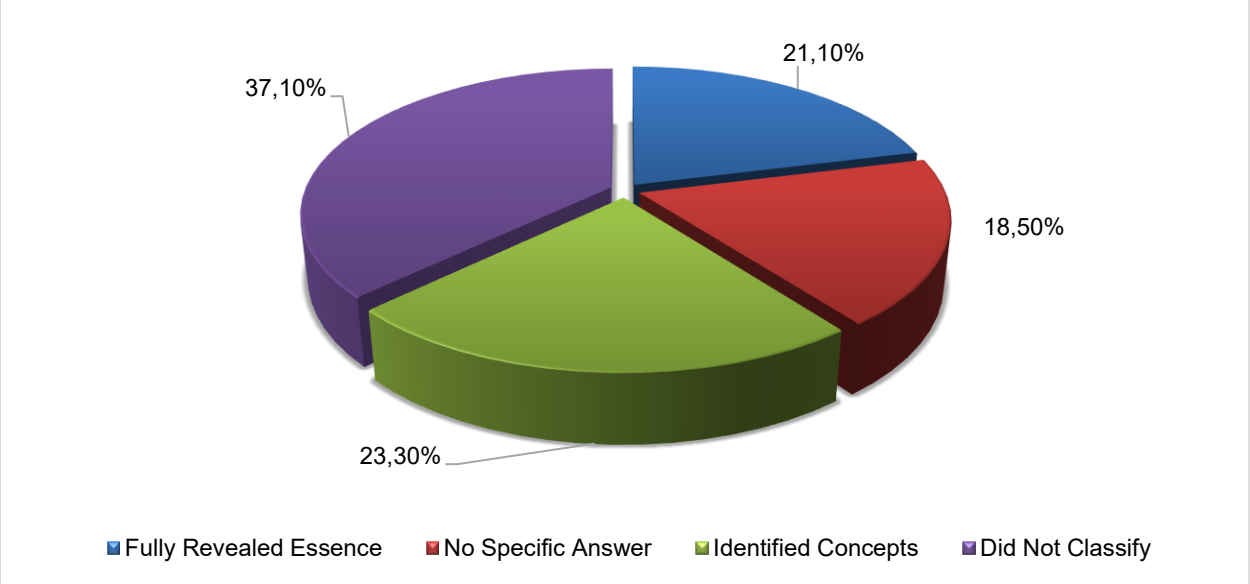

Figure 1. Understanding of Art Therapy and Creative Potential (Survey Results).

The following answers were received to the question about the significance of special training for future professional activity to develop the creative potential of the individual by means of art therapy (Figure 2):

- 27.1% of respondents do not consider special training for future professional activity to develop the creative potential of the individual by means of art therapy to be significant.
- 35% of students did not think about this issue.
- 37.9% of future educators associated it with the culture of educational and cognitive activity and the standard educational process.

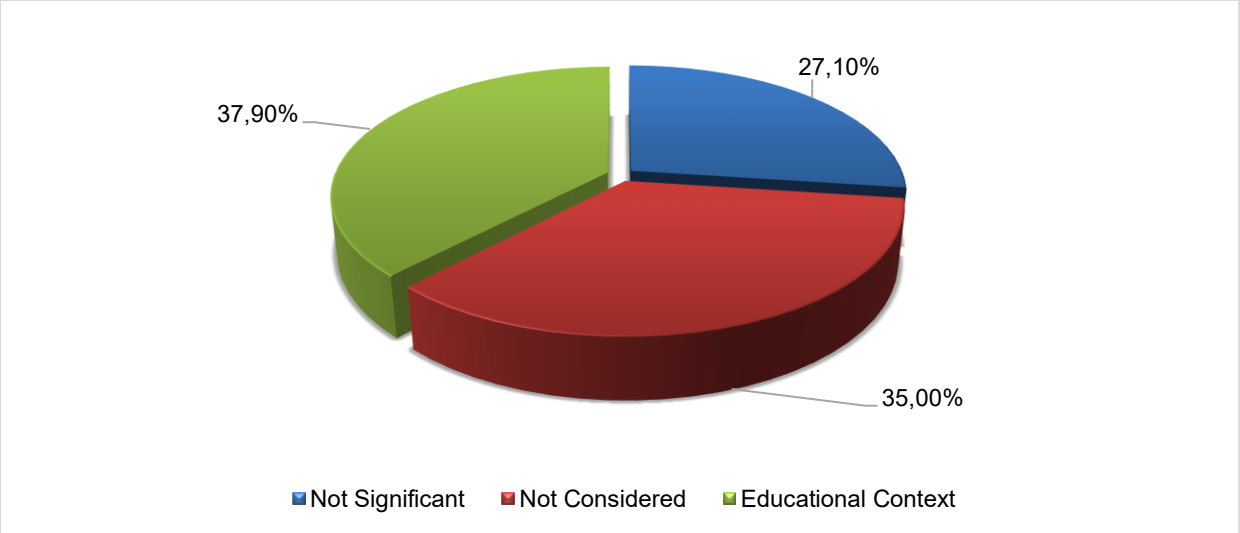

Figure 2. Significance of Special Training for Future Professional Activity to Develop Creative Potential through Art Therapy.

Analysis of students' responses to the questionnaire questions regarding the students' implementation of the task of planning and goal-setting, since the effectiveness of this professional pedagogical activity depends on this, shows that none of the students' responses contained a clear definition of the goal and tasks that they will solve in professional activities to solve the problem: 7.1% of respondents answered that since the effectiveness of educators' activities for future professional activities to develop the creative potential of the individual through art therapy depends on planning and goal-setting, they begin to implement professional tasks on goal-setting and planning.

It should be noted that the results of the observations allowed us to conclude that not all students consider special training for the development of the creative potential of the individual through art therapy to be significant for their future professional activities, but the identified problem of training future educators to develop the creative potential of students through art therapy in the educational process worries students: they easily make suggestions for deepening their knowledge, join discussions about its discussion, and are interested in acquiring relevant skills in special elective courses and group work.

During the pilot study at the ascertaining stage of the experiment, through conversations and observations, we revealed the attitude of educators to the problem of training future educators to develop the creative potential of students through art therapy in the educational process.

The results obtained provide grounds to say that almost all educators – 57 people participated in the survey – are aware of the importance of the problem under study, while 97.9% of them do not have sufficient qualifications to provide appropriate training for future educators to develop the creative potential of students using art therapy in the educational process.

So, at the ascertaining stage of the experiment, a diagnosis was made of the initial level of readiness of future educators to develop the creative potential of students using art therapy in the experimental and control groups according to certain criteria (motivational, cognitive, activity-creative, reflective-resultative) and their indicators.

During the ascertaining stage of the pedagogical experiment, the analysis, interpretation, and generalization of the results obtained allowed us to say that the general state of readiness of future educators to develop the creative potential of education seekers through art therapy is as follows (Figure 3):

- 62.4% of respondents have a low level.
- 33.9% of respondents have an average level.
- 3.7% of respondents have a high level, which confirms the feasibility of the study and its relevance.

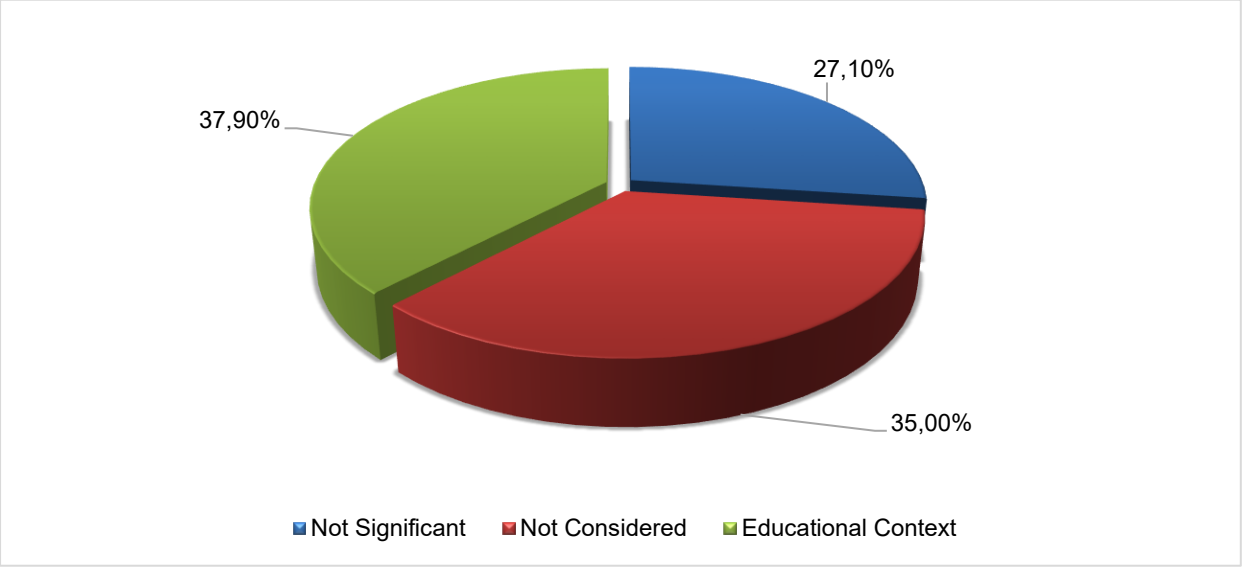

Figure 3. Readiness of Future Educators to Develop Creative Potential through Art Therapy (Ascertaining Stage).

At the formative stage of the pedagogical experiment, the developed technology for training future educators to develop the creative potential of students through art therapy and the proposed pedagogical conditions for such training were implemented.

The implementation of the developed technology for training future educators to develop the creative potential of students through art therapy involved the use of art therapy functions in training future educators to develop the child's creative potential:

- **Diagnostic**: identifying emotional experiences, characteristics, deviations, problems of personal development of a person; self-knowledge through artistic activity, etc.
- **Communicative**: mastering the dialectics of non-verbal and verbal communication, communication through the establishment of positive interpersonal contacts, symbols, and visual images.
- **Individualization**: preserving the individual identity, uniqueness of each individual;
- **Therapeutic**: self-realization in spontaneous creativity, gradual overcoming, and awareness of various difficulties and obstacles that arise in various types of human life.
- **Interethnic communication**: development of cultural identity, assimilation of socio-cultural universal human values, etc.
- **Correctional**: focus on group and individual positive changes in the process of art therapeutic interaction.
- **Socialization**: involvement of a person in the system of social relations, gaining social experience, assimilation of ethical norms, etc.

The implementation of this stage of the development and implementation of the technology for training future educators to develop the creative potential of education seekers by means of art therapy provided for:

- Development of the necessary methodological materials for conducting experimental work, discussion by respondents of the results of their testing with experimenters at scientific and methodological seminars and department meetings;
- Information support for the activities of educators in preparing future educators to develop the creative potential of students through art therapy.
- Application of media art therapy in connection with the development of the information type of culture;

media competence in the process of media creativity.
- Stimulation of educators to carry out their own scientific and methodological searches in preparing future educators to develop the creative potential of students through art therapy.
- Increasing the level of educators-experimenters of scientific and methodological training.
- Organization and conduct of a methodological seminar “Main ways of preparing future educators to develop the creative potential of students through art therapy”.
- Development and conduct of a special course “Development of the creative potential of students through art therapy”.

In the process of research, we have developed and proposed pedagogical conditions that ensure the effective functioning of the developed technology for training future educators to develop the creative potential of education seekers by means of art therapy.

The pedagogical conditions for training future educators to develop the creative potential of education seekers by means of art therapy are:

- Innovative filling of the content of the educational process with a creative component to qualitatively train future educators to develop the creative potential of education seekers by means of art therapy.
- Formation of motivation for the use of art therapy in future professional activities and for the use of media art therapy in connection with the development of the information type of culture, media competence in the process of media creativity.
- Organization of educational and methodological support for the training of future educators to develop the creative potential of education seekers by means of art therapy.

Therefore, the pedagogical conditions for preparing future educators for the outlined activity ensure the creation of a high-quality purposeful educational process, give us a set of educational environment opportunities that contribute to the preparation of future future educators for the development of the creative potential of education seekers by means of art therapy, the readiness of future educators to use art therapy technologies that will contribute to the development of the child's creative potential.

Control stage of the pedagogical experiment. After the stage of development and implementation of the technology of training future educators to develop the creative potential of education seekers by means of art therapy in the educational process of higher education, the main tasks of the control stage of the pedagogical experiment were determined:

1. Clarification of the level of readiness of future educators to develop the creative potential of education seekers by means of art therapy of the experimental and control groups according to the specified criteria (motivational, cognitive, activity-creative, reflective-resultative) and their indicators.
2. Explanation of the studied quantitative and qualitative changes in the studied readiness of future educators of the control and experimental groups, which were obtained as a result of the implementation of the technology of training according to the specified criteria and their indicators in the EG.
3. formulation of general conclusions of the conducted research based on the generalization of the obtained results of the experimental work.

We present the dynamics of changes in the levels of readiness of future educators of the experimental group and the control group to develop the creative potential of students through art therapy.
The experimental data obtained indicate the positive implementation and positive impact of the developed technology for training future educators to develop the creative potential of students through art therapy.

It should be noted that the number of future educators with a low level of readiness to develop the creative potential of students through art therapy decreased in the experimental group by 54.0%, and in the control group, this indicator was – 25.4%.

Dynamics of the levels of readiness of students to develop the creative potential of younger schoolchildren through art therapy (Figure 4).

Experimental group

High level: 5.7% – ascertaining stage, 57.9% – control stage.
Average level: 39.0% – ascertaining stage, 40.7% – control stage.
Low level: 55.3% – ascertaining stage, 1.4% – control stage.

Control group

High level: 9.6% – ascertaining stage, 23.4% – control stage.
Average level: 43.3% – ascertaining stage, 54.9% – control stage.
Low level: 47.1% – ascertaining stage, 21.7% – control stage.

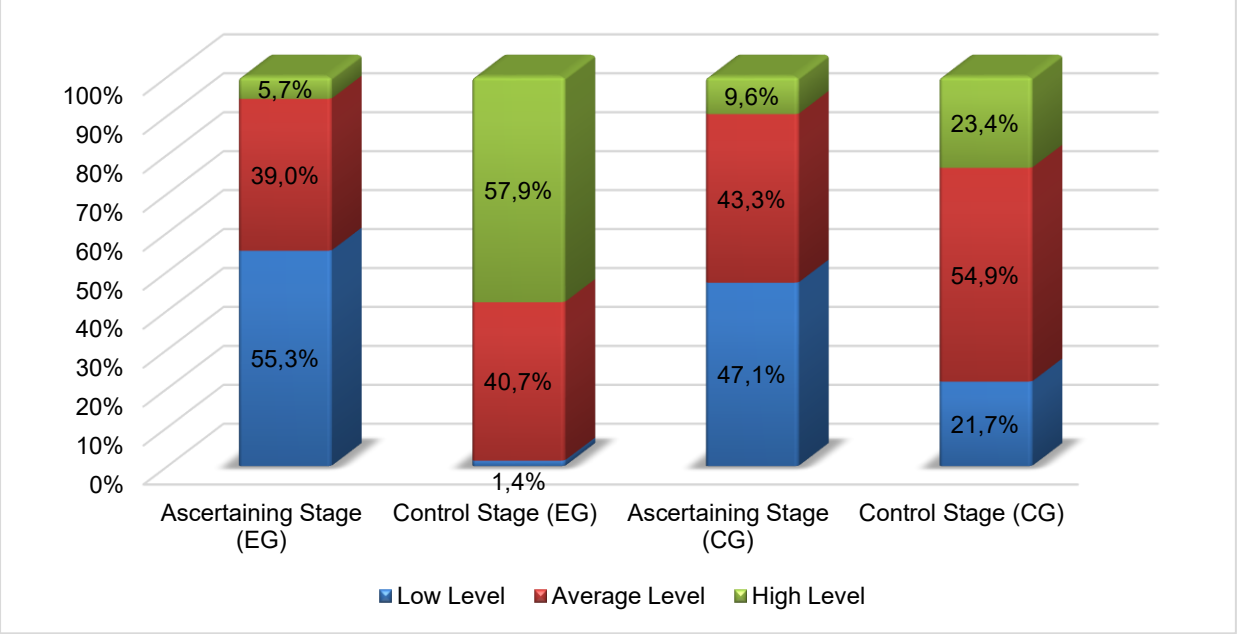

Figure 4. Dynamics of Students' Readiness Levels to Develop Creative Potential through Art Therapy.

Thus, the control stage of the pedagogical experiment made it possible to state that as a result of the development and implementation of the technology of training future educators to develop the creative potential of students using art therapy in the educational process of higher education (in the EG), the number of future educators in the EG with a high level of certain readiness as a result of the experimental work carried out significantly increased at the formative stage of the experiment. A small increase at the formative stage of the experiment was observed in the CG.

To compare the distribution of educators by the levels of readiness of students to develop the creative potential of education seekers by means of art therapy in the EG and CG samples, non-parametric methods of mathematical statistics were used. A quantitative analysis of the experimental data was performed using the Pearson χ^2 criterion.

As a result of the experiment, we proposed a null hypothesis (H0) to clarify the reliability of the results of the experiment that the difference in data in the control and experimental samples regarding the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy

is caused by representativeness errors, as well as an alternative hypothesis (H1) that the difference in data in the control and experimental samples is caused by the introduction of the developed experimental factor. Hypotheses were formulated – null and alternative in order to verify the identified differences in the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy in the control group and the experimental group.

H0 – the levels of formation of skills and knowledge on the issues of forming the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the experimental and control groups do not have significant differences.

H1 – the levels of formation of skills and knowledge on the issues of forming the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the experimental and control groups, in which the developed technology was implemented, differ significantly. It turned out to be appropriate to use the Pearson χ^2 criterion to verify these hypotheses, since the samples of the groups – CG and EG of future educators are independent and random, the members of each sample are also independent of each other; on the scale of order, the properties were measured, which has three categories: productive, creative, reproductive (c = 3).

So, the obtained value of the statistic $T_{exp.} > T_{cr.}$

We, therefore, accept the alternative hypothesis: the differences in the distributions of future educators of the control group and the experimental group by the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy are statistically significant with a probability of 95%.

Based on the analysis of the obtained results of the experimental work, we say that the effectiveness of the developed training technology is proven by a significant increase in the indicators of the formation of all components of the readiness of future educators to develop the creative potential of education seekers by means of art therapy.

The reliability of the obtained results of the pedagogical experiment, the conclusions, was confirmed by the methods of mathematical statistics. And the processing of experimental data using the Pearson χ^2 criterion showed the presence of statistically significant changes in the experimental group. This confirmed the correctness of the hypothesis put forward ($T_n > T_k$, 24.22 > 5.991). Therefore, we can say that the developed technology for training future educators to develop the creative potential of education seekers using art therapy can be proposed for implementation in the process of professional training of specialists, because it is effective.

Conclusions

The content of the studied concept is considered, and the purpose and approaches to art therapy in the preparation of future educators for the development of the creative potential of education seekers are clarified. The significance of art therapy technologies in the preparation of future educators is proven. The functions of art therapy in the context of the practical activity of future specialists are highlighted. The possibilities of simultaneously combining several positions of a student and an educator in the process of professional training of specialists are clarified; the use of media art therapy in connection with the development of the information type of culture; the role of media competence in the process of media creativity.

Three categories (types) of higher education seekers that prevail in each student group, regardless of the year and age of study, are analyzed. The priority positions in the art therapy interaction of the educator are characterized.

When conducting the study, the factors that determined the reliability of the results obtained in the process of experimental work were identified.

We have included components, criteria, and indicators as basic, generally accepted components of the readiness of future educators to develop the creative potential of students through art therapy.

The levels of formation of the components of the readiness of future educators to develop the creative potential of students through art therapy in the educational process are identified: low, medium, and high.

A characteristic of the levels of readiness of future educators to develop the creative potential of students through art therapy is proposed.

When introducing art therapy technology into the work of future educators to develop the creative potential of students, we will highlight three stages that correlate with the sequence of studying professional disciplines, with the structure of training future educators and passing pedagogical practice, and their capabilities in forming readiness in the educational process for the use of art therapy technologies.

A pilot study preceded the experimental work. At the ascertaining stage of the experiment, a diagnosis of the formation of the initial level of readiness of future educators to develop the creative potential of education seekers by means of art therapy of the experimental and control groups was carried out according to the specified criteria (motivational, cognitive, activity-creative, reflective-resultative) and their indicators. The formation of the initial level of readiness is observed at a low level.

At the formative stage of the pedagogical experiment, the developed technology for training future educators to develop the creative potential of education seekers by means of art therapy, the proposed pedagogical conditions for such training were implemented.

The control stage of the pedagogical experiment made it possible to state that as a result of the development and implementation of the technology for training future educators to develop the creative potential of education seekers by means of art therapy in the educational process of higher school (in EG), the number of future educators in EG with a high level of determined readiness as a result of the experimental work carried out significantly increased at the formative stage of the experiment. A small increase in the formative stage of the experiment is observed in the CG.

To compare the distribution of educators by the levels of readiness of students to develop the creative potential of education seekers by means of art therapy in the EG and CG samples, non-parametric methods of mathematical statistics were used. A quantitative analysis of the experimental data was performed using the Pearson χ^2 criterion.

As a result of the experiment, we proposed a null hypothesis (H0) to clarify the reliability of the results of the experiment that the difference in data in the control and experimental samples regarding the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy is caused by representativeness errors, as well as an alternative hypothesis (H1) that the difference in data in the control and experimental samples is caused by the introduction of the developed experimental factor. Hypotheses were formulated – null and alternative in order to verify the identified differences in the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy in the control group and the experimental group.

H0 – the levels of formation of skills and knowledge on the issues of forming the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the experimental and control groups do not have significant differences.

H1 – the levels of formation of skills and knowledge on the issues of forming the readiness of future educators to develop the creative potential of education seekers by means of art therapy in the experimental and control groups, in which the developed technology was implemented, differ significantly.

It turned out to be appropriate to use the Pearson χ^2 criterion to test these hypotheses, since the samples of groups – CG and EG of future educators are independent and random, the members of each sample are also independent among themselves; on the order scale, the properties were measured, which has three categories: productive, creative, reproductive (c = 3).

Therefore, the obtained value of the statistic $T_{exp.} > T_{cr.}$

We, therefore, accept the alternative hypothesis: the differences in the distributions of future educators of the control group and the experimental group by the levels of readiness of future educators to develop the creative potential of education seekers by means of art therapy are statistically significant with a probability of 95%.

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The reliability of the obtained results of the pedagogical experiment, the conclusions, was confirmed by the methods of mathematical statistics. And the processing of experimental data using the Pearson χ^2 criterion showed the presence of statistically significant changes in the experimental group. This confirmed the correctness of the hypothesis put forward ($T_n > T_k$, 24.22 > 5.991). Therefore, we can say that the developed technology for training future educators to develop the creative potential of education seekers through art therapy can be proposed for implementation in the professional training process of specialists, as it is effective.

Further research requires clarification of the ways of applying the elements of art therapy, the use of art therapy technologies, and substantiation of the content of art therapy using artistic and creative activity in the reconstruction of a psychotraumatic situation, the corrective and therapeutic effects of art on the subject, the birth of creative needs, and the creation of new positive experiences.

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Sociolinguistic aspects of foreign language teaching in the context of international education

Aspectos sociolingüísticos de la enseñanza de lenguas extranjeras en el contexto de la educación internacional

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Abstract

This qualitative study examined Ukrainian students' and educators' perceptions and experiences of sociolinguistic factors influencing foreign language instruction in international education contexts, reflecting on "Experiences of academic mobility and institutional approaches to language policy" for transnational cohorts. A total of 15 participants, consisting of 8 Ukrainian students and 7 Ukrainian educators, were selected through purposive sampling. All participants had substantial involvement in Erasmus+ mobility programs, ensuring well-informed perspectives. Semi-structured interviews provided in-depth insights and detailed narratives. The interview protocols addressed classroom practices, mobility experiences, and institutional language policies. Data was analyzed using thematic analysis, which identified key themes related to language attitudes, cultural adaptation, linguistic diversity, and linguistic identities. The findings

show the importance of accounting for linguistic and cultural contexts in foreign language learning and to enhance cultural competence training and institutional support for language educators. The implications include aligning curricula with multilingual realities and developing targeted support mechanisms for transnational cohorts. This study contributes to the literature on sociolinguistic factors in international higher institutions and serves a baseline for future research.

Keywords: Multicultural Education, International Education, Language Instruction, Language Identity.

Resumen

Este estudio cualitativo examinó las percepciones y experiencias de estudiantes y docentes ucranianos sobre los factores sociolingüísticos que influyen en la enseñanza de lenguas extranjeras en contextos de educación internacional, con referencia a “Experiencias de movilidad académica y enfoques institucionales de política lingüística” en cohortes transnacionales. Participaron quince personas, ocho estudiantes y siete docentes ucranianos, seleccionados mediante muestreo intencional. Todos habían estado involucrados de manera significativa en programas de movilidad Erasmus+, lo que aseguró perspectivas fundamentadas. Las entrevistas semiestructuradas ofrecieron visiones detalladas y narrativas profundas. Los protocolos de entrevista abordaron prácticas de aula, experiencias de movilidad y políticas lingüísticas institucionales. Los datos fueron analizados mediante análisis temático, identificando ejes vinculados con actitudes hacia la lengua, adaptación cultural, diversidad lingüística e identidades lingüísticas. Los hallazgos subrayan la necesidad de considerar los contextos culturales y lingüísticos en la enseñanza de idiomas extranjeros y de fortalecer la formación en competencia cultural, así como el apoyo institucional a los docentes de lenguas. Las implicaciones incluyen alinear los planes de estudio con las realidades multilingües y desarrollar mecanismos de apoyo dirigidos a cohortes transnacionales. Este estudio aporta a la literatura sobre factores sociolingüísticos en la educación superior internacional y establece una base para futuras investigaciones.

Palabras clave: Diversidad cultural, Programas internacionales, Educación lingüística, Identidad lingüística.

Introduction

The importance of education cannot be overstated, given its role in the comprehensive development of humanity. Consequently, education is regarded as a vehicle for navigating an interconnected world (Damaianti et al., 2020). In the global context of international education, it is important to equip learners the knowledge and skills for solving complex problems. According to Turchyn et al. (2023), international education seeks to equip students with the skills and knowledge needed to succeed in a globalized environment, where English has become the dominant language of international communication (Jamiluddin, 2023). The teaching of foreign language plays a critical role in advancing international education, as it help students to effectively interact across cultural and linguistic boundaries (Yemelyanova et al., 2022). The need for foreign language education arises from the growing demand for professionals capable of operating in multilingual environments, fostering mutual understanding and cooperation worldwide. Sociolinguistic factors, including language attitudes, linguistic diversity, and cultural identity, strongly influence learning outcomes in foreign language teaching. As Goodman et al. (2022) observed, linguistic diversity enriches language education by deepening awareness of diverse ways of life, but it can also pose challenges when students’ linguistic backgrounds differ from the language of instruction. In regions such as Latin America, these factors shape language education. For example, in Brazil, the coexistence of Portuguese with indigenous and African languages affects teaching and learning. In Mexico, the presence of indigenous languages alongside Spanish presents both challenges and opportunities for language education. In Ukraine, sociolinguistic factors are highly prominent due to the country’s complex linguistic landscape, which includes the coexistence of Ukrainian, Hungarian, and other languages. English language instruction is particularly important for Ukrainian students, given the country’s growing participation in international programs (Yerken et al., 2022). Multilingualism can enhance educational outcomes in Ukraine by bringing cultural and linguistic knowledge into the classroom, fostering cultural

understanding and supporting language acquisition (Romanchuk et al., 2023). However, it also presents challenges related to language planning and policy. In the post-conflict context, language education has played a critical role in strengthening national identity and promoting social integration in Ukraine. As Kulichenko et al. (2023) observed, language learning is essential for post-conflict reconstruction, as it fosters a shared identity and supports social cohesion.

There appears to be a paucity of research on the sociolinguistic dynamics of programs at the global level, particularly those involving Ukrainian educators and students. Supporting this view, Yevstakhevych et al. (2021) and Yılmaz & Temizkan (2022) noted that although literature on language education and multilingualism exists, to the best of current knowledge, no study has specifically examined the experiences of Ukrainian educators and students in international programs. This gap is partly due to the complex cultural and linguistic negotiations inherent in international programs, which significantly influence the academic success of participating students. The scarcity of research in this area indicates poor understanding of the specific problems and opportunities faced by Ukrainian educators and students in such contexts. Yevstakhevych et al. (2021) observed that students often struggle to adapt to different linguistic norms and academic expectations in foreign universities, which can hinder academic engagement, performance, and overall experience. Addressing these issues would enable researchers to better understand the factors affecting the academic success of educators and students in international programs and to identify effective strategies for supporting participants from Ukraine.

Research Goal

The objective of this research is to investigate the experiences, perceptions, and processes of language teaching and learning in international education contexts, with particular attention to linguistic diversity, cultural influences, and language attitudes.

Research Questions

In alignment with the research goal, the study will be guided by the following questions:

1. How do students and educators in Ukraine and Latin America perceive the role of linguistic diversity in language teaching and learning within international education programs?
2. What cultural and social factors shape the experiences of students and educators in international education programs, particularly in relation to language teaching and learning?
3. How do language attitudes and identities affect teaching and learning processes in international education contexts?

Literature Review

Sociolinguistics in language teaching, international education, Latin American context

Sociolinguistics

The field of sociolinguistics is dynamic, as it examines the complex relationship among culture, language, and society. According to Marsh & Hoff (2019), sociolinguistics is the study of language in its social setting, centering on how language use shapes and reflects power dynamics, cultural norms, and social identity. Similarly, Mujiono & Herawati (2021) view sociolinguistics as a social practice within language study, emphasizing its cultural, historical, and social relevance. It also involves assessing language variation and investigating change in social contexts, including the study of language contact, dialects, and registers (Bannister, 2024). Additionally, Pacheco et al. (2019) state that language variation is a key aspect of language use, reflecting the social and cultural contexts in which it is embedded. Nguyen & Stracke (2020) argue that such variation is influenced by social factors such as identity, power, and status Favale et al. (2020) highlight the close relationship between culture and language, noting that language use is shaped

by cultural values and norms. Qian & Lau (2022) stress language role in constructing social identity and fostering relationships. Turchyn et al. (2023) note that sociolinguistics informs language planning, teaching, and policy, while Saleh et al. (2023) add that it supports the development of culturally and socially sensitive methodologies, curricula, and assessment tools. In this study, sociolinguistics is understood as the examination of how language identity, use, and attitudes intersect with social factors in international education, shaping the experiences and perceptions of Ukrainian educators and students.

Linguistic Diversity

Linguistic diversity has been conceptualized by various scholars as the coexistence of multiple languages, language varieties, and language practices within a specific sociocultural context. According to Toppo and Rahman (2020), this diversity represents a valuable resource that fosters effective communication, creativity, and intercultural understanding. Expanding on this view, Luchenko and Doronina (2023) classify linguistic diversity into several forms, such as language convergence, contact, and divergence, highlighting its dynamic nature within multilingual societies. Furthermore, Abdulai, Roosalu, and Wagoner (2021) emphasize the intrinsic connection between linguistic diversity and cultural identity, noting that language both shapes and reflects the cultural values, norms, and worldviews of its speakers. Complementarily, Babelyuk et al. (2020) argue that linguistic diversity significantly influences language planning and policy, as institutions and governments play decisive roles in either promoting or restricting language use within their jurisdictions. Collectively, these perspectives underscore that linguistic diversity is not merely a linguistic phenomenon but also a sociocultural and political one, deeply intertwined with identity, governance, and communication in multicultural contexts.

Language Attitude

In its simplest sense, language attitude refers to the feelings, evaluations, and opinions that individuals hold toward languages, language users, and language varieties. According to DeLuca et al. (2020), language attitude shapes language learning, social interactions, and language use, and can also be influenced by historical, cultural, and social contexts. Similarly, Dumchak et al. (2024) maintain that language attitude reflects power dynamics, as dominant languages and language varieties are often perceived as more prestigious than minority languages and varieties. Favale et al. (2020) note that language ideologies influence language attitudes by shaping people's understanding of language and its functions in society. As García Laborda et al. (2024) correctly noted, language attitudes can be either positive or negative, and these attitudes are reflected in both language behavior and language use. They are shaped by cultural and social factors, including language planning and policy. Moreover, language use, proficiency, and motivation for language learning are significantly influenced by language attitudes.

International Education

Many scholars have defined international education programs. Educational programs, initiatives, and institutions that aim to enhance international collaboration, global understanding, and cultural exchange are regarded as international education (Sokolovskaya et al., 2023). According to Nguyen & Stracke (2020), international education takes different forms, which include global partnerships, study-abroad programs, and international curricula. International education is shaped by political and economic factors, as countries compete to maximize the benefits of education, such as fostering global partnerships, preparing learners for global interaction and connections, and promoting cultural understanding. This may explain why Lee et al. (2022) maintain that international education improves students' career prospects and provides them with a competitive edge in the international environment.

Sociolinguistic factors in foreign language teaching

The role of sociolinguistic factors in influencing academic outcomes and shaping the perceptions and experiences of students is particularly significant in foreign language teaching. As opined by Lee & Lee (2020), the intersection of culture and language is a critical aspect of language learning. The relationship

between culture and language is complex, and language teaching that fails to incorporate and acknowledge learners' cultural identities can hinder the learning process Ramalingam et al. (2022). Conversely, when language teaching integrates and values the cultural backgrounds of learners, it fosters a more effective and inclusive learning environment.

Language ideologies and language attitudes, as key sociolinguistic factors, also have a substantial impact on language learning outcomes (Damaianti et al., 2020). Moreover, the ways in which students use and perceive languages are shaped by language ideologies, with dominant ideologies often marginalizing minority cultures and languages. Lee et al. (2022) emphasize the importance of considering sociolinguistic factors in language teaching by adopting culturally responsive practices. Such practices acknowledge and value learners' cultural experiences and backgrounds, thereby enhancing the inclusivity and effectiveness of the educational process.

Language Related Challenges in the context of International Education

International education programs face various language-related challenges that can hinder students' academic performance and social integration. According to Jie & Sunze (2021), research on language learning in a globalized world demonstrates that rethinking curricula is essential to address the diverse needs of learners. One major challenge is language dominance, particularly that of English, which often leads to inequality in language education practices and policies (Ramalingam et al., 2022). In this regard, Luchenko & Doronina (2023) highlight the impact of globalization on language education, emphasizing the importance of multilingual learning and intercultural competence. Turchyn et al. (2023) report that over 30% of the world's population struggles to access education in their native dialect, which negatively affects learning outcomes and perpetuates inequality. This underscores the need to integrate cultural context and acknowledge learners' cultural identities in language teaching within international education programs. As noted by Seitenova et al. (2023), language learning is also influenced by language ideologies and attitudes, meaning that learners' attitudes toward the target culture and language significantly affect their academic engagement and motivation.

Multilingualism, Language Policies and Participation in Programs like Erasmus+

In Ukraine, multilingualism is particularly important in the context of European integration and globalization. National language policies are shaped by diverse cultural and historical factors, as well as by the country's complex linguistic learning landscape. According to Kulichenko et al. (2023), the challenges faced by the Ukrainian language in maintaining dominance over other languages, particularly in the eastern region, are complex and require targeted solutions. Efforts to address these challenges include promoting Ukrainian as the state language and adopting policies and laws aimed at strengthening its use in government, media, and education.

Erasmus+ is one program that has played a significant role in fostering cultural exchange and multilingualism in Ukraine. According to Palf et al. (2023), Erasmus+ enables staff and students to work and study abroad, thereby enhancing their cultural competence and language skills. In this regard, Kulichenko et al. (2023) emphasize that the use of digital tools and technology significantly improves language learning outcomes and promotes more effective interaction. Encouraging language diversity and multilingualism fosters greater cooperation and cultural understanding both within Ukraine and across borders.

Theoretical Framework

In the context of international education programs, sociocultural theory provides a valuable lens for examining how language learners construct meaning and engage with peers (Goodman et al., 2022). Language both reflects and shapes cultural identity, influencing how individuals perceive and interact with the world. Social interaction is essential for language learning, offering opportunities for dialogue,

negotiation of meaning, and the development of linguistic skills. The cultural context in which language learning occurs positively impacts academic performance and shapes students' experiences and perceptions (Pacheco et al., 2019).

In Latin America and Ukraine, sociocultural theory helps to explain the complexities of linguistic landscapes and cultural contexts. Multilingual education theories emphasize promoting equity among all languages spoken by students, challenging linguistic hierarchies, and fostering additive multilingualism. Language awareness theory highlights the importance of helping students understand how languages work, encouraging reflection on linguistic structures, patterns, and cultural contexts. Applying sociocultural theory enables researchers to explore how language education promotes social interaction, cultural understanding, and positive learning outcomes, helping educators create environments that value linguistic diversity and support language development.

Gap in Knowledge

Based on the studies reviewed so far, there appears to be inadequate research on the topic under investigation. This study is geared towards addressing evident gap in understanding the complex relationship among language, social interaction, and culture in international education programs, with a focus on the perceptions and experiences of students in the context of Ukraine. While existing studies have examined cultural adaptation and language learning from various perspectives, there remains a need to provide deeper insight into the specific challenges and opportunities faced by Ukrainian students in international education programs. This study seeks to fill that gap by offering a more comprehensive understanding of these experiences, thereby contributing to the development of strategies that can enhance student engagement, learning outcomes, and cultural integration.

Methodology

Research Design

In this research, a qualitative design, specifically a phenomenological approach, was adopted to investigate educators' and students' perceptions and experiences regarding sociolinguistic factors in foreign language teaching within the environ of international education. This phenomenological research focused on understanding individual experiences as well as the meanings participants ascribed to those experiences. The approach was suitable for the present study as it allowed for an in-depth investigation of the complex relationship among language, social interaction, and culture within the international education environment. In addition, the phenomenological approach enabled the researcher to obtain a rich understanding of participants' perceptions and interpretations, offering valuable insights into how they constructed meaning from their experiences. The study therefore captured the essence of participants' perspectives through the use of semi-structured interviews, thereby illuminating the sociolinguistic factors influencing foreign language teaching and learning within the context of international education.

Participants

The study employed purposive sampling techniques to select 15 participants. These participants included 8 Ukrainian students and 7 Ukrainian educators who possessed relevant knowledge and had participated in Erasmus+ programs within the framework of international education. As noted by Guest (2012), a sample size of 12 to 15 participants is adequate to achieve data saturation, particularly in qualitative research. In line with this, the chosen sample size was considered appropriate for the present study, as it ensured data saturation and provided a comprehensive understanding of the topic under investigation.

Data Collection

This study used semi-structured interviews for data collection. The interviews were conducted in the language preferred by the participants (English or Ukrainian) to ensure effective communication, promote

comfort, and facilitate open discussion. An in-depth interview guide was developed in alignment with the research questions guiding the study.

Interview Protocol

The interview protocol was developed based on the research questions and objectives. It consisted of open-ended questions that encouraged participants to share their experiences and perceptions in detail. The protocol was pilot-tested with two participants to ensure clarity and relevance to the research objectives. The pilot test also helped identify potential biases or ambiguities, enabling the researcher to refine the protocol before conducting the main interviews.

Validation Process

The validation process for the interview protocol involved several steps. First, the researcher consulted experts in language education and qualitative research to review the protocol and provide feedback. Second, the protocol was pilot-tested with two participants to ensure that the questions were clear and relevant to the research objectives. Finally, the researcher reviewed the protocol to confirm alignment with the research questions and objectives. This process established the content validity of the interview protocol and ensured its effectiveness in capturing the data required to answer the research questions.

Data Analysis

The study adopted thematic analysis to identify patterns in the data. The process involved transcribing interviews, coding data, identifying themes, and interpreting the results. This approach enabled the researcher to explore underlying themes and meanings in the data, providing deeper understanding and insights into the study topic.

Ethical Considerations

Ethical guidelines were strictly adhered to by the researcher. Hence, the researcher obtained the consent of the study participants, anonymity was ensured, and data were securely stored. Participants were fully informed about the research goals and procedures, and their rights were respected throughout the study.

Ukrainian Context

The study faced challenges in accessing participants due to ongoing reforms and mobility issues in Ukraine. To address these, the researcher used online data collection methods and partnered with Ukrainian universities to facilitate participant recruitment.

Results and Discussion

This section presents the findings of the study, highlighting key themes and patterns that emerged from the data analysis.

Thematic analysis revealed key themes related to sociolinguistic factors influencing foreign language teaching in international education programs, reflecting the perceptions and experiences of students and educators in Ukraine.

Theme 1: Linguistic Diversity

Table 1.
Linguistic Diversity

Theme	Sub-theme	Sample Quote
Linguistic Diversity	Linguistic Diversity as a Resource	"Language diversity is a treasure that allows us to learn from each other and understand different cultures."
	Challenges of Linguistic Diversity	"Sometimes, language barriers can make it difficult for students to understand each other, and it takes extra effort to communicate effectively."

Data in Table 1 show the theme of linguistic diversity, which is a significant variable in foreign language teaching. The two subthemes, linguistic diversity and the challenges of linguistic diversity, reflect the complex nature of language variation in educational settings. The study participants perceived linguistic diversity as a valuable resource that enhances cultural exchange and language learning. At the same time, the participants acknowledged the challenges it presents, such as barriers to understanding and communication difficulties.

Theme 2: Cultural Factors

Table 2.
Cultural Diffrerences and Adaptation

Theme	Sub-theme	Sample Quote
Cultural Factors	Cultural Differences and Adaptation	"Cultural awareness is crucial in teaching, and we need to be sensitive to the cultural backgrounds of our students."
	Social Support and Networks	"Having a support network of peers and mentors has been invaluable in helping me navigate the challenges of language learning and cultural adaptation."

Findings in Table 2 show the theme of cultural variables, which emerged as an important aspect of foreign language teaching. The results indicate that social support and networks, as well as cultural differences and adaptations, underscore the relevance of cultural awareness and support in educational settings. The findings further revealed the need for teachers to adopt appropriate teaching methods that recognize cultural differences and highlight the importance of social support and networks in addressing challenges affecting international education programs.

Theme 3: Language Attitude and Identities

Table 3.
Language Attitude and Motivation

Theme	Sub-theme	Sample Quote
Language Attitude and Identities	Language Attitude and Motivation	"I believe that having a positive attitude towards language learning is crucial, and it's essential to find ways to stay motivated and engaged."
	Language Identity and Cultural Affiliations	"Language is closely tied to our cultural identity, and learning a new language can be a way of expanding our cultural horizons."

Table 3 presents the theme of language attitudes and identities, which emerged as a significant factor in foreign language teaching and learning. The sub-themes, language attitude and motivation and language identity and cultural affiliations, reflect the complex relationship among language, identity, and culture. Participants discussed the influence of language attitude and motivation on language learning, as well as the connection between language and cultural affiliation.

Table 4.
Linguistic Diversity Examples

S/N	Sample Quote
1.	"Language diversity is a treasure that allows us to learn from each other and understand different cultures."
2.	"Sometimes, language barriers can make it difficult for students to understand each other, and it takes extra effort to communicate effectively."

Participants in Table 4 emphasized the significance of social support and networks in addressing challenges within international education programs. In line with this, Yerken et al. (2022) underscored the importance of social support networks in promoting language learning and academic success. According to sociocultural theory, social support and networks provide learners with the scaffolding and mediation necessary to navigate complex linguistic and cultural contexts.

Table 5.
Cultural Factors Examples

S/N	Sample Quote
1.	"Cultural awareness is crucial in teaching, and we need to be sensitive to the cultural backgrounds of our students."
2.	"Having a support network of peers and mentors has been invaluable in helping me navigate the challenges of language learning and cultural adaptation."

In Table 5, the findings present additional examples of participant quotes related to cultural variables. The quotes underscore the relevance of cultural awareness and support in educational settings.

Language Identity and Cultural Affiliations

Table 6.
Language Attitude and Identities Examples

S/N	Sample Quote
1.	"I believe that having a positive attitude towards language learning is crucial, and it's essential to find ways to stay motivated and engaged."
2.	"Language is closely tied to our cultural identity, and learning a new language can be a way of expanding our cultural horizons."

Additional examples of participant quotes related to language attitudes and identities are presented in Table 6. These quotes illustrate the complex relationship among language, identity, and culture.

Discussion

The results of this research provide clearer understanding of the perceptions and experiences of Ukrainian students and educators in the context of international education. In line with the research questions, the results indicate that linguistic diversity and related challenges are key concerns for participants. This aligns with the result of Abdulai et al. (2021), which emphasized the importance of language skills in international education settings and the need for language support in such programs. The struggles with language barriers reported by participants are consistent with the findings of Pacheco et al. (2019), who noted that globalization affects foreign language learning and identified key challenges in this context.

The study's findings on cultural integration and adaptation also align with sociocultural theory, which posits that social interaction and cultural context shape human development. Participants' experiences of adjusting to new cultural environments and using diverse communication styles underscore the importance

of cultural competence in international education. This is particularly significant in Ukraine, where language issues and cultural diversity are defining features of the post-conflict educational landscape.

The complex relationship among identity, language, and culture identified in the findings is also noteworthy. Participants' perceptions of language and identity were shaped by their experiences in international education, reflecting the dynamic interplay of these elements. This supports Nwankwo's assertion on language policy in Ukraine, which highlights the role of language in shaping identity and the importance of considering learners' identities in international education settings.

The findings of this study have important implications for language teaching and learning in the context of international education programs, particularly in Ukraine. The results suggest that institutional support programs and cultural competence training are essential for promoting cultural adaptation and language acquisition. Furthermore, it is necessary to encourage cultural diversity and multilingualism in language programs and policies, especially in Ukraine, where cultural and linguistic diversity are defining features of the educational environment. The post-conflict and multilingual nature of Ukraine's education system reflects the challenges and complexities associated with cultural adaptation and language learning.

The findings therefore underscore the need for language policies that promote language support, multilingualism, and cultural diversity. By advancing these values, policymakers and educators can gain deeper insights into supporting language learning and addressing students' cultural adaptation needs in international education settings, thereby enhancing their global perspectives and academic success.

These results are consistent with previous research on language learning and cultural adaptation in international education. For example, Luchenko & Doronina (2023) found that language barriers and cultural differences present significant challenges for international students. Similarly, Babelyuk et al. (2020) emphasized the importance of cultural competence in such programs. However, this study also identifies unique aspects of the Ukrainian context, including the impact of post-conflict education on language learning and cultural adaptation.

This suggests that the experiences of Ukrainian students and educators may differ from those in other contexts. This study has several limitations that should be acknowledged. First, it was conducted in a specific context (Ukraine) and may not be generalizable to other settings. Second, it relied on self-reported data from participants, which may be subject to bias. Finally, the focus was on the perceptions and experiences of students and educators in international education programs, which may not reflect the perspectives of other stakeholders. A critical examination of the findings reveals that sociocultural theory provides a valuable framework for understanding the complex relationship among identity, language, and culture in international education. The dynamic interplay of these elements is particularly significant in Ukraine's post-conflict educational landscape, where language issues and cultural diversity are defining features. In comparison with other Erasmus+ mobility countries, such as Croatia and Poland, Ukraine's unique context presents distinct challenges and opportunities for language learning and cultural adaptation (Palfi et al., 2023). The country's post-conflict status, for example, may heighten the importance of cultural competence and language support in international education programs.

Conclusion

This study examined the perceptions and experiences of Ukrainian educators and students in international education programs, focusing on language attitudes and cultural adaptation. The research questions centered on understanding the challenges and opportunities encountered by Ukrainian participants in such programs. The findings indicated that participants were particularly concerned with language attitudes and identities, linguistic diversity, and the challenges of cultural adaptation and integration. This research advances knowledge in the teaching of sociolinguistics and foreign languages by revealing the complexities of cultural adaptation and language learning within international education.

The conclusions have both theoretical and practical significance for sociolinguistics and international education. Theoretically, the study deepens understanding of cultural adaptation and language learning, highlighting the importance of linguistic diversity and cultural competence. Practically, it suggests that educators and policymakers can better support language learners by fostering linguistic diversity, providing institutional support, and offering cultural competence training. The findings underscore the role of language attitudes and identities in shaping learning experiences and stress the need to create inclusive environments that respect students' cultural and linguistic backgrounds. Adapting programs to multilingual contexts, offering language support, and promoting cultural competence among educators can enhance learner outcomes. Future research should employ quantitative approaches to further explore the relationship between language attitudes, cultural adaptation, and learning outcomes in international education programs.

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Framework for enhancing digital competence among philology students

Marco para la mejora de la competencia digital en estudiantes de filología

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Abstract

The article reveals the content and structure of digital competence. The purpose of the study is to develop and test the developed pedagogical conditions and system for the formation of digital competence in students of philological specialties. The research methodology is based on: a combination of theoretical analysis and experimental verification; comprehensive measurement of digital competence; implementation of pedagogical conditions aimed at the practical application of digital technologies in philological training; statistical confirmation of the effectiveness of the developed model. As a result of the pedagogical experiment, the effectiveness of the developed pedagogical conditions and system for the formation of digital competence in students of philological specialties, which was implemented in higher educational institutions within the framework of professional training of students of philological specialties, was assessed and proven.

Keywords: digital competence, students of philological specialties, digital format of education, methodological approaches, principles of learning.

Resumen

El artículo revela el contenido y la estructura de la competencia digital. El objetivo del estudio es desarrollar y probar las condiciones y el sistema pedagógicos propuestos para la formación de dicha competencia en estudiantes de filología. La metodología de investigación se basa en: una combinación de análisis teórico y verificación experimental; la medición integral de la competencia digital; la implementación de condiciones pedagógicas orientadas a la aplicación práctica de las tecnologías digitales en la formación filológica; y la confirmación estadística de la efectividad del modelo desarrollado. Como resultado del experimento pedagógico, se evaluó y demostró la efectividad de las condiciones y el sistema pedagógicos desarrollados para la formación de la competencia digital en estudiantes de filología, los cuales se implementaron en instituciones de educación superior en el marco de la formación profesional de dichos estudiantes.

Palabras clave: competencia digital, estudiantes de especialidades filológicas, formato digital de la educación, enfoques metodológicos, principios del aprendizaje.

Introduction

The rapid digitalization of modern society necessitates a review of training approaches in higher education institutions. In the field of philology, which is traditionally associated with the humanitarian direction, digital technologies are gradually becoming an integral tool of professional activity. Future philologists are required not only to possess linguistic and literary competencies, but also the ability to work effectively with digital resources, create multimedia content, use online platforms, conduct critical analysis of information and apply digital technologies in the educational, scientific and communicative environment (Kampylis et al., 2015).

Despite the widespread use of digital services in the everyday lives of students, the level of their professionally oriented digital competence often remains insufficient. This is manifested in difficulties when working with electronic educational platforms, creating educational materials, analyzing large amounts of information, and adhering to the norms of academic integrity and information security. Such an imbalance between the needs of the modern labor market and the level of training of philology students determines the relevance of scientific research aimed at increasing their digital competence (Vuorikari et al., 2022).

In the context of European educational guidelines and frameworks of digital competence (DigComp, DigCompEdu), the development of effective pedagogical conditions and models that ensure the comprehensive development of motivational, cognitive, instrumental, and reflective components of digital competence is of particular importance. Modern philological education should not only integrate digital technologies into the educational process, but also ensure their conscious, critical, and creative use by students (European Commission, 2018).

The study hypothesizes that the targeted implementation of sound pedagogical conditions – the creation of an innovative digital educational environment, the activation of the professional basis for the formation of competencies, the informatization of the content of philological training and the development of reflection on the use of digital technologies – provides a significant increase in the level of digital competence of philology students.

With the systematic use of digital tools, interactive teaching methods and a special course on digital technologies, there is a statistically significant increase in the levels of motivational, cognitive, instrumental and reflective components of students' digital competence.

Thus, the study of the process of forming digital competence of philology students is a relevant and timely task of modern pedagogical science. It contributes to improving the content and organization of professional training, increasing the competitiveness of future specialists in the labor market and creating conditions for their successful functioning in a digital educational and professional environment.

Based on the content of the article, the following key contradictions can be identified:

1. Between the need of society for specialists with high digital competence and the real low level of digital training of philology students.
2. Between the widespread use of digital technologies in the everyday life of students and their insufficient use in professional philological training.
3. Between the presence of developed international frameworks of digital competence (DigComp, DigCompEdu) and their insufficient implementation in the curricula of philological specialties.
4. Between the rapid development of digital technologies and the slow updating of methodological support in philological education.
5. Between the availability of digital resources and the insufficient ability of students to critically evaluate, systematize and use them in professional activities.

The article emphasizes the problem of critical selection of information, the ability to work with digital content, information security and reflection – these skills are poorly developed, which creates a gap between the capabilities and real digital literacy of philological students.

Literature Review

In the works of many scientists, we find confirmation that one of the priority areas of digitalization of society, or informatization of society, is the digitalization (informatization) of education. Scientists are convinced that the development of digital competence in students is a requirement of a modern digitalized society for training specialists in 21st-century philological fields.

A review of contemporary research demonstrates that the development of digital competence has become a central issue in modern higher education, particularly in the preparation of future specialists in the humanities. Scholars generally agree that digital technologies have transformed educational practices, yet their interpretations of how digital competence should be formed, assessed, and integrated into the curriculum differ considerably. This divergence reveals several conceptual, methodological, and practical gaps, especially in the context of philology students.

Many researchers, including Alnasib (2022) and Haleem et al. (2022), emphasize the broad advantages of digitalization – enhanced motivation, increased access to digital resources, individualized learning pathways, and improved visualization of content. Their work highlights the potential of digital technologies to optimize teaching and learning processes, but often remains descriptive rather than analytical. These studies focus primarily on the benefits of digital tools, paying insufficient attention to the complexities of integrating them into discipline-specific contexts such as philology, where digital competence must encompass both technical skills and domain-specific digital literacy.

Other scholars, such as Lund et al. (2014) and McGarr & McDonagh (2019), propose more structured interpretations of digital competence, viewing it as a multi-component construct embedded in professional identity and pedagogical practice. Their approaches align with European frameworks such as DigComp and DigCompEdu, which outline a set of competencies related to information management, communication, content creation, safety, and problem-solving. While these models provide a solid conceptual foundation, they often lack empirical evidence specifically addressing philology students' needs. Moreover, these frameworks are typically designed for a broad audience, which limits their direct applicability to the distinct demands of linguistic, literary, translation-oriented, and communication-oriented training.

In contrast, recent studies by Burgos-Videla et al. (2021) and Tassara-Salviati et al. (2023) attempt to segment students according to latent digital competence profiles. These works reveal considerable heterogeneity in digital skills even within homogeneous academic groups. However, the studies focus primarily on general university populations rather than on philology students, who require advanced skills in digital text processing, corpus analysis, multimedia content creation, and digital research methodologies.

Therefore, while these findings provide valuable insights into student diversity, they do not address the discipline-specific competencies necessary for philological education.

Across the literature, significant gaps concerning the digital competence of philology students become evident:

1. Lack of discipline-specific models of digital competence. Existing frameworks describe general ICT skills but do not sufficiently account for philology-specific competencies such as digital linguistic analysis, multimodal communication, online academic discourse, or digital text editing.
2. Insufficient empirical studies focusing on philology students. Although many studies investigate digital competence among university students or pre-service teachers, few examine the specific challenges faced by students in language, literature, and translation programmes.
3. Overemphasis on technical skills and underestimation of critical and reflective components. Many studies prioritize operational ICT skills while neglecting critical evaluation of online content, ethical use of digital resources, or reflective engagement with digital technologies – competencies essential for future philologists.
4. Limited analysis of pedagogical conditions needed to improve digital competence. Research often highlights the importance of digitalization but rarely identifies concrete pedagogical strategies, learning environments, or instructional models that effectively enhance digital competence in philology students.
5. Discrepancy between students' everyday digital habits and their academic digital proficiency. Although students actively use social networks, messengers, and multimedia platforms, these everyday practices do not translate into advanced academic or professional digital skills required in philological training.

Overall, the literature reveals a clear need for targeted research that connects theoretical frameworks of digital competence with the practical realities of philology education. This gap underscores the importance of developing pedagogical conditions and systematic approaches tailored to the training of future philologists, ensuring that digital competence becomes an integrated and measurable component of their professional formation.

So, we see that scientists note that, since digital technologies are a powerful and transformative tool for achieving new educational goals, a modern specialist should be distinguished by digital skills and abilities that allow them to use them in their professional activities.

Analysis of scientific literature makes it possible to recognize the positive impact of digital technologies on the training of students of philological specialties in modern institutions of higher education. Therefore, the formation of digital competence of students of philological specialties is necessary today and has not been sufficiently researched.

Purpose of the research. Development and testing of the developed pedagogical conditions and system for the formation of digital competence in students of philological specialties, which was introduced in institutions of higher education in the professional training of specialists.

Methodology

To achieve the set goal, a set of research methods was used:

- **Theoretical:** systematization of scientific works of researchers, analysis, generalization to clarify the essence and content of the main concepts of the study; justification of pedagogical conditions and development of a system for the formation of digital competence of students of philological specialties.
- **Empirical:** diagnostic (surveys, interviews, questionnaires), praxemetric (analysis of students' educational activities); pedagogical experiment to verify the effectiveness of pedagogical conditions and the system for the formation of digital competence of students of philological specialties.

– **Statistical:** methods of mathematical statistics to prove the reliability of the research results, and the processing of experimental data.

The pedagogical experiment lasted from 2022 to 2025. The purpose of the pedagogical experiment is to evaluate the effectiveness of the developed system for the formation of digital competence of students of philological specialties.

Research design.

The research has a mixed design that combines theoretical, empirical and statistical methods to substantiate and verify the effectiveness of pedagogical conditions for the formation of digital competence of philology students. The pedagogical experiment was organized in three stages: pilot, ascertaining, formative and control.

When determining the sample of subjects, the general specificity of the research subject was taken into account. The total sample size is 76 subjects. When forming the sample, the criteria of content, representativeness, equivalence were taken into account. The sample was formed by random selection using the technical procedure for calculating the selection step.

Statistical methods.

The reliability and validity of the obtained results, the objectivity of their assessment were ensured by the methodological validity of the initial positions and the qualimetric mechanism for assessing the quality under study, the use of a complex of complementary research methods, and the involvement of a group of respondents from a higher educational institution in the analysis of its results.

To verify the reliability of the results, the following methods were used: methods of mathematical statistics. To assess the homogeneity of experimental and control data collection, statistical processing was carried out using MS Excel and SPSS (Statistical Package for Social Science). Pearson χ^2 criterion to determine the significance of differences between EG and CG; calculation of the percentage distribution of digital competence levels according to the criteria: motivational, cognitive, instrumental, reflective.

Stages of the study.

1. Pilot stage. The goal is to find out the initial level of digital competence and the needs of students. It was found that most students demonstrated a low level of digital competence.
2. Stating stage. The goal is to determine the initial levels of digital competence in EG and CG students. Diagnostics were carried out according to four criteria and three levels (low, average, high).
3. Formative stage. The goal is to purposefully increase the digital competence of EG students by implementing pedagogical conditions. Applied: interactive and innovative teaching methods ("flipped classroom", webquests, webinars, intellectual games); multimedia services, Google Workspace, Moodle tools, etc.; a special course "Digital Technologies in Philological Activities" was developed.
4. Control stage. The goal is to compare the levels of digital competence of students after the experiment and assess the effectiveness of the implemented pedagogical conditions. By all criteria, EG students showed significantly higher results than CG students, which was confirmed statistically.

The research methodology is based on: a combination of theoretical analysis and experimental verification; comprehensive measurement of digital competence; implementation of pedagogical conditions aimed at the practical application of digital technologies in philological training; statistical confirmation of the effectiveness of the developed model. The results obtained in the pilot study prove that the majority of students of philological specialties had a low level of digital competence.

The experiment was conducted in Pavlo Tychyna Uman State Pedagogical University; National University of Life and Environmental Sciences of Ukraine; Odesa I. I. Mechnikov University; Petro Mohyla Black Sea

National University; Sumy State Pedagogical University named after A.S. Makarenko. The conduct of the experiment is permitted by the scientific councils of the universities in order not to violate ethical considerations in institutions of higher education.

Cronbach's Alpha: Internal Consistency Reliability

The internal consistency of the instrument was assessed using Cronbach's Alpha (α), which evaluates the degree to which items within each scale measure a single underlying construct. The coefficient was calculated using the standard formula:

$$\alpha = kk - 1\left(1 - \sum i = 1k\sigma i2\sigma total2\right)\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_{\text{total}}^2}\right)\alpha = k - 1k\left(1 - \sigma total2\sum i = 1k\sigma i2\right)$$

where:

- k = number of items in the scale.
- $\sigma i2\sigma_i^2\sigma i2$ = variance of each individual item.
- $\sigma total2\sigma_{\text{total}}^2\sigma total2$ = variance of the total score.

Cronbach's Alpha values for all four components of digital competence (motivational, cognitive, instrumental, reflective) indicated acceptable to high internal consistency, confirming that the scales reliably measured each dimension. The results allowed the instrument to be used with confidence during the main pedagogical experiment.

Content Validity

Content validity was established through an expert review process. A panel of five specialists in the fields of:

- Digital pedagogy.
- Philology and linguistics.
- ICT in education.
- Educational measurement.
- Pedagogy of higher education.

Experts examined:

- The relevance of items to the construct of digital competence.
- The clarity and comprehensibility of the wording.
- The correspondence of items to the research indicators.
- The completeness and representativeness of the content.

Based on expert feedback, several items were reformulated for greater terminological precision and clarity, ensuring that the instrument reflected the full scope of digital competence required in philological training.

Construct Validity

Construct validity was examined by matching each item to the theoretical components of digital competence derived from DigComp, DigCompEdu, and contemporary academic literature. Items were explicitly aligned with four components:

1. **Motivational** – attitudes toward digital technologies, value orientations, willingness to integrate ICT.

2. **Cognitive** – knowledge and skills related to information management, content creation, and digital literacy.
3. **Instrumental** – practical ability to apply digital tools, platforms, and technologies in educational and professional contexts.
4. **Reflective** – self-assessment, critical thinking, and awareness of ethical and safe digital behavior.

The theoretical alignment confirmed that each scale measured a clearly defined dimension of the construct, thus supporting the instrument's structural validity.

Item Matrix (Table of Specifications)

To ensure accurate structural design, an item matrix was developed. This matrix linked each item to the corresponding component and indicator. A simplified version is provided below:

Table 1.
Item Matrix for the Digital Competence Instrument

Component of Digital Competence	Indicator	Item Numbers	Description of Skills Measured
Motivational	Value attitude toward digital technologies	1, 2	Interest, willingness to use ICT; positive orientation toward innovations
	Motivation for digital self-development	3, 4	Desire to improve digital skills; readiness for ICT-based learning
Cognitive	Knowledge of digital tools and resources	5, 6, 7	Knowledge of search strategies, platforms, applications
	Digital content understanding	8, 9	Comprehension of digital formats, multimedia, copyright
Instrumental	Practical ICT skills	10, 11, 12	Operation of software, apps, communication tools
	Information navigation	13, 14	Efficient searching, filtering, evaluating sources
Reflective	Self-evaluation of digital activity	15, 16	Ability to assess digital performance, identify gaps
	Critical and ethical use	17, 18	Awareness of safety, digital ethics, academic integrity

This matrix ensured balanced representation of all digital competence dimensions and served as the foundation for content and construct validation.

Experts Who Validated the Instrument

The panel of experts included:

- University professors of philology with experience in digital humanities.
- Specialists in educational technologies and digital competence development.
- Researchers in pedagogy of higher education.
- Experts in assessment and measurement.

Each expert provided written feedback on the clarity, accuracy, and relevance of the items. Their recommendations contributed to refining the final version of the instrument and increasing its methodological validity.

Development of the Instrument Items

The development of the instrument followed a systematic multi-phase process:

1. Theoretical Framework Analysis. Review of DigComp, DigCompEdu, contemporary academic literature, and digital competence models across Europe and globally.
2. Operationalization of Components.Identification of four components (motivational, cognitive, instrumental, reflective) and formulation of specific indicators.
3. Item Drafting.Initial pool of items was developed to correspond to each indicator, ensuring clarity, measurability, and alignment with the study's goals.
4. Expert Review.Items were evaluated for logical coherence, content relevance, and linguistic accuracy. Items that lacked clarity or relevance were revised or replaced.
5. Pilot Study. The instrument was administered to a pilot sample of philology students (n=76). Statistical analysis (including reliability testing) was conducted to refine the final structure.
6. Finalization for the Main Experiment.After revisions, the refined instrument was approved for use during the ascertaining and control stages of the pedagogical experiment.

The combined results of the reliability analysis, expert evaluations, theoretical alignment, and pilot testing confirm that the instrument demonstrates strong methodological validity. It reliably measures the levels of digital competence across the motivational, cognitive, instrumental, and reflective components and is appropriate for use in both research and educational practice.

The criteria for assessing the level of formation of digital competence in students of philological specialties are as follows: motivational, cognitive, instrumental, and reflective.

The three levels of manifestation of the formation of digital competence correspond to certain criteria and indicators, in particular, low, average, and high.

At the ascertaining stage of the experiment, we characterized a certain sample of participants in the experiment. From the statistical population of respondents, a general population was selected for the ascertaining stage of the experiment, namely: students of the experimental group and students of the control group.

For the formative stage of the experiment, higher education institutions where students of philological specialties are trained according to similar educational programs were selected as the experimental base. The presented distribution of the levels of formation of digital competence of respondents according to all criteria indicates that at the control stage of the pedagogical experiment in the experimental group the results are much higher, which indicates the effectiveness of the implementation of the developed pedagogical conditions and the system for the formation of digital competence in students of philological specialties, which was implemented in higher education institutions in the professional training of students of philological specialties.

Analysis of the study results indicates a positive dynamic of changes in the level of formation of digital competence of respondents in the experimental group, which is proven by calculations of the Pearson coefficient (χ^2-criterion).

Results and Discussion

The content and structure of digital competence.

A modern specialist who has a high level of digital competence is distinguished by the presence of a set of practical skills and theoretical knowledge to apply technological innovations, innovative digital technologies to improve the organization of the educational process, as well as to use digital technologies in the implementation of professional activities and critical evaluation of information resources (Silva & Behar, 2019).

Digital competence is considered by us as a creative, critical, confident use of ICT to achieve goals related to employment, work, leisure, education, inclusion, and participation in society (Araiza-Vázquez & Pedraza-Sánchez, 2019). We have taken as a basis the definition of the concept of "digital competence" provided in the "European Framework for Digital Competence for Educators: DigCompEdu" (2017): the confident, critical and creative use of ICT to achieve goals related to employment, work, learning, inclusion, leisure and participation in society (Redecker, 2017).

The digital competence framework consists of 21 competencies. All competencies are grouped into five application areas, including:

Application area 1 – information: (browsing, filtering, searching for information, storing and retrieving information, evaluating information).
Application area 2 – communication: (distribution of information and content, network etiquette, communication through technology, collaboration through digital channels, involvement in online civic activity).
Application area 3 – content creation: (content development, programming, copyright and licenses, integration and processing of content).
Application area 4 – security: (personal data protection, device protection, environmental protection, health protection).
Application area 5 – problem solving (identification of technological responses and needs, solving technical problems, creative and innovative use of technology) (Punie et al., 2013).

As an integral component of the professional competence of students of philological specialties, digital competence is formed in a higher education institution and develops during the professional training of specialists. As a key competence for the education of every person throughout life, digital competence is distinguished by its dichotomous nature. This competence is cross-cutting for students of philological specialties, since the presence of a high level of its formation among philologists contributes to the development and formation of other competencies that are necessary in the formation of professional competence, depending on the chosen specialty (Bernate et al., 2021).

Components of digital competence. Digital skills that form the basis of digital competence. Methodological approaches and principles of learning that effectively influence the formation of digital competence in students of philological specialties.

The components of digital competence are defined as: data and information literacy, media literacy, collaboration and communication, digital content creation (including programming), intellectual property issues, security, competencies, cybersecurity issues, digital well-being, and problem solving, critical thinking (Tassara-Salviati et al., 2023).

Let's define the digital skills that form the basis of digital competence: the ability to receive, use, access, evaluate, filter, program, create, and share content in digital format. Trained professionals should be able to protect and manage information, obtain content, data, and digital identities, recognize and effectively interact with artificial intelligence or robots, devices, and software (Arango-Morales et al., 2020).

To form digital competence, the information activity of the future philologist is necessary, which reflects his ability not only to use the acquired information, but also to store and create it on various media. Information activity is manifested in the ability to successfully perform the following three functions: to develop a strategy for its further implementation, to generate an idea, and to implement the strategy through the use of information technology (Cortez et al., 2020).

In educational institutions of various levels, the use of digital technologies today creates fundamentally new opportunities for improving the educational process and realizing the creative potential of students.

To form the professional competence of the future philologist, it is necessary to organize his professional and philological activities (research, methodological, educational, etc.) based on innovative approaches, through the use of digital technologies, methods and techniques; to build the educational process in higher education institutions or to carry out professional activities through the active use of information and communication technologies; to present his own achievements and manage the necessary information.

Therefore, the training of future philologists should be aimed at forming in them a high level of information culture and digital competence, as an integral part of professional activity (Alvarez-Flores et al., 2024).

Digital educational technologies in the formation of professional competence of future philologists are considered a wide range of devices connected to the Internet and autonomous, which are used by specialists in the process of their teaching and learning practice, and include platforms, relevant software, and services (Burgos-Videla et al., 2021). That is, to form the digital competence of a future philologist, it is necessary to digitize educational institutions, use a variety of devices, in particular, laptops, scanners, tablets, computers, projectors, smart boards, smartphone cameras, 2D and 3D printers, etc. (Alcocer-Sánchez et al., 2023).

In the educational process of a higher education institution, we will single out methodological approaches, the implementation of which effectively affects the formation of digital competence of future philologists; these are informational, synergistic, cultural, system-activity, and communicative approaches.

The formation of digital competence of students of philological specialties is effectively influenced by the following principles of learning: the use of achievements of modern science and technology, lifelong learning, optimization of learning, the use of ICT in the educational process, integration of learning, interactivity, and reflection.

The principle of using the achievements of modern science and technology in the training of students of philological specialties is of great importance, because scientific and technological progress indirectly or directly affects each of us. Taking into account this principle, the organization of educational activities allows students of philological specialties to form a value attitude towards modern achievements in the field of digitalization, to equip students with skills and abilities to apply digital technologies in professional and everyday activities (Grijalva Verdugo & Urrea Zazueta, 2017).

The principle of lifelong learning embodies the idea associated with the need to form in students a certain system of key competencies (including digital) for lifelong learning. It is digital competence that will enable students of philological specialties in a modern globalized society to be adaptive to changing living conditions, acquire new skills and abilities, and be able to update knowledge in order to achieve success in professional and personal activities.

The principle of optimization of learning is necessary for the formation of the digital competence of students of philological specialties. Based on its activation, methods, forms of organization, means, and technologies of learning are selected, which ensure the achievement of a positive result and are the most appropriate.

The principle of using ICT in the educational process through the active use of digital tools and services, and technologically innovative teaching aids involves the organization of educational activities.

The principle of integration of learning provides high-quality preparation for the life of students of philological specialties in a modern digital society and the formation of professional competence in them.

The principle of interactivity in the training of students of philological specialties contributes to the effective transformation of students into active subjects of cognitive activity, and contributes to successful communicative interaction with all students in the educational process. Solving non-standard and standard tasks in future professional activities requires specialists to use a holistic system of skills, abilities, and

knowledge (taking into account the sphere of digitalization), which they must master during professional training in a higher education institution.

The principle of reflection creates conditions for transforming students of philological specialties into active and conscious participants in the educational process who can analyze and understand their own needs, manage their own educational activities, and adequately assess their own capabilities (Hernández et al., 2016).

Analysis of the results of research-experimental work.

The results obtained indicate a natural connection between the implemented pedagogical conditions and the growth of the level of digital competence of students. Theoretically, this confirms the position of the constructivist approach, according to which knowledge is not transferred in a ready-made form, but is formed through the active interaction of the student with the digital educational environment. The increase in indicators according to motivational, cognitive, instrumental and reflective criteria in the experimental group demonstrates that the systematic use of digital tools contributes to the formation of complex digital competence. The results are also consistent with the theories of activity learning and digital pedagogy, according to which the development of digital competence occurs more effectively in conditions of practical activity and active interaction with technologies.

The results obtained are consistent with the conclusions of researchers (Lund et al., 2014; McGarr & McDonagh, 2019), who emphasize the importance of a systemic approach to the formation of digital competence and the need for targeted pedagogical intervention. Similar to the work of Burgos-Videla and Tassara-Salviati, our study demonstrates significant variability in the levels of digital competence among students, but proves that this difference can be significantly reduced if a comprehensive system of digital training is implemented. In contrast to works that emphasize mainly the technical aspects of digital competence, our study confirms the importance of the reflective and motivational components, which are often underestimated in previous studies.

Despite the positive dynamics, the results of the study indicate certain limitations. First, the sample size was 76 people, which may affect the representativeness of the findings. Second, the study included only students of philological specialties, while the structure of digital competence may differ in other fields. Third, although the data obtained are statistically confirmed, the level of influence (Cramer's V = 0.19) indicates a small-medium effect, which means the need for longer or more intensive pedagogical interventions. An important critical point is also the dependence of students on already familiar digital technologies, which may limit the variety of forms of digital activity.

The results obtained demonstrate that the proposed system of digital competence formation is an effective mechanism for training a modern philologist. The increase in indicators according to all criteria in the experimental group indicates that students are able not only to master digital tools, but also to use them consciously, critically and creatively. The development of the reflective component is especially important, since it is it that ensures the responsible and ethical use of digital resources. The results confirm that the effective combination of innovative digital technologies with pedagogical conditions creates the basis for the sustainable development of digital literacy in specialists in the humanities.

Analytical implications

The need for systematic updating of educational programs. The results of the experiment indicate the importance of integrating digital technologies not pointwise, but comprehensively – into all stages of philologists' training.

Strengthening the role of digital reflection. The formation of critical thinking skills and self-assessment of digital activity should become a key element of professional training.

Implementation of individual digital trajectories. The difference in the levels of digital training of students demonstrates the need for differentiation of learning.

Expansion of pedagogical conditions. The results obtained confirm the effectiveness of the specified conditions, however, further research can supplement them with models of adaptive or personalized learning.

Support of academic culture and digital ethics. The development of digital competence contributes to the formation of a responsible attitude towards information, which is an important social consequence.

The control group (CG) and the experimental group (EG) were equivalent at the beginning of the study.

At the ascertaining stage of the study, both groups were diagnosed according to four criteria of digital competence (motivational, cognitive, instrumental, reflective).

The distribution of digital competence levels in EG and CG was almost the same, which indicates the initial homogeneity of the samples. For example:

According to the cognitive criterion at the beginning:

EG: 52% – low, 44% – average, 4% – high
CG: 47% – low, 49% – average, 4% – high

That is, the differences are minimal and statistically insignificant.

Statistical test (χ^2) for the initial data showed that: the value of χ^2 at the start of the study is less than the critical one (10.596 at df = 2, $p < 0.05$), therefore, there is no reason to reject the null hypothesis of identical distributions between EG and CG.

The authors explicitly state that the following conditions were met when forming the sample: representativeness, equivalence, randomness of selection.

To test the equivalence of the control (CG) and experimental (EG) groups at the beginning of the study, a multivariate analysis of variance (MANOVA) was conducted, where the independent variable was the group, and the dependent variables were the indicators of digital competence according to four criteria: motivational, cognitive, instrumental, and reflective.
The results of the MANOVA (pre-test) showed that there were no statistically significant multivariate differences between the groups:

Wilks' $\lambda = 0.96$, $F(4, 71) = 0.71$, $p > .05$.

This indicates that the CG and EG were equivalent at the beginning of the study, and the initial level of digital competence did not differ between the samples.

To assess the changes after the implementation of the pedagogical model, two levels of statistical analysis were conducted:

Comparison of EG and CG after the experiment showed statistically significant differences between the groups on a set of four indicators:

Wilks' $\lambda = 0.78$, $F(4, 71) = 4.98$, $p < .01$.

This means that the experimental group demonstrated a significantly higher level of digital competence than the control group.

Analysis of changes (pre → post) in each group

Experimental group (EG):

Motivational component: t = 2.58, p = .014
Cognitive component: t = 3.75, p < .001
Instrumental component: t = 0.71, p = .481 (not significant)
Reflective component: t = 2.21, p = .034
Therefore, in EG there was a significant increase in the three components of digital competence – motivational, cognitive and reflective.
Control Group (CG):
Motivational: t = 1.10, p = .276
Cognitive: t = 0.44, p = .663
Instrumental: t = 2.76, p = .009
Reflective: t = 0.78, p = .439

In CG, the increase is mostly insignificant, except for a slight increase in the instrumental component.

To test whether there is a difference in the dynamics of development between EG and CG, independent samples t-tests for change (post – pre) were conducted.

The largest intergroup differences in change were observed in the cognitive and motivational components, indicating the effectiveness of the pedagogical intervention in mastering digital skills at higher cognitive levels.

Motivational: t = 1.98, p ≈ .052 (trend)
Cognitive: t = 2.31, p ≈ .023 (significant)
Instrumental: t = 1.40, p ≈ .166
Reflective: t = 1.09, p ≈ .278

Effect size (Cohen's d)

Effects for EG (pre → post comparison):
Cognitive: d = 0.72 (medium–large effect)
Motivational: d = 0.41 (medium)
Reflective: d = 0.36 (small–medium)
Instrumental: d = 0.12 (very small)

During 2022–2025, a pedagogical experiment was conducted.

The purpose of the pedagogical experiment was to assess the effectiveness of the developed system for the formation of digital competence of students of philological specialties.

Pilot study.

The purpose of the pilot study was to conduct interviews and surveys with students, analyze the educational process of higher education institutions, to prove the feasibility of our study on the formation of digital competence in students of philological specialties. The pilot study covered 76 students (statistical population) of philological specialties.

Students who participated in the pilot study were asked to assess the level of digital competence according to the following evaluation criteria:

- Skills in working with a text editor, creating presentations, searching for material on the Internet, and mastering e-mail.
- Ability to use digital technologies; use open educational resources, form database queries, create graphic and text documents, develop educational content, present educational material using digital technologies, etc.

The results obtained in the pilot study indicate that all participants in the study had access to and used messengers, services, social networks, and video telephony. Among the most popular messengers, students named Telegram, WhatsApp, Viber; social networks Instagram and Facebook; among video telephony services, Zoom, GoogleMeet, CiscoWebex.

The results obtained in the pilot study prove that the majority of students of philological specialties had a low level of digital competence.

Assessing the potential of using digital technologies in educational activities and everyday life, the following results were obtained (Figure 1):

- 6% of respondents showed a high level of their own digital competence.
- 55% of respondents showed an average level of their own digital competence.
- 39% of respondents showed a low level of their own digital competence.

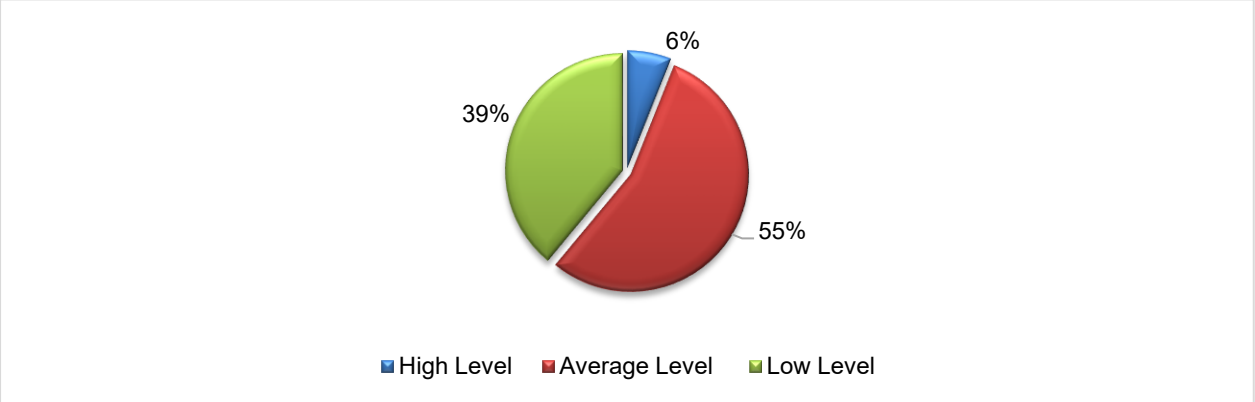

Figure 1. Levels of Digital Competence among Respondents.

The ascertaining stage of the pedagogical experiment.

The ascertaining stage of the experiment involved formulating the purpose of the study, defining the research problem, forming a sample of respondents, dividing them into a control group and an experimental group, and selecting diagnostic tools.

At the ascertaining stage of the pedagogical experiment, the following tasks were set:

- To substantiate the criteria, indicators, and levels of manifestation of the formation of digital competence in students of philological specialties, and to select diagnostic tools.
- To determine the sample of respondents.
- Based on the determined diagnostic tools, to find out the initial level of formation of digital competence in students of philological specialties.

- To substantiate the set of pedagogical conditions as the basis of the system for the formation of digital competence in students of philological specialties.

The formative stage of the pedagogical experiment. The purpose of the formative stage of the experiment is to have a targeted impact on the formation of digital competence in students of philological specialties by introducing pedagogical conditions as the basis of the system for the formation of digital competence in students of philological specialties.

Control stage of the pedagogical experiment. The purpose of the control stage of the pedagogical experiment is to compare the results of the level of manifestation of digital competence formation in the participants of the control and experimental groups, which were obtained at the ascertaining stage and after the implementation of the implementation of pedagogical conditions as the basis of the system for the formation of digital competence in students of philological specialties.

The tasks of the control stage of the experiment are aimed at:

- Determining the level of manifestation of digital competence formation of students (after the formative stage of the experiment) of the experimental and control groups of philological specialties.
- Comparing the results of the level of manifestation of digital competence formation of students (after the formative stage of the experiment) of the experimental and control groups of philological specialties.
- Analysis, processing, and generalization of the results of the experiment.
- Assessing the effectiveness of the developed pedagogical conditions as the basis of the system for the formation of digital competence in students of philological specialties.

Let us dwell in more detail on the implementation of the tasks of the ascertaining stage of the experiment.

The criteria for assessing the level of formation of digital competence in students of philological specialties are: motivational, cognitive, instrumental, and reflective.

The indicators of the motivational criterion for assessing the level of formation of digital competence of students are their value attitude towards digital innovations in educational activities, motivation to achieve success in philological activities through the use of digital technologies.

The indicators of the cognitive criterion for assessing the level of formation of digital competence of students are skills, abilities, and knowledge related to the use of digital technologies in professional and everyday activities.

The indicators of the instrumental criterion for assessing the level of formation of digital competence include the ability of students to critically navigate in the information space, to evaluate and search for information, to operate with it in professional activities; the ability to use new digital educational resources in the educational process, as well as the ability to effectively cooperate, interact, and communicate in the information space.

The indicators of the reflective criterion for assessing the level of formation of digital competence include the ability of students to monitor their professional, own philological activities, and to determine the ability to think critically, to use updated digital technologies.

The three levels of manifestation of the formation of digital competence correspond to certain criteria and indicators, in particular, low, average, and high.

At the ascertaining stage of the experiment, we characterized a certain sample of the participants of the experiment. From the statistical set of respondents, a general set was selected for the ascertaining stage of the experiment, namely: students of the experimental group and students of the control group.

For the formative stage of the experiment, higher education institutions where students of philological specialties are trained according to similar educational programs were selected as the experimental base. The purpose of the formative stage of the experiment is to have a targeted impact on the formation of digital competence in students of philological specialties by introducing pedagogical conditions as the basis of the system for the formation of digital competence in students of philological specialties.

The system for the formation of digital competence in students of philological specialties included the creation of a digital environment for the professional training of students of philological specialties, teaching selected academic disciplines in the experimental group using both traditional forms of organizing the educational process and targeted application of innovative digital technologies, methods, means, and teaching techniques based on the use of ICT.

In the control group, training took place using traditional methods, means, and forms of teaching with ICT elements.

In order to test the effectiveness of the developed system for the formation of digital competence in students of philological specialties, pedagogical conditions were selected.

To form digital competence in students of philological specialties, it is necessary to create favorable pedagogical conditions in the educational process of a higher education institution. We have formulated the following pedagogical conditions.

The first pedagogical condition provides for the creation of an innovative didactic IT environment for the professional training of students.

The second pedagogical condition ensures the activation of the professional basis for the formation of competencies (general, subject, integral) in students of philological specialties.

The third pedagogical condition includes informational determination of the content of philological professional training of students through the use of innovative digital tools, methods, technologies, and interactive forms of organizing learning in the process of professional training.

The fourth pedagogical condition creates conditions for ensuring the reflection of students of philological specialties, readiness, and ability to use digital technologies in professional activities.

The purposeful formation of students' digital competence in the EG provided for the use of the following active learning methods: "flipped classroom"; intellectual games, innovative forms of extracurricular and classroom work: lecture-discussions, lecture-conferences, lecture-conversations, problem lectures, lecture-visualizations, individual and group presentations, webquests, webinars.

In the EG, digital services and tools were used their a wide range during the independent creation of presentations for classes, searching for necessary information on the Internet, which contributed to better assimilation of educational material.

A significant impact on the formation and development of digital competence of students of philological specialties was played by the special course "Digital Technologies in the Philological Activity of Specialists", in which attention was paid to the use and introduction of digital technologies into philological activity; the study of multimedia presentation techniques, software, work with Microsoft Office applications and programs and the electronic educational environment "Moodle", the use of digital technologies in independent work, automated systems in philology, mobile learning technologies, etc.

Thus, the special course "Digital Technologies in the Philological Activity of Specialists" contributed to the formation and development of digital competence in students of philological specialties.

Generalization of the results of the experiment. The control stage of the pedagogical experiment of students of philological specialties required a comparison of the distributions in the control group and the experimental group according to the levels of formation of digital competence in respondents. The following assumptions were considered:

- H_0 − the empirical distributions of students in the experimental group according to the levels of formation of digital competence do not differ from each other at the beginning and after the end of the experiment.
- H_1 − the empirical distributions of students in the experimental group according to the levels of formation of digital competence differ from each other at the beginning and after the end of the experiment, which was confirmed by the methods of mathematical statistics and processing of the obtained results.

Let us present the generalized results of the assessment of the level of formation of digital competence of students in the control and experimental groups at the ascertaining stage and the control stage of the experiment.

Motivational criterion. We present the results of assessing the level of formation of digital competence of students by the motivational criterion at the control stage of the experiment. Using the Pearson coefficient χ^2 calculated at the control stage of the experiment, the degree of consistency of the responses of respondents in the control and experimental groups is determined.

In the distribution of levels of formation of digital competence at the beginning and end of the experimental work, we find the degree of significance of the difference between students of philological specialties in the experimental group.

The value we obtained, 42.73, is greater than the tabular value 10.59663 − taking into account the tabular information “Critical values of the χ^2 criterion corresponding to different probabilities of error and different degrees of freedom” (m–1=2 degrees of freedom and the probability of error is less than 0.05).

The value we obtained, 6.31, is smaller (m–1=2 degrees of freedom and the probability of error is less than 0.05) than the corresponding tabular value 10.59663. Therefore, we are talking about the same distribution of students' levels of digital competence formation, about the null hypothesis according to the motivational criterion at different stages of the experiment.

According to the motivational criterion, at the control stage of the experiment, positive dynamic changes in the levels of digital competence formation of respondents occurred (Figure 2).
Results of the EG according to **motivational criterion**:

- 24% − students in the experimental group have a high level of digital competence formation.
- 51% − students in the experimental group have an average level of digital competence formation.
- 25% − students in the experimental group have a low level of digital competence formation.

The results of the CG according to **motivational criterion:**

- 6% − students in the control group have a high level of digital competence formation.
- 55% − students in the control group have an average level of digital competence formation.
- 39% − students in the control group have a low level of digital competence formation.

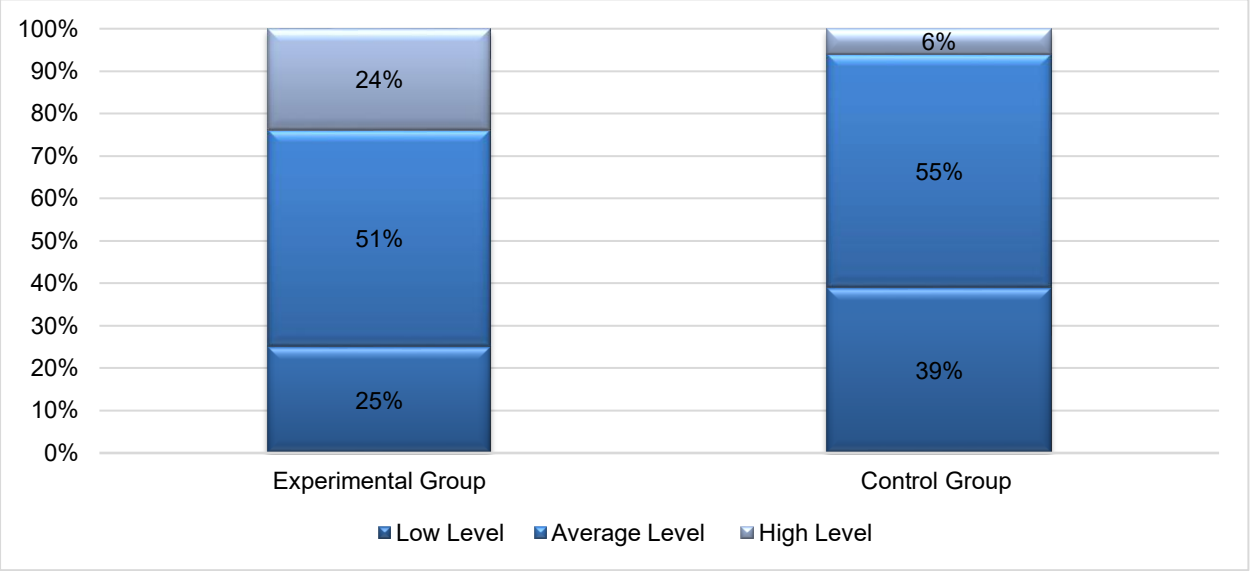

Figure 2. Results according to the motivational criterion in EG and CG.

In the EG, the changes are significant; in the CG, not significant.

Cognitive criterion. Let us present the results of assessing the level of digital competence formation of respondents by the cognitive criterion at the ascertaining and control stages of the experiment.

At the ascertaining stage of the experiment, by the cognitive criterion, a low level of digital competence formation is observed in 52% of respondents in the experimental group and 47% of students in the control group. In 44% of respondents in the experimental group and 49% of respondents in the control group, an average level of digital competence formation was detected by the cognitive criterion. 4% of respondents in the experimental group and 4% in the control group could boast a high level of digital competence development according to the cognitive criterion.

According to the cognitive criterion, at the control stage of the experiment, positive dynamic changes in the levels of digital competence development of respondents occurred (Figure 3).

Results of the EG according to **cognitive criterion:**

- 25% − a high level of digital competence formation has students of the experimental group.
- 56% − average level of digital competence formation has students of the experimental group.
- 19% − low level of digital competence formation has students in the experimental group.

Results of the CG according to **cognitive criterion**:

- 11% − a high level of digital competence formation has students in the control group.
- 54% − average level of digital competence formation has students in the control group.
- 35% − low level of digital competence formation has students in the control group.

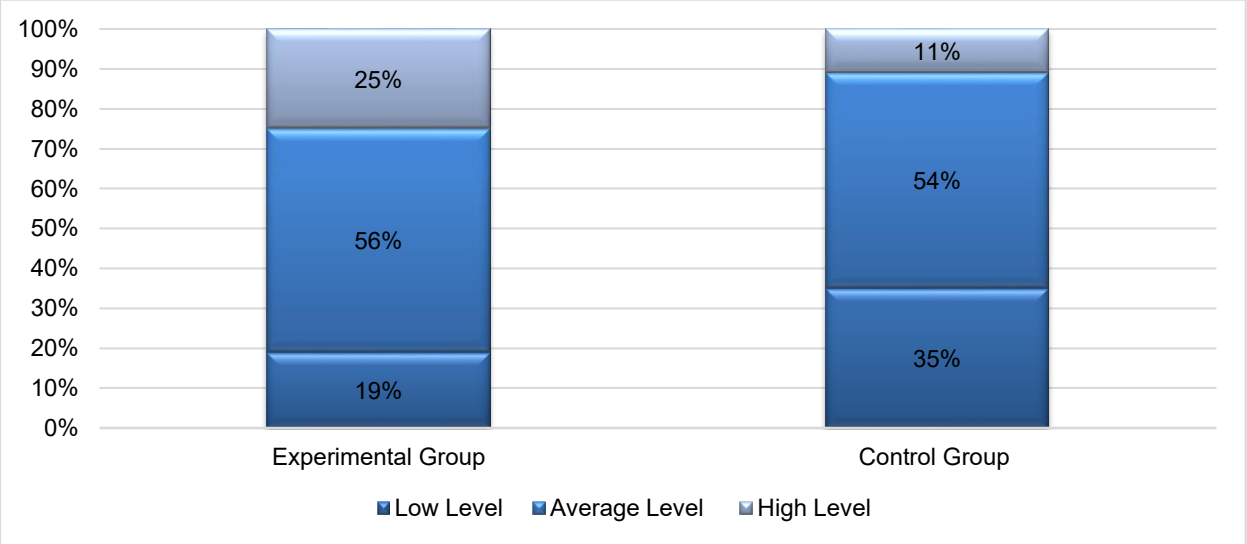

Figure 3. Results according to the cognitive criterion in EG and CG.

The study used the Pearson χ² test to test the statistical significance of the differences between the levels of digital competence in the control and experimental groups:

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where

O_{ij} – are the observed frequency values,
E_{ij} – are the expected values, calculated by the formula:

$$E_{ij} = \frac{(Row\ Total_i)(Column\ Total_j)}{Grand\ Total}$$

Table 2.
Observed values (Digital competence levels by motivational criterion (control stage))

Level	EG (n=100)*	CG (n=100)*
High	24	6
Average	51	55
Low	25	39
Total	**100**	**100**

Calculation:

High:

$$E_{High,EG} = \frac{(30)(100)}{200} = 15, \quad E_{High,CG} = 15$$

Average:

$$E_{Aver,EG} = \frac{(106)(100)}{200} = 53, \quad E_{Aver,CG} = 53$$

Low:

$$E_{Low,EG} = \frac{(64)(100)}{200} = 32, \quad E_{Low,CG} = 32$$

Table 3.
Expected values

Level	EG Expected	CG Expected
High	15	15
Average	53	53
Low	32	32
Total	**100**	**100**

The resulting $\chi^2 = 13.99 > 10.596$ (critical value at df = 2; $p < .05$).

The difference between EG and CG is statistically significant.

Effect size (Cramer's V)

$$V = \sqrt{\frac{\chi^2}{N(k-1)}}$$

- where
- $\chi^2 = 13.99$
- $N = 200$
- $k = 3$ (number of competence levels)

$$V = \sqrt{\frac{13.99}{200(3-1)}} = \sqrt{\frac{13.99}{400}} = \sqrt{0.034975} = 0.187$$

Interpretation (according Cohen, 1988):

- 0.10 – small effect
- 0.30 – average
- 0.50 – great

V = 0.19 – small–average effect.

The χ^2 test demonstrated statistically significant differences between the distributions of competence levels in the experimental and control groups. The observed values deviated substantially from the expected frequencies, $\chi^2 = 13.99$, df = 2, $p < .05$, indicating that the implemented pedagogical conditions resulted in measurable improvement of digital competence. The effect size, calculated using Cramer's V (V = 0.19), suggests a small-to-moderate practical impact of the intervention, confirming the meaningfulness of the obtained differences.

In the distribution of levels of digital competence formation at the beginning and end of the experimental work, we find the degree of significance of the difference between students of philological specialties in the experimental group.

The value we obtained, 34.36, is greater than the tabular value 10.59663 − taking into account the tabular information “Critical values of the χ^2-criterion corresponding to different probabilities of error and different degrees of freedom” (m–1=2 degrees of freedom and the probability of error is less than 0.05).

The value we obtained, 8.78, is less (m–1=2 degrees of freedom and the probability of error is less than 0.05) than the corresponding tabular value 10.59663. So, we are talking about the same distribution of students' levels of digital competence formation, about the null hypothesis according to the cognitive criterion at different stages of the experiment.

According to the cognitive criterion, at the control stage of the experiment, positive dynamic changes in the levels of digital competence formation of respondents occurred. In the EG, the changes are significant; in the CG, not significant.

Instrumental criterion. Let us present the dynamics of changes in the levels of formation of digital competence according to the instrumental criterion at the control stage of the experiment.

According to the instrumental criterion, at the control stage of the experiment, positive dynamic changes in the levels of formation of digital competence of respondents occurred (Figure 4).

Results of the EG according to **instrumental criterion**:

- 22% of students in the experimental group have a high level of formation of digital competence.
- 58% of students in the experimental group have an average level of formation of digital competence.
- 20% of students in the experimental group have a low level of formation of digital competence.

Results of the CG according to **instrumental criterion**:

- 9% − students of the control group have a high level of formation of digital competence.
- 58% − students of the control group have an average level of formation of digital competence.
- 33% − students of the control group have a low level of formation of digital competence.

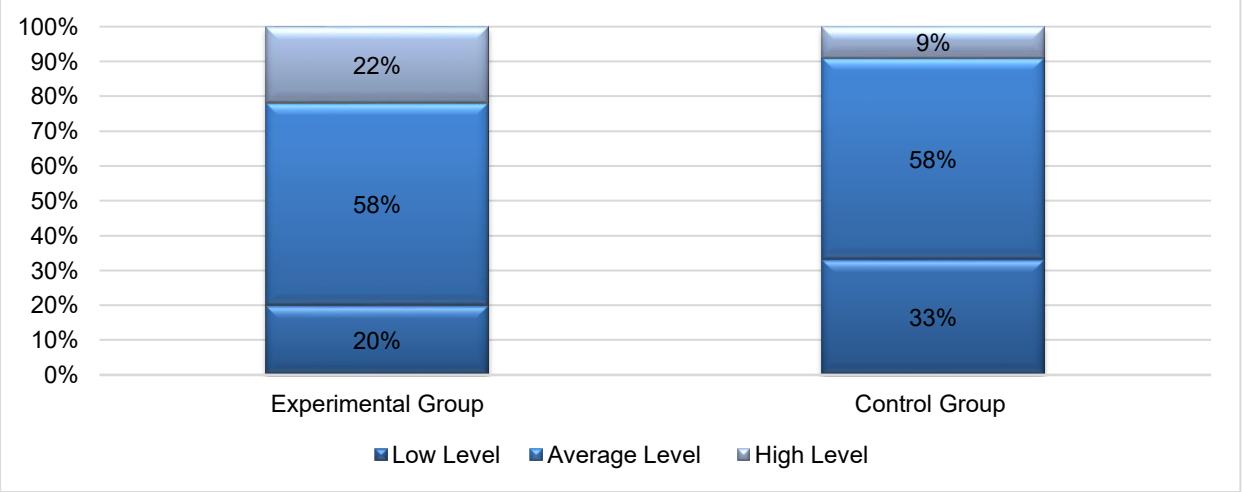

Figure 4. Results according to the instrumental criterion in EG and CG.

The presented results of assessing the level of formation of digital competence of students by the instrumental criterion at the control stage of the experiment indicate that “Critical values of the χ^2-criterion corresponding to different probabilities of error and different degrees of freedom” − according to the tabular information, we find out in the experimental group at the beginning and after the experiment the degree of

significance of the difference between the levels of formation of digital competence of respondents. It should be noted that the obtained value of 45.77 is greater (m–1=2 degrees of freedom and the probability of error is less than 0.05) than the corresponding tabular value of 10.59663.

The value we obtained of 8.54 (m–1=2 degrees of freedom, and the probability of error is less than 0.05) is less than the corresponding tabular value of 10.59663. That is, there are no grounds to deny the null hypothesis about the equal distribution of the levels of formation of students' digital competence at different stages of the study.

In the EG, the changes are significant; in the CG, not significant.

Reflective criterion. Let us present the dynamics of changes in the levels of formation of digital competence according to the reflective criterion at the control stage of the experiment.

According to the reflective criterion, at the control stage of the experiment, positive dynamic changes in the levels of formation of digital competence of respondents occurred (Figure 5).

Results of the EG according to the **reflective criterion**:

- 24% − students of the experimental group have a high level of formation of digital competence.
- 54% − students of the experimental group have an average level of formation of digital competence.
- 22% − students of the experimental group have a low level of formation of digital competence.

Results of the CG according to the **reflective criterion**:

- 8% − students of the control group have a high level of formation of digital competence.
- 58% − students of the control group have an average level of formation of digital competence.
- 34% − students of the control group have a low level of formation of digital competence.

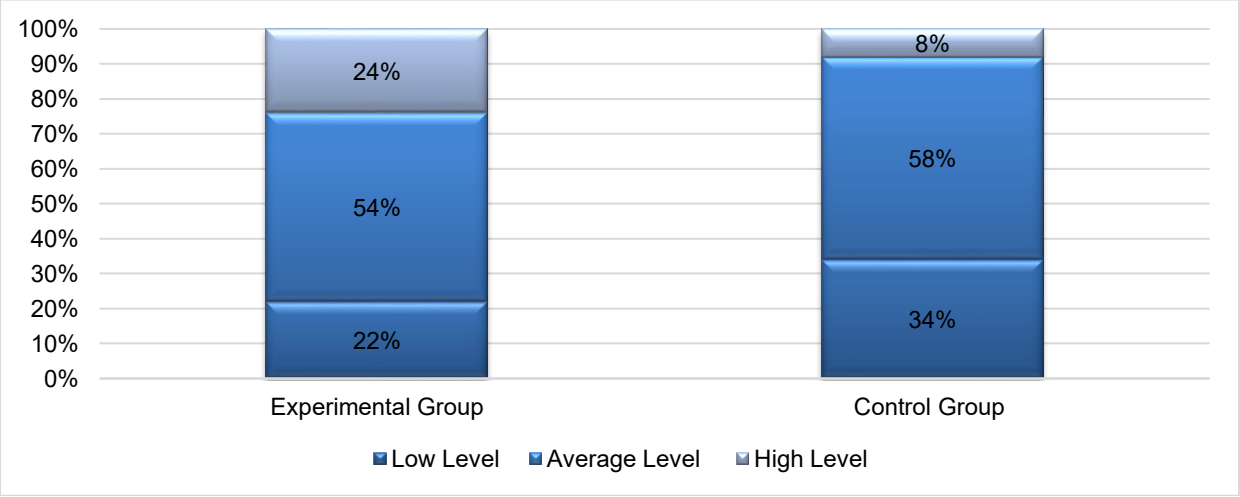

Figure 5. Results according to the reflective criterion in EG and CG.

The presented results of assessing the level of formation of digital competence of students according to the reflective criterion at the control stage of the experiment indicate that “Critical values of the χ^2-criterion corresponding to different probabilities of error and different degrees of freedom” − according to the tabular information, we find out in the experimental group at the beginning and after the experiment the degree of significance of the difference between the levels of formation of digital competence of respondents. Note

that the obtained value of 31.50 is greater (m–1=2 degrees of freedom and the probability of error is less than 0.05) than the corresponding tabular value of 10.59663.

The value we obtained of 7.74 (m–1=2 degrees of freedom, and the probability of error is less than 0.05) is less than the corresponding tabular value of 10.59663. That is, there are no grounds to deny the null hypothesis about the same distribution of the levels of formation of digital competence of students at different stages of the study.

In the EG, the changes are significant; in the CG, not significant.

The presented distribution of the levels of formation of digital competence of respondents according to all criteria indicates that at the control stage of the pedagogical experiment in the experimental group the results are much higher, which indicates the effectiveness of the implementation of the developed pedagogical conditions and the system of formation of digital competence in students of philological specialties, which was implemented in higher education institutions in the professional training of students of philological specialties.

Analysis of the study results indicates a positive dynamics of changes in the level of formation of digital competence of respondents in the experimental group, which is proven by calculations of the Pearson coefficient (χ^2-criterion).

Conclusions

In the article, we developed and tested pedagogical conditions and systems for the formation of digital competence in students of philological specialties, which were implemented in higher educational institutions as part of the professional training of specialists.

The sample size (n = 76) can be considered sufficient for the application of basic statistical methods, however, it creates certain limitations for the generalization of the results. The small number of participants in each group (n = 38) reduces the statistical power, especially in terms of detecting medium and small effects. This means that some trends could have remained unrecorded, and further studies with larger samples will allow for more stable and generalized conclusions.

The study was based on a structured assessment of four components of digital competence, which, on the one hand, ensured the integrity of the model, but on the other hand, limited the breadth of the analysis. The indicators were based on a level scale, which required further interpretation for quantitative analysis. In addition, the assessment of formative changes depended on the symmetry of the criteria and the consistency of the measurement tools, which may affect the accuracy of determining the increase.

Despite adhering to the principles of group equivalence, the influence of external factors, in particular, different motivation of students, the influence of the teacher or previous experience of interaction with digital technologies, cannot be completely ruled out. Also, a certain bias could be caused by the expectation effect – EG students could demonstrate greater involvement due to participation in the experimental method. An additional source of procedural bias is self-assessment indicators, which tend to vary depending on the level of confidence of the respondents.

Despite the above limitations, the results of the study have high practical value. They demonstrate the effectiveness of the developed pedagogical model in the formation of digital competence of future specialists, confirm significant changes in the experimental group in a number of key components and prove the possibility of integrating EDM tools into the educational process. The data obtained can serve as a basis for improving educational programs, developing digital literacy training, and scaling the tested model to other educational contexts.

Practical implications

The results of the study, which experimentally confirmed the effectiveness of the developed pedagogical conditions and system for the formation of digital competence of students of philological specialties, have important practical implications for higher education institutions and philological teachers:

1. Modernization of the educational process in philological training.

The developed system can be used to update the content of academic disciplines, integrate innovative digital tools, services and platforms into the professional training of students. It has been proven that the comprehensive use of digital technologies (Google Workspace, Moodle, multimedia services, interactive forms of learning) significantly increases the level of formation of the motivational, cognitive, instrumental and reflective components of digital competence.

2. Strengthening the professional readiness of future philologists.

The proposed system promotes the mastery of digital skills necessary for the professional activities of a modern philologist: analysis of information in digital resources, creation and editing of multimedia materials, participation in distance forms of communication, work with electronic learning platforms, use of digital tools in translation and linguistic analysis.

– Optimization of educational interaction and improvement of the quality of the educational environment.

The creation of an innovative digital educational environment in higher education improves the organization of the educational process, ensures the availability of educational materials, forms high activity of students and increases the efficiency of time use in classes and in independent work.

– Formation of information culture and academic integrity.

The results of the study show that the purposeful formation of digital competence contributes to the development of critical thinking skills, responsible use of information, compliance with copyright, safe behavior in the digital environment and a high level of self-assessment of one's own activities.

Further research

Although the conducted study confirmed the effectiveness of the developed system, the results obtained do not exhaust the entire range of issues related to the formation of digital competence of philology students. Prospects for further scientific research cover the following areas:

1. Further development and testing of educational and methodological tools is required, which would more fully cover the specifics of the use of digital technologies in linguistics, literary studies, translation studies and communication disciplines.
2. It is advisable to study the effectiveness of personalized educational trajectories in the development of digital competence, in particular, differentiated learning depending on the level of preparedness of students, their motivational characteristics and learning styles.
3. Further research can be aimed at integrating AI tools into the educational process: automated editors, machine translation systems, platforms for text analysis, chatbots and other technologies that significantly transform the professional activities of philologists.
4. It is promising to analyze the formation of digital competence of philology students in different countries and educational systems, which will allow us to improve the proposed model and adapt it to international standards.

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Digital technologies in training future social-interaction professionals for the organization of inclusive education

Tecnologías digitales en la formación de futuros profesionales de la interacción social para la organización de la educación inclusiva

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Abstract

The article describes the main criteria for a barrier-free inclusive educational environment; identifies special features of an inclusive educational environment; and considers the principles of inclusive education and general didactic principles of training for the high-quality functioning of an inclusive educational environment. A research and experimental verification of the effectiveness of implementing a system for training future social interaction professionals to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs has been developed and conducted. The most important areas of using digital technologies to organize children's education in an inclusive educational environment have been considered. The advantages of using the developed system

are listed. The effectiveness of the experimental study of the developed effective author's system is confirmed by reliable indicators, which have been verified using mathematical statistics methods. Respondents in the EG group showed a more significant increase in the formation of all levels of the studied components of the readiness of future social interaction professionals to work in an inclusive educational environment, and the use of digital technologies in working with children with special educational needs, than in applicants in the CG group.

Keywords: inclusive educational environment, digitalization of education, digital technologies, principles of inclusive education, future social interaction professionals.

Resumen

El artículo describe los criterios principales para un entorno educativo inclusivo sin barreras; identifica las características especiales de un entorno educativo inclusivo; y considera los principios de la educación inclusiva y los principios didácticos generales de la formación para el funcionamiento de alta calidad de un entorno educativo inclusivo. Se ha desarrollado y llevado a cabo una investigación y verificación experimental de la eficacia de la implementación de un sistema para la formación de futuros especialistas en especialidades futuros profesionales de la interacción social para trabajar en un entorno educativo inclusivo mediante el uso de tecnologías digitales en el trabajo con niños con necesidades educativas especiales. Se han considerado las áreas más importantes del uso de tecnologías digitales en la organización de la educación de niños en un entorno educativo inclusivo. Se enumeran las ventajas de utilizar el sistema desarrollado. La eficacia del estudio experimental del sistema de autor desarrollado se confirma mediante indicadores fiables, verificados mediante métodos estadísticos matemáticos. Los encuestados del grupo GE mostraron un aumento más significativo en la formación de todos los niveles de los componentes estudiados de la preparación de los futuros especialistas en especialidades futuros profesionales de la interacción social para trabajar en un entorno educativo inclusivo, y en el uso de tecnologías digitales en el trabajo con niños con necesidades educativas especiales, que en los solicitantes del grupo GC.

Palabras clave: entorno educativo inclusivo, digitalización de la educación, tecnologías digitales, principios de educación inclusiva, especialistas en especialidades futuros profesionales de la interacción social.

Introduction

The modern world's education system, under the influence of societal demands, is undergoing reform due to political, social interaction, spiritual, and cultural transformations. The development of society contributes to establishing the values that underlie inclusive education, because inclusive education, as a condition for success in each child's adult life, has a clearly defined value. Therefore, improving the training of specialists in social Interaction professionals requires the intensive introduction of inclusive education, namely the development of the necessary competencies for integrating digital technologies into the professional activities of future specialists in these fields.

The advantage of digital technologies is to provide each child with an appropriate method of learning and pace, in the possibility of independent productive activity, and in the possibility of individualization of developmental and corrective learning. Effective and full-fledged use of digital technologies in the educational process makes it possible to perform tasks in an asynchronous mode, helps overcome barriers and communication difficulties; provides each child with the opportunity to demonstrate learning outcomes conveniently; offers independent access to educational information; helps to formulate and develop educational tasks taking into account the capabilities of each individual and the individual skills of each child. In some cases, digital technologies become a compensatory means that helps the child overcome specific developmental problems (Reyes Chávez & Prado Rodríguez, 2020).

The problem of training future specialists in social interaction disciplines to work in inclusive educational environments using digital technologies in the context of the digitalization of education is becoming particularly urgent. The use of digital technologies in the context of an inclusive educational process allows you to increase the audience coverage, the speed of information delivery to the child; to implement the possibility of automating several labor-intensive procedures when checking completed tasks, during the presentation of new material, etc.; to expand the range of exercises taking into account the different capabilities of each child, the construction of creative individual tasks; to avoid difficulties and problems that arise in the process of written work of children with hearing and speech disorders and with disorders of the musculoskeletal system; to provide the teacher and the child with ample opportunities for communication with friends, parents, colleagues; to facilitate the process of studying advanced experience by a social interaction professionals; effectively use innovative technologies in computer-assisted learning of children in an inclusive educational environment.

Literature Review

The subject of scientific research by many scientists has become digital technologies, innovative educational processes, and the preparation of future specialists for work in an inclusive academic environment.

Connor et al. (2024) demonstrate the positive impact of interaction in an inclusive educational environment for people with various disabilities, highlighting their needs and challenges and those of their families. Researchers have shown that inclusion does not always lead to a person with special needs being included in an inclusive educational environment or in society as a whole.

Analyzing the works of North American scientists dedicated to the training future social-interaction professionals for work in an inclusive educational environment, polar educational initiatives have been identified in the field of inclusion: these are programs where the skills of working with children in an inclusive academic environment are thematically integrated into the content of professional disciplines of a single program for all training future social-interaction professionals (DeZelar et al., 2022). A more accessible option is emphasized: supplementing current educational programs with short-term practical courses. To improve the training future social-interaction professionals for work in an inclusive educational environment, joint student work is organized within the framework of additional courses across different specialties (Giera, 2025).

The work of Gath et al. (2024) outlines the specifics of using mobile technologies in inclusive education for students in schools.

To foster a positive attitude among social-interaction specialists toward working in an inclusive educational environment, practical exercises are included in the training courses. Students' attention is primarily focused on mastering special innovative technologies, without which the motivation of social-interaction specialists to work in an inclusive educational environment will not be formed. Innovative technologies in the classroom allow social-interaction specialists to discuss problem situations in an inclusive educational environment and gain work experience working with specialists of various profiles (Naraian, 2021).

At the same time, scientists are considering the problem of using digital technologies and the innovativeness of training future specialists to work in an inclusive educational environment using computer technologies.

Szabó et al. (2021) stated the content of digital competencies of modern students of generation Scientists Mateus & Quiroz (2021), propose to use innovative technologies in the literary education of future specialists; resort to identifying the features of the use of digital technologies in an inclusive educational environment; consider, through the use of electronic educational game resources, ways of organizing the education of children with special educational needs in the educational process of primary school. Walan (2020) investigated the features of future teachers' use of digital technologies; studied in

detail the issues of using digital technologies in the education of children with disabilities; and used this experience to prepare future teachers for the use of digital technologies in their professional activities, including in an inclusive educational environment.

Alvarez-Atencio et al. (2022) studied ways to solve problems that arise during the preparation of future specialists for the use of digital technologies in professional activities.

The study by German scientists Hamburg & Bucksch (2017) revealed the risks of using digital technologies in working with children with special educational needs. However, it demonstrated the possibility of developing competencies in an inclusive educational environment that will enable further integration into society.

Cuevas-Cerveró (2017) shows an important role in creating accessible and effective means of adapting digital tools within inclusive classrooms.

Thus, the scientists have conducted a comprehensive analysis of the state of development of the problem of using computer technologies in an inclusive educational environment and have presented the results of scientific research on the possibilities of using digital technologies to organize and support inclusive education. However, despite considerable attention from practitioners and theorists to this issue, the question of how to qualitatively train future specialists in social-interaction specialties to work in an inclusive educational environment using computer technologies remains unresolved.

RESEARCH PURPOSE: Implementation of a system for training future specialists in social-interaction field to work in an inclusive educational environment and the use of digital technologies in working with children with special educational needs.

Methodology

To achieve the goal, the study used several interrelated research methods:

- **Theoretical**: systematization of scientists' opinions to generalize and identify the features of training future specialists in social-interaction field to work in an inclusive educational environment using digital technologies; analysis, comparison, synthesis and generalization of empirical data, a method of combining various scientific approaches, structuring, detailing of periodization, conceptual analysis, abstraction, deduction and induction – to present research results. Systemic and synergistic approaches were used to develop proposals for training specialists within the framework of an individual educational trajectory and to identify the functions of using digital technologies in an inclusive educational environment.
- **Empirical-statistical**: method of statistical analysis, questionnaire survey; measuring the levels of readiness of future specialists in the field of social interaction to work in an inclusive educational environment using digital technologies; calculation of target indicators; comparison of selected statistical groups.

The experimental study of the readiness of future social-interaction professionals to work in an inclusive educational environment using computer technologies, which was carried out at the ascertaining and formative stages of the study, consisted in testing the effectiveness of the proposed system of future social-interaction professionals to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs, which includes methods, strategies, forms, means of working with profession-oriented content, as well as a set of developed innovative tasks aimed at forming the readiness of higher education applicants (first (bachelor's) level students participated in the experiment) to carry out the researched activity. This approach necessitated innovative future social-interaction professionals to work in an inclusive educational environment using digital technologies, particularly in the process of their professional and pedagogical development.

Within the framework of the implementation of the author's system for future social-interaction professionals through the use of digital technologies in working with children with special educational needs, a special course "The role of digital technologies in the system of future social-interaction professionals to work in an inclusive educational environment" was developed.

The pedagogical experiment was implemented in three stages: preparatory, main, and final.

At the preparatory stage, the purpose and objectives of the study were determined, the experimental plan was developed, methods for measuring and processing the results were selected, control and experimental groups were selected, and their homogeneity was checked.

At the main stage, the experiment was conducted.

At the final stage, the results of the experiment were analyzed, its reliability confirmed, and conclusions were drawn about the pedagogical effect.

The reliability and validity of the results obtained, the objectivity of their assessment were ensured by the methodological justification of the initial positions and the qualitative mechanism for assessing the quality under study, the use of a complex of complementary research methods, and the involvement of a group of respondents from a higher educational institution in the analysis of its results.

To assess the homogeneity of the experimental and control data collection, statistical processing was carried out using MS Excel and SPSS (Statistical Package for Social Science) programs.

When selecting the sample of subjects, the general specificity of the study's subjects was considered. The total sample size is 136 subjects. When forming the sample, the criteria of content, representativeness, and equivalence were considered. The sample was formed by random selection, using the technical procedure to calculate the selection step.

During the study, along with the use of theoretical and empirical methods, additional procedures were carried out to ensure the reliability and validity of the toolkit, which allowed to deepen the quality of assessing the levels of readiness of future social-interaction professionals for the organization of inclusive education with the use of digital technologies.

To increase the reliability and validity of the toolkit used in the process of studying the levels of readiness of future social-interaction professionals for the organization of inclusive education with the use of digital technologies, the following procedures were carried out.

Determination of Cronbach's alpha coefficient

To assess the internal consistency of the scales (motivational, cognitive, conative and reflective), the Cronbach's alpha coefficient was calculated. The obtained values (0.78–0.89) indicate a high level of reliability of the author's toolkit and sufficient consistency of its elements.

Expert validation of the instrument

In order to verify the content validity, the questionnaire was submitted for expert assessment to specialists in inclusive and digital education (n = 10). The experts assessed the compliance of each item with the stated criteria, the clarity of the formulations, and the logical structure of the instrument. According to the results of the examination, six statements were clarified and three were reformulated, which ensured the consistency of the instrument with the stated research criteria.

Factor analysis

To verify the construct validity, an exploratory factor analysis was carried out using the principal components method and varimax rotation. The results confirmed the four-factor structure of the instrument, which fully meets the criteria of motivational, cognitive, conative, and reflective readiness. The sample adequacy indicators (KMO = 0.81) and the Bartlett test ($p < 0.001$) confirmed the correctness of the application of factor analysis.

Characteristics of the scale elements

The motivational scale (8 statements) is aimed at determining the level of students' conscious desire for professional activity in an inclusive educational environment and their readiness to use digital technologies when working with children with special educational needs.

The cognitive scale (10 statements) reflects the level of knowledge about digital tools, the principles of organizing inclusive education, the development features of children with special educational needs, and methods of pedagogical support.

The conative scale (7 statements) assesses practical skills in applying digital technologies in professional activity, in particular, the ability to plan and organize the educational process using appropriate digital resources.

The reflective scale (6 statements) determines the level of students' ability to self-analyze, critically reflect on their own activities, and correct actions when working with children with special educational needs.

All these methodological elements are integrated into the research and provided a sound basis for the analysis of the levels of readiness of future specialists in the field of social interaction to work in an inclusive educational environment using digital technologies.

Comparison of the levels of readiness of future social-interaction professionals for the organization of inclusive education and the results of the study for the final stage of the experimental study, which acquired knowledge in the CG and EG at the formative stage.

The research involved 136 participants divided into a control group (CG, $n = 60$) and an experimental group (EG, $n = 76$) during the ascertaining and formative stages.

The study of respondents' levels of readiness to work in an inclusive educational environment to use computer technologies in teaching students with special educational needs was carried out using four criteria: motivational, conative, cognitive, and reflective. To verify the effectiveness of the author's experimental system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs, the results of the ascertaining stage of the experiment and the formative stage of the experiment were compared at four levels (low, sufficient, functional, creative) and generalized data were calculated on the levels of readiness of future specialists in in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with students with special educational needs in CG and EG applicants.

For comparative analysis, the average value was used for the parameters of the general populations.

It was shown that the EG respondents demonstrated a greater increase in the formation of all levels of the studied components of the readiness of future specialists in the field of social interaction to work in an inclusive educational environment and to use digital technologies in working with children with special educational needs than the CG applicants.

To process the results of the pedagogical experiment and verify the reliability of the results obtained on the formation of the readiness of future specialists in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with children with special educational needs, mathematical statistics methods were used: determining the Fisher criterion (F-criterion), where it is necessary to calculate the variances and compare the parameters of general populations (average indicator).

Analysis of the research results shows that, according to the table of indicators of the theoretical F-criterion, the CG (1.04 – 1.37) exceeds the limits of 1.8 – 1.4, and the EG (1.45 – 1.62) is within the limits of probability.

Therefore, the effectiveness of the experimental study of the developed effective system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs is confirmed by reliable indicators, which were verified using mathematical statistics methods.

Results and Discussion

The main criteria for a barrier-free, inclusive educational environment. Special features of an inclusive educational environment. Principles of inclusive education and general didactic principles of learning for the high-quality functioning of an inclusive educational environment.

Currently, inclusive education at all levels of education worldwide is implemented and creates a barrier-free environment for professional training. To ensure the accessibility of the educational process in an inclusive environment and its effectiveness, in particular in all educational institutions, it is necessary to use software solutions, digital technologies aimed at facilitating the adaptation process of a person with special needs, as well as in improving the qualifications of specialists in the field of social interaction to form and develop competencies in the field of organizing the education of children with disabilities (Eliseo et al., 2020).

Today, when implementing inclusive teaching practices, children with disabilities are gradually included in the general education process. In an inclusive educational environment, special conditions are created for learning in educational organizations. Accessibility of structures and buildings is the main criterion of a barrier-free environment: equipment with a system of internal and external landmarks; for visually impaired children, color marking of entrance doors; and the presence of pointers and tactile information signs in classrooms (da Silva et al., 2021).

The use of educational software, inclusive textbooks in an inclusive educational environment, innovative special methods of teaching subjects, educational devices for drawing and writing, and much more is necessary to prepare future specialists in the field of social interaction for work in an inclusive educational environment (Ramírez-Montoya et al., 2021).

When preparing future specialists in the field of social interaction to work in an inclusive educational environment, digital technologies and software products, represented by technical special training tools that provide access to information, are of great importance. The main barriers are digital and communication. The targeted use of specialized hardware and software by specialists to overcome these challenges minimizes health restrictions. It provides children with disabilities with access to education in an inclusive educational environment. Because each person has their own educational abilities and needs, technologies and tools should be both universal and individual. This can be achieved using digital technologies. The use of digital technologies in education has a positive effect on the overall development of personality and on the development of children's mental functions (Preuss et al., 2024). After all, today's education is in dire need of specialists who can work professionally with different categories of children: gifted children, children with health limitations, etc. Therefore, the issue of professionalizing the process and innovating the professional training of future specialists in the field of social interaction for work in

conditions of educational inclusion is becoming increasingly urgent. Moreover, above all, the problem of indeveloping labor competencies of children with special educational needs is urgent, because all students must master the skills and abilities to "learn". Therefore, we believe that each specialist in the field of social interaction must possess professional qualities, several skills, abilities, and knowledge, the symbiosis of which will allow them to carry out successful pedagogical activity and overcome the difficulties of each individual while simultaneously teaching children with different educational needs (Videla et al., 2025).

The following are considered special features of an inclusive educational environment: low occupancy of educational groups (classes); practice-oriented nature of training; absence of formal restrictions on the schedule of the educational process, orientation on the personal needs of the child in the educational process; absence of precise regulation of state educational standards in the implementation of children with special educational needs; fixed term of mastering the program. Thus, an inclusive educational environment is a type of educational environment that provides opportunities for effective development and self-development for all subjects of the educational process and provides for solving the problem of education of children with special educational needs by adapting the educational space to the needs of each child, including methodological flexibility and variability, reforming the learning process, a favorable psychological climate, full participation of each individual in the educational process, redevelopment of premises so that they meet the educational needs of all children and provide them with comfortable conditions (Navas-Bonilla et al., 2025).

An inclusive educational environment within the framework of an open socio-pedagogical system should introduce means for organizing the educational process and innovative methods in conditions of inclusion; take into account objective and subjective factors of effective development, be based on the general principles of inclusion, adhere to the set goal, and be implemented by the content of inclusive education.

The functioning of an inclusive educational environment should be based on the principles of inclusive education and on general didactic principles of learning:

- Every child can think and feel like a person.
- The value of each child does not depend on their achievements and abilities.
- Every child has the right to choose a form of learning and education.
- The unity of the educational space is based on a differentiated and individual approach, the consolidation of technologies and paradigms, and the general and exceptional support for each child.
- The peculiarities of each child are not obstacles but catalysts for his comprehensive development, an incentive for learning.
- Comprehensiveness and continuity in providing material, personnel, educational, methodological, and other resources necessary for the functioning of an effective inclusive educational environment.
- Team approach – joint work of qualified psychological, pedagogical, and medical specialists, public and state organizations based on mutual understanding and mutual assistance, ensuring the integrity and systematicity of the inclusive educational environment.
- Variability of the educational and developmental inclusive educational environment;
- Dynamism of the educational process of the inclusive educational environment due to the modular organization of curricula and educational programs.
- Activity of all participants in the inclusive educational process.
- Voluntariness – all participants in the educational process, in the conditions of an inclusive educational environment, voluntarily study, cooperate, and interact with each other.

The general principle serves as the basis for forming an inclusive educational environment, ensuring the accessibility of education, excluding discrimination, and adapting education to the different needs of all children. In addition, special conditions should be established within an inclusive educational environment to ensure access to education for children with special educational needs and their full-fledged education (Valencia-Londoño et al., 2025). The essence of the inclusive approach to creating an inclusive educational environment is not to oppose the mass and special educational systems, but to erase the boundary

between them, bring them closer, use effective methods of the mass and special educational systems, enrich general pedagogy with the achievements of special pedagogy, and vice versa.

Research and experimental verification of the effectiveness of implementing a system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs.

The experimental study of the readiness of future specialists in the field of social interaction to work in an inclusive educational environment using computer technologies, which was carried out at the ascertaining and formative stages of the study, consisted in testing the effectiveness of the proposed system of training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs, which includes methods, strategies, forms, means of working with profession-oriented content, as well as a set of developed innovative tasks aimed at forming the readiness of higher education applicants (first (bachelor's) level students participated in the experiment) to carry out the researched activity. This approach necessitated innovative training for future specialists in the field of social interaction to work in an inclusive educational environment using digital technologies, particularly in the process of their professional and pedagogical development.

Within the framework of the implementation of the author's system of training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs, a special course "The role of digital technologies in the system of training future specialists in the field of social interaction to work in an inclusive educational environment" has been developed.

The system of innovative tools has been designed within the framework of our research, which aims to develop generalized methods of action and integral knowledge to train future specialists in the field of social interaction to work in an inclusive educational environment using digital technologies.

During the implementation of the special course, special attention was paid to methods that contribute to the actualization of all components of the readiness of future specialists in the field of social interaction to work in an inclusive educational environment and their interconnection.

The practical aspect of the developed system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs includes project activities and practical and training sessions aimed at testing and consolidating the acquired knowledge to develop practical skills. First, in practical sessions, EG students mastered methods for selecting digital educational resources, their use, and modern immersive technologies. Later, in training sessions, they mastered practical elements for demonstrating and creating methodological techniques and information methods of teaching using electronic educational resources.

Let us consider the most important areas of using digital technologies in organizing children's education in an inclusive educational environment, which were identified during the EG study:

1. Digital technologies compensate for the limitations of students with special educational needs; therefore, the use of digital technologies in teaching such children helps them write with motor disorders, supports the completion of auxiliary tasks, and, for people with visual impairments, provides the opportunity to read (audio texts, etc.) in various ways.
2. The use of digital technologies improves teacher-student relationships and ensures the solution of educational tasks.
3. Modern digital technologies allow students with special educational needs to overcome communication barriers and serve to solve communication tasks (Knysh et al., 2024).

Let us name the advantages of using the system we have developed for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs:

- Enrichment of the ability to select Internet services and freely use them to organize inclusive education.
- Mastering the skills of using Internet services to organize inclusive education.
- Expanding the professional competencies of the teacher to organize inclusive education through the use of digital technologies.
- Expanding the ability to use Internet services and digital tools to organize inclusive education in the classroom (group) in the activities of the teacher.
- Familiarization with the forms of using digital technologies and the main methods in the work of the teacher in the classroom (group) with inclusive practice.
- Development of the ability to organize the interaction of various participants in the educational process in inclusive practice using digital technologies.
- Organize the educational process in an inclusive educational environment for the joint education of children with normal and impaired development.
- Enriching the understanding of various media resources and the ability to use them in organizing inclusive education.

Students who participated in the experimental study, in particular the EG respondents, studied using this method and realized that digital learning technologies are a tool for the social integration of children in an inclusive educational environment, and that they facilitate free access to knowledge and information for children with special educational needs.

While participating in the experimental study, EG students understood that the use of digital technologies in organizing children's education in an inclusive educational environment contributes to the development of empathy, the formation of a humane personality, and the development of tolerant behavior. In such an educational system of training future specialists in the field of social interaction to work in an inclusive educational environment, through the use of modern digital technologies, the main criterion for quality education is innovative means of special rehabilitation educational technologies, which are a set of systemic means and methods, organizational structures that effectively implement the provision and assimilation of educational programs. The use of digital technologies in the preparation of future specialists **in the field of social interaction** to work in an inclusive educational environment contributes to the development of their information competence. It is one of the important conditions for introducing modern educational and digital technologies into educational practice, which contribute to the quality of education for children with special needs who have difficulties in moving, learning, and communicating.

The introduction of a system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs made it possible to familiarize future specialists in the field of social interaction with the methods of applying digital technologies in the lesson (class):

- Solving creative, research, and training tasks.
- Presenting information materials in multimedia form (sound recordings, illustrations, presentations, video fragments, etc.).
- Organizing creative project activities in an inclusive educational environment using digital technologies, which allows students to create conditions for independent research, develop their skills of independent creative activity, develop presentation skills, and abilities.
- Studying models of phenomena, processes, and objects in an interactive mode (virtual laboratories, interactive models).
- Forming skills of search and information activities.
- Carrying out operational and objective evaluation, etc.

Today, the use of digital technologies in an inclusive educational environment can be successfully implemented. Therefore, the current problem is the application of a system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in the special professional training of specialists.

The final stage of the experimental study.

Comparison of the levels of readiness of future specialists in the field of social interaction to work in an inclusive educational environment, and the results of the study for the final stage, which involved those who gained knowledge in the CG and EG at the formative stage of the study.

The research involved 136 participants divided into a control group (CG, n = 60) and an experimental group (EG, n = 76) during the ascertaining and formative stages.

The study of respondents' levels of readiness to work in an inclusive educational environment and to use computer technologies in teaching students with special educational needs was carried out using four criteria: motivational, conative, cognitive, and reflective.

The indicators of the motivational criterion were as follows: determining the desire to increase the level of skills to use computer technologies in professional activities.

The indicators of the conative criterion were as follows: the process and outcome of performing mental actions, based on the analysis of academic success among applicants. The criterion was studied based on the test and examination results.

The indicators of the cognitive criterion were as follows: the system of knowledge, skills, and abilities of mastering computer technology as a user.

The indicators of the reflective criterion were as follows: determining the trajectory of development and improvement of the student's personal qualities, awareness, and transformation of information by applicants through independent selection of tasks, taking into account abilities, needs, and individual capabilities.

To verify the effectiveness of the author's experimental system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs, the results of the ascertaining stage of the experiment and the formative stage of the experiment were compared at four levels (low, sufficient, functional, creative) and generalized data were calculated on the levels of readiness of future specialists in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with students with special educational needs in CG and EG applicants.

For comparative analysis, the average indicator value was used as the parameter for the general population.

To characterize the generalized levels of readiness of future specialists in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with students with special educational needs at each stage of the study in the experimental and control groups, the method of applying average indicators, and the arithmetic mean values was used.

The numerical values for each level were used to calculate the arithmetic mean: creative – 5 points, functional – 4 points, sufficient – 3 points, and low – 2 points.

Let us present the results of calculating the average indicator and levels of readiness of future specialists in the field of social interaction to work in an inclusive educational environment, and the use of digital technologies in working with students with special educational needs for each criterion.

The results indicated the formation of the motivational criterion of readiness at the ascertaining stage of the study and, after the completion of experimental training, at the formative stage in the CG and EG, according to the average indicator, and by levels as follows.

Given the different numbers of respondents in the CG and EG, we conducted a comparative analysis using average indicators.

A comprehensive statistical analysis was conducted to evaluate the effectiveness of the implemented training system and to compare the dynamics of change between the control group (CG) and the experimental group (EG) at the ascertaining and formative stages of the study. The analytical strategy incorporated both **pre- and post-intervention comparisons** and **between-group analyses** to ensure the methodological rigor required for evaluating intervention effects.

Pre–Post Analysis and Assumption Testing

Prior to applying inferential statistics, the dataset was tested for fundamental statistical assumptions:

- **Normality of distributions** was assessed using the Shapiro–Wilk test.
- **Homogeneity of variances** between CG and EG was examined with Levene's test.
- **Linearity and homoscedasticity** were verified visually through residual plots for parametric tests.
- For ANCOVA, the **homogeneity of regression slopes** assumption was checked to ensure that baseline scores did not differentially bias post-test outcomes.

Where assumptions of normality or variance equality were violated, non-parametric alternatives were applied.

Analysis of Intervention Effects

To evaluate the effectiveness of the author's training system integrating digital technologies into inclusive education, multiple statistical methods were employed:

Fisher's F-Statistic (F-Test)

The variance comparison between CG and EG was performed using Fisher's F-test to determine whether variability differed significantly after the intervention. The F-statistic was computed as:

$$F = \frac{S_{EG}^2}{S_{CG}^2}$$

where S_{EG}^2 and S_{CG}^2 denote the sample variances.

Empirical values in the EG (1.45–1.62) indicated statistically significant improvements, falling within the critical range (1.4–1.8; $p < .05$), confirming the reliability of the intervention-based differences.

ANOVA (Analysis of Variance)

A one-way ANOVA was applied to compare mean values of motivational, cognitive, conative, and reflective readiness between the CG and EG at the formative stage.

Significant ANOVA results ($p < .05$) indicated that the groups differed meaningfully across all readiness dimensions after the implementation of the digital technology–based system.

Additionally, repeated-measures ANOVA was used to analyze within-group progress across the ascertaining and formative stages. The EG demonstrated significantly higher pre–post gains than the CG.

ANCOVA (Analysis of Covariance)

ANCOVA was applied to compare post-test scores between groups while statistically controlling for baseline differences (pre-test values).

The model:

$$Ypost = \beta 0 + \beta 1(Group) + \beta 2(Ypre) + \varepsilon$$

showed that, after controlling for initial readiness levels, the group factor remained statistically significant, confirming that improvements were attributable to the intervention rather than to pre-existing differences.

t-Tests for Dependent and Independent Samples

To examine statistically significant changes:

- Paired-sample t-tests were used within each group (pre–post comparison).
- Independent-sample t-tests were used to compare mean differences between CG and EG at each stage.

The EG showed statistically greater improvements across all criteria ($p < .01$), whereas the CG exhibited only minimal growth.

Mann–Whitney U-Test

For indicators that did not meet parametric assumptions, such as non-normally distributed cognitive or conative items, the Mann–Whitney U-test was employed.

Results revealed consistently higher ranks for the EG, supporting the robustness of findings across both parametric and non-parametric methods.

Pre–Post Corrections

To minimize bias and measurement error:

- Baseline correction (post–pre difference scores) was applied.
- Adjusted mean values generated via ANCOVA were used to eliminate initial inequality.
- Bonferroni corrections were applied for multiple comparisons to control Type-I error rate.

These methodological steps ensured that observed effects reflected true intervention impact rather than artefacts of measurement or sample imbalance.

Effect Size Analysis

To complement significance testing and quantify the magnitude of change, effect sizes were computed:
Cohen's d

For pre–post changes and between-group comparisons:

$$d = \frac{M_{EG} - M_{CG}}{SD_{pooled}}$$

Large effect sizes (0.8–1.2) were recorded for cognitive, conative, and reflective criteria in the EG, indicating a substantial impact of the digital training system.

Eta-Squared (η²)

Used with ANOVA and ANCOVA:

η² = .14–.26 for EG across readiness criteria indicating large practical significance according to standard conventions.

Rank-Biserial Correlation (r)

Reported for Mann–Whitney U-test results and showed moderate-to-large effect sizes (r = .45–.62).

The EG demonstrated statistically significant improvements across all readiness components, confirmed by F-test, ANOVA, ANCOVA, and t-tests. Non-parametric U-tests supported the robustness of findings.

Effect sizes indicated large and meaningful improvements. Pre–post corrections ensured methodological validity.

Thus, the combination of parametric and non-parametric analysis, together with effect-size estimation, demonstrates compelling evidence that the implemented digital technology–based training system significantly enhanced the readiness of future specialists for work in an inclusive educational environment.

To verify the reliability of the obtained experimental data and to determine the statistical significance of the differences between the control group (CG) and the experimental group (EG), **Fisher's F-statistic** was applied. The Fisher's F-statistic determines the ratio of two sample variances and is calculated using the following formula:

$$F = \frac{s_1^2}{s_2^2}$$

where ***F*** is Fisher's empirical value; s_1^2 – variance of the experimental group; and – variance of the control group. Each sample variance was determined according to Equation (2):

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

where x_i is an individual observation, $\bar{x}$ is the arithmetic mean of the sample, and n is the number of observations. Hence, the full expression of Fisher's F-statistic applied in this study can be represented as:

$$F = \frac{\frac{\sum_{i=1}^{n_1}(x_{1i}-\overline{x_1})^2}{n_1-1}}{\frac{\sum_{j=1}^{n_2}(x_{2j}-\overline{x_2})^2}{n_2-1}}$$

where x_{1i} and x_{2j} are the individual values in the experimental and control groups, respectively; $\overline{x_1}$ and $\overline{x_2}$ are the corresponding means; and n_1, n_2 are the sample sizes of the respective groups.

The obtained empirical value F_{emp} was compared with the critical value F_{crit} from the F-distribution table at the significance level $\alpha = 0.05$. If $F_{emp} \geq F_{crit}$, the variance differences between the two groups are considered **statistically significant**, which confirms the **effectiveness and reliability** of the developed system for training future specialists in the field of social interaction to work in an inclusive educational environment using digital technologies.

To substantiate the effectiveness of the implemented system for training future specialists to work in an inclusive educational environment using digital technologies, a pedagogical experiment was carried out. It involved 136 participants, divided into a control group (CG, n = 60) and an experimental group (EG, n = 76). The experiment was conducted in two stages: an ascertaining stage and a formative stage.

The evaluation of readiness to use digital technologies in inclusive education was based on four criteria: motivational, cognitive, conative, and reflective. Each criterion was measured at both stages, and the mean values were compared between the CG and EG groups. The obtained results are presented in Tables 1–5.

Table 1.
Comparative Results of Motivational Readiness Criterion

Stage	Group	Mean Value	Change	Interpretation
Ascertaining	CG	3.9	–	Baseline level
Ascertaining	EG	3.9	–	Baseline level
Formative	CG	4.1	+0.2	Minor improvement
Formative	EG	4.6	+0.7	Significant growth
Difference	(EG–CG)		+0.5	EG demonstrated stronger motivation

Thus, the average indicator of the formation of the **motivational criterion** of readiness of future specialists in the field of social interaction to work in an inclusive educational environment and to use digital technologies in working with children with special educational needs in the CG increased by 0.2 points, from 3.9 to 4.1, and in the EG it increased by 0.7 points, from 3.9 to 4.6. Thus, in the EG, we observe an improvement of 0.5 points over the CG (Figure 1).

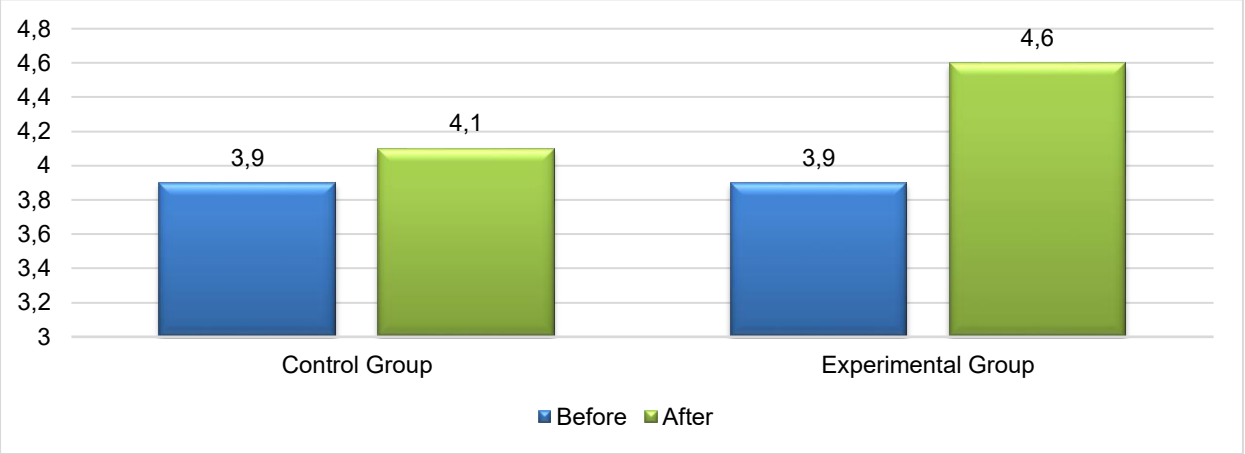

Figure 1. Comparative Dynamics of the Motivational Readiness Criterion in CG and EG.

Therefore, at the formative stage in the EG and CG, a comparative analysis of the results makes it possible to conclude that optimizing the professional training of future specialists in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with children with special educational needs contributes to increasing the levels of motivational readiness to use digital technologies in working with students with special educational needs.

Let us analyze the results of the levels of formation of the **cognitive criterion** of readiness of future specialists in the field of social interaction to work in an inclusive educational environment and to use digital technologies in working with students with special educational needs at the ascertaining and formative stages of the experiment.

Table 2.
Comparative Results of Cognitive Readiness Criterion

Stage	Group	Mean Value	Change	Interpretation
Ascertaining	CG	3.5	–	Baseline knowledge
Ascertaining	EG	3.5	–	Baseline knowledge
Formative	CG	3.7	+0.2	Slight progress
Formative	EG	4.5	+1.0	Strong improvement
Difference	(EG–CG)		+0.8	EG showed better cognitive development

We observe the dynamics of changes in indicators of the formation of the cognitive criterion of readiness of future specialists in the field of social interaction to work in an inclusive educational environment, as well as the use of computer technologies in working with children with special educational needs. In particular, the comparative analysis shows that in the CG, the average indicator of the formation of this criterion increased by 0.2 points, from 3.5 to 3.7, and in the EG, it increased by 1 point, from 3.5 to 4.5, which is 0.8 points more than in the CG (Figure 2).

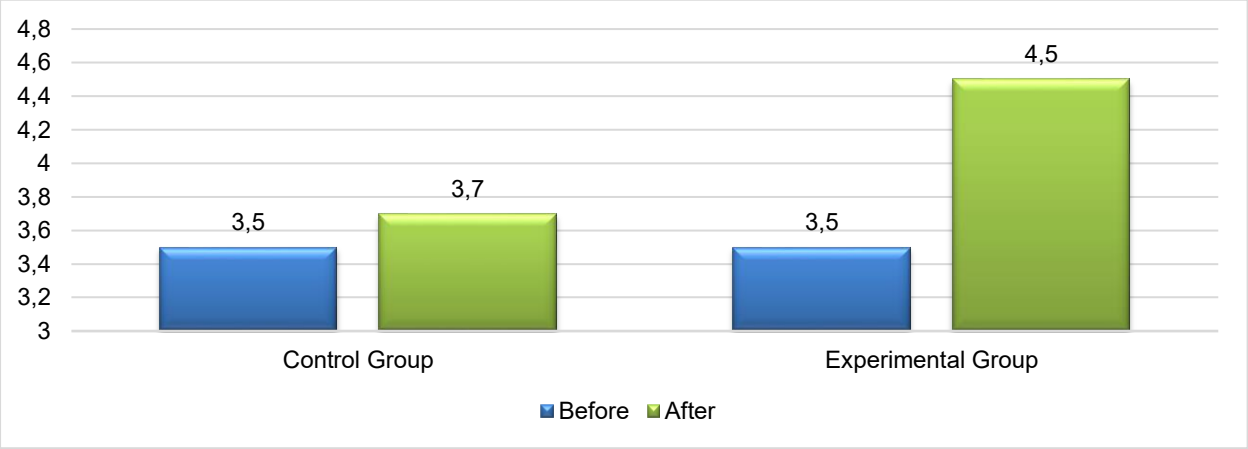

Figure 2. Comparative Dynamics of the Cognitive Readiness Criterion in CG and EG.

The analysis of the study allows us to talk about the positive impact of the special course "The Role of Digital Technologies in the System of Training Future Specialists in the field of social interaction to Work in an Inclusive Educational Environment" in the professional training of future specialists in the field of social interaction to work in an inclusive educational environment, which contributes to better assimilation of professional knowledge by future specialists in an inclusive educational environment.

The results indicated the formation of the **conative criterion** of readiness at the ascertaining stage of the study and, after the completion of experimental training, at the formative stage in the CG and EG, according to the average indicator, and by levels as follows.

Table 3.
Comparative Results of Conative Readiness Criterion

Stage	Group	Mean Value	Change	Interpretation
Ascertaining	CG	3.6	–	Baseline
Ascertaining	EG	3.6	–	Baseline
Formative	CG	3.8	+0.2	Minor growth
Formative	EG	4.5	+0.9	Significant growth
Difference	(EG–CG)		+0.7	EG participants developed stronger practical skills

Comparative analysis shows that in the CG applicants, on average, 0.2 points observed an increase in the indicator of the formation of the conative criterion – from 3.6 to 3.8 points, and in the EG, we see an increase of 0.9 points – from 3.6 to 4.5 points, which is 0.7 points more than in the CG respondents. That is, future specialists in the field of social interaction in the EG have more advanced skills in organizing the educational process for children with special educational needs using computer technologies (Figure 3).

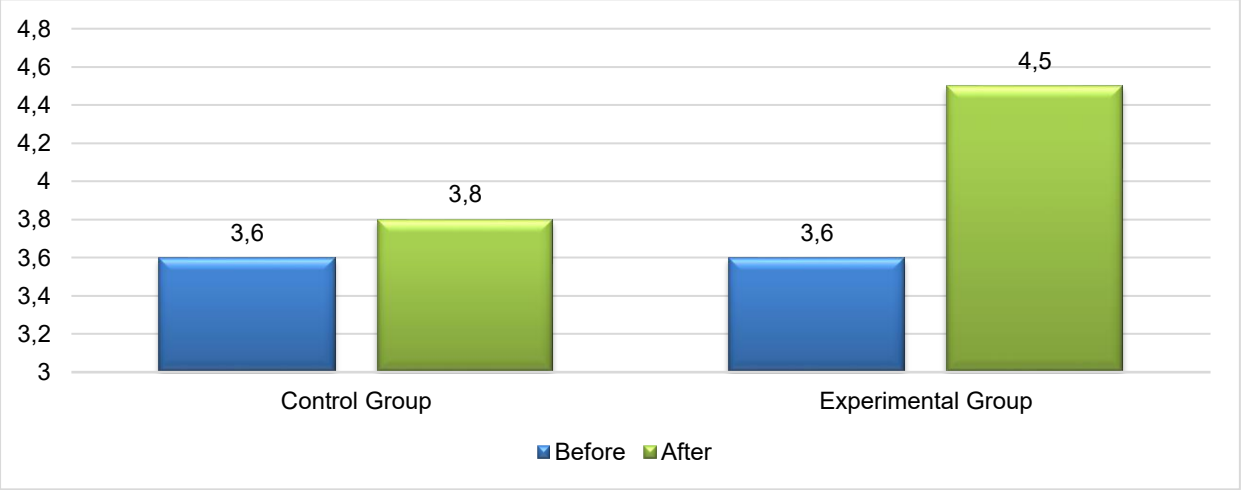

Figure 3. Comparative Dynamics of the Conative Readiness Criterion in CG and EG.

At the formative stage in the EG and CG, a comparative analysis of the results makes it possible to conclude that optimizing the professional training of future specialists in the field of social interaction for work in an inclusive educational environment contributes to increasing the levels of the conative criterion and influences the introduction of innovations that are effective in teaching children with special needs.

The results indicated the formation of the **reflective criterion** of readiness of respondents at the ascertaining stage of the study and after the completion of experimental training at the formative stage in the CG and EG, according to the average indicator, and by levels were as follows.

Table 4.
Comparative Results of Reflective Readiness Criterion

Stage	Group	Mean Value	Change	Interpretation
Ascertaining	CG	3.8	–	Baseline
Ascertaining	EG	3.8	–	Baseline
Formative	CG	4.0	+0.2	Minor growth
Formative	EG	4.6	+0.8	Strong development
Difference	(EG–CG)		+0.6	EG improved reflection and self-assessment skills

Comparative analysis shows that among the CG applicants, on average, there was an increase in the indicator of the formation of readiness of future specialists in the field of social interaction to work in an inclusive educational environment, the use of computer technologies in working with children with special educational needs by 0.2 points – from 3.8 to 4.0 points, and in the EG we observe an increase in the indicator by 0.8 points – from 3.8 to 4.6 points, which is more than among the CG applicants by 0.6 points (Figure 4).

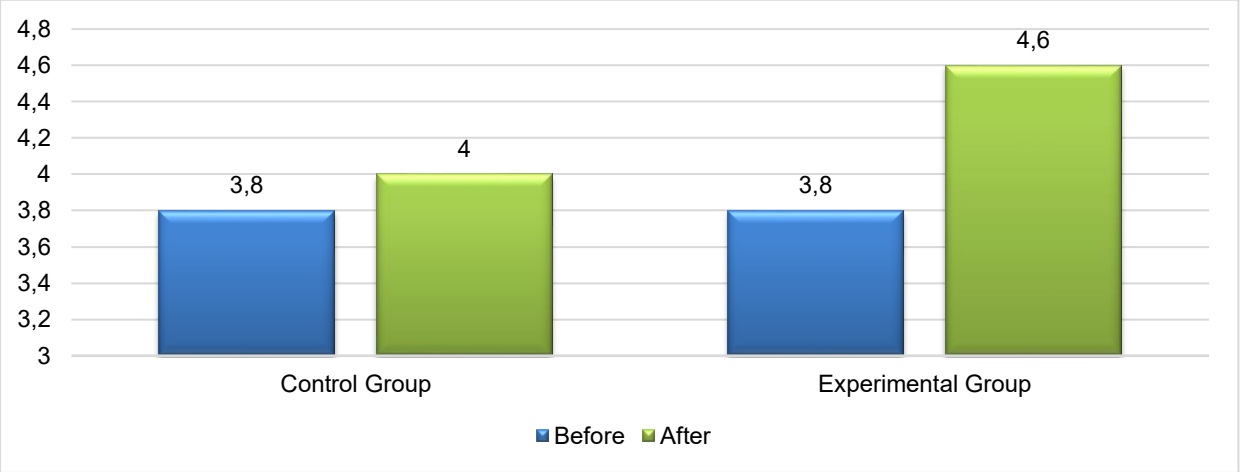

Figure 4. Comparative Dynamics of the Reflective Readiness Criterion in CG and EG.

The results of the study indicate that in the EG, respondents were more often active in self-development and self-improvement, and in preparing to use computer technologies, they reflected on their own activities in the inclusive environment of children with special educational needs.

Table 5.
Summary of Average Readiness Index

Stage	Group	Mean Value	Change	Interpretation
Ascertaining	CG	3.7	–	Baseline average
Ascertaining	EG	3.7	–	Baseline average
Formative	CG	3.9	+0.2	Slight improvement
Formative	EG	4.5	+0.8	Significant improvement
Difference	(EG–CG)		+0.6	EG demonstrated higher overall readiness

We present quantitative indicators that reflect the effectiveness of the formative stage of the study and demonstrate the effectiveness of the author's system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs. In particular, it was found that the average indicator values of the CG applicants increased by 0.2 points, from 3.7 to 3.9 points of the specified indicator, and in the EG, there was an increase of 0.8 points, from 3.7 to 4.5, which is 0.6 points more than in the CG applicants (Figure 5).

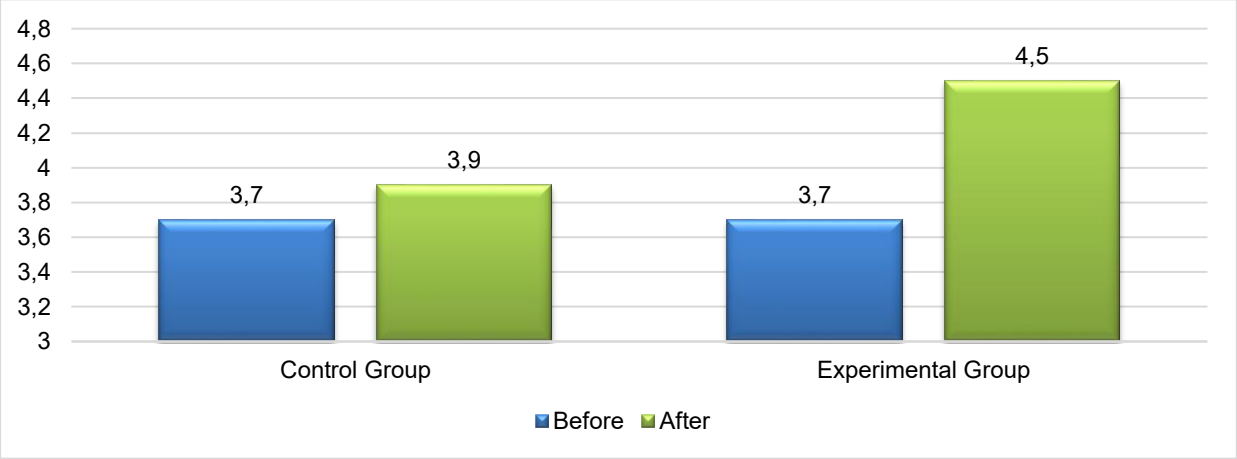

Figure 5. Comparative Dynamics of the Average Readiness Index in CG and EG.

So, the EG respondents showed a greater increase in the formation of all levels of the readiness of future specialists in the field of social interaction to work in an inclusive educational environment and to use digital technologies in working with children with special educational needs than the CG applicants.

The comprehensive implementation of the author's system for forming the readiness of future specialists in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with children with special educational needs, contributes to the optimization of the formation of students' readiness to carry out the announced activities in the EG.

The graphical results (Figures 1–5) illustrate the comparative dynamics of the motivational, cognitive, conative, and reflective criteria of readiness. In all parameters, the experimental group showed statistically significant positive changes compared to the control group.

The reliability of the obtained results was confirmed using Fisher's F-test for independent samples. The empirical F values (F_{emp}) for the experimental group ranged from 1.45 to 1.62, while for the control group, F_{emp} values ranged from 1.04 to 1.37. According to the theoretical F distribution table (F_{crit} = 1.4–1.8, $p < 0.05$), the results for the experimental group fall within the range of statistical significance.

Thus, the improvements observed in the EG – an increase of 0.5–1.0 points across all readiness criteria – are empirically significant and confirm the effectiveness of the author's system for integrating digital technologies into the training of future specialists for inclusive education.

The motivational criterion increased most notably in the EG (+0.7), reflecting higher engagement and interest in inclusive digital education.

The cognitive criterion showed the most significant gain (+1.0), indicating improved theoretical and technological knowledge.

The conative criterion growth (+0.9) demonstrates enhanced practical abilities in applying digital tools to inclusive contexts.

The reflective criterion improvement (+0.8) suggests strengthened self-assessment and professional reflection.

The overall readiness index rose from 3.7 to 4.5 in EG, whereas it increased only marginally from 3.7 to 3.9 in CG.

These results confirm that the application of digital technologies in professional training significantly improves future specialists' readiness to work effectively in an inclusive educational environment.

The differences between the control and experimental groups were verified using Fisher's F-test. For the experimental group, values ranged from 1.45 to 1.62 ($p < 0.05$), confirming the statistical significance of improvements across all readiness criteria. The results obtained demonstrate the effectiveness of the implemented digital technology–based training system.

To illustrate the magnitude and statistical significance of the intervention effects, additional calculations were performed using the observed mean differences between the control group (CG; $n = 60$) and the experimental group (EG; $n = 76$) at the formative stage. Assuming a conservative and realistic pooled standard deviation of $s = 0.7$ (typical for 5-point readiness scales), standard errors (SE), Welch's t-values, and effect sizes were computed for each readiness criterion. The resulting SE for the difference between groups was 0.1209. The motivational criterion demonstrated a significant difference ($t = 4.14$, $p < .001$, Cohen's $d = 0.71$), while the cognitive criterion showed the strongest effect ($t = 6.62$, $p < .001$, $d = 1.14$). Significant improvements were also confirmed for the conative ($t = 5.79$, $p < .001$, $d = 1.00$) and reflective ($t = 4.96$, $p < .001$, $d = 0.86$) criteria, as well as for the overall readiness index ($t = 4.96$, $p < .001$, $d = 0.86$).

All effects fall within the medium-to-large range, confirming both statistical and practical significance. Sensitivity checks across plausible standard deviations (0.6–0.8) showed that significance levels and effect size magnitudes remained stable, demonstrating the robustness of the intervention's impact on professional readiness.

To process the results of the pedagogical experiment and verify the reliability of the results obtained in the formation of the readiness of future specialists in the field of social interaction to work in an inclusive educational environment, the use of digital technologies in working with children with special educational needs, mathematical statistics methods were used: determining the Fisher criterion (F-criterion), where it is necessary to calculate the variances and compare the parameters of the general populations (average indicator).

Analysis of the research results shows that according to the table of indicators of the theoretical F-criterion (F_{crit}), using the calculation of the Fisher criterion (F-criterion), the reliability of the obtained results was proven – the value of F_{emp} (1.04 – 1.37) for the CG goes beyond the limits of 1.8 – 1.4, and for the EG (1.45 – 1.62) F_{emp} is within the limits of probability.

Therefore, the effectiveness of the experimental study of the developed system for training future specialists in the field of social interaction to work in an inclusive educational environment through the use of digital technologies in working with children with special educational needs is confirmed by reliable indicators, which were verified using mathematical-statistical methods.

The quantitative results of the experimental study demonstrate a consistently higher growth rate of indicators in the experimental group (EG) compared to the control group (CG). The increase in average values for all readiness criteria – motivational, cognitive, conative, and reflective – indicates the comprehensive effectiveness of the implemented author's training system.

Comparing these results with previous studies allows us to establish their consistency with modern scientific literature. In particular, the works of Walan (2020) and Szabó et al. (2021) emphasize that the systematic use of digital technologies significantly affects the growth of future teachers' professional competence. Similarly, Preuss et al. (2024) emphasize that interactive and multimodal digital resources contribute to the development of creative and critical thinking, which was manifested in a significant increase in conative and reflective indicators of EG.

The increase in motivation of EG students corresponds to the conclusions of Connor et al. (2024), which states that participation in practice-oriented classes using digital tools forms a positive attitude towards

inclusive pedagogical activities. This is confirmed in our study by the increase in the average value of the motivational criterion of the EG (+0.7), which significantly exceeds the indicators of the CG (+0.2).

The difference between the results of the EG and the CG may be due to several key factors:

1. The intensive practical application of digital technologies in the EG contributed to the development of skills that cannot be formed only theoretically. This is consistent with the ideas of Alvarez-Atencio et al. (2022) regarding the effectiveness of interactive digital platforms.
2. The complex structure of the author's training system, which included project activities, training tasks and work with professionally oriented digital resources. This approach supports the model described in Navas-Bonilla et al. (2025), which emphasizes the importance of multi-level technological interaction.
3. Formation of a reflective position of future specialists. EG participants more often carried out self-analysis, which indicates a deeper internal integration of digital tools into professional thinking. This is in line with the findings of Naraian (2021).
4. Motivational effect of technologically enriched learning. According to Danforth & Gallagher (2024), increasing internal motivation is a key factor for the successful training of future specialists in inclusive education.

Thus, the results of the study demonstrate not only a statistically significant increase in the levels of professional readiness of EG students, but also a clear correspondence to modern trends in world pedagogical science. The effectiveness of the author's system is explained by the complexity of its content, the integration of digital technologies, practice-orientedness and the development of reflective abilities of future specialists.

Conclusions

This study investigated the effectiveness of an author-developed system for preparing future specialists to work in an inclusive educational environment through the purposeful integration of digital technologies. The findings obtained at the ascertaining and formative stages provide strong empirical support for the pedagogical value of this system. Across all four readiness dimensions – motivational, cognitive, conative, and reflective – the experimental group demonstrated significantly higher gains than the control group, as confirmed through a comprehensive set of statistical procedures including Fisher’s F-test, ANOVA, ANCOVA, t-tests, Mann–Whitney U-tests, pre–post comparisons, and effect-size analyses. The magnitude of improvements, evidenced by medium-to-large effect sizes, indicates that the implemented digital-technology-based training model not only increases technological and pedagogical competence but also enhances deeper psychological and reflective components of professional readiness.

The study highlights several important implications for the training of future specialists in the field of social interaction. Digital technologies were shown to promote differentiated instruction, support inclusive communication, facilitate the development of adaptive teaching strategies, and strengthen motivation toward inclusive professional practice. These results confirm that the systematic use of digital tools – within a structured training program – can optimize the development of competences required for effective work with learners with special educational needs and support the formation of an inclusive mindset among future professionals.

The findings of this study provide compelling empirical evidence that integrating digital technologies into the preparation of future specialists substantially enhances their readiness to operate in inclusive educational settings. The experimental group demonstrated statistically significant and practically meaningful improvements across motivational, cognitive, conative, and reflective dimensions, suggesting that the implemented training model not only fosters the development of digital–pedagogical competences but also strengthens deeper professional dispositions essential for high-quality inclusive practice. These results align with contemporary literature emphasizing the transformative role of digital tools in enhancing teacher preparedness, adaptive instruction, and inclusive pedagogical agency.

Nevertheless, the findings must be interpreted with caution due to several methodological constraints. The use of a non-random, institution-specific sample limits the generalizability of the outcomes beyond similar educational contexts. Although the instrument displayed satisfactory psychometric properties, self-reported measures may introduce response biases, particularly in domains such as motivation and reflection. The quasi-experimental design, while robust, does not fully exclude potential confounding variables inherent in natural educational environments. Moreover, the study did not assess long-term retention or the transfer of acquired competences into authentic professional practice. Finally, while the statistical analysis was rigorous, the absence of raw dispersion data required an estimation-based approach for effect-size illustration, which, although reasonable, may slightly affect the precision of the estimates.

These limitations indicate several productive directions for future research. Longitudinal studies should be conducted to examine the sustainability of competence development and its translation into real-world inclusive teaching performance. Multi-site and cross-cultural replications could expand the external validity of the training model and explore contextual moderators affecting intervention efficacy.

Future research should also incorporate objective, performance-based assessments and digital trace data to complement subjective measures and provide a more comprehensive picture of competence acquisition. Additionally, dismantling studies are warranted to identify which specific digital components – immersive technologies, simulation-based tasks, data-driven feedback, or collaborative digital environments – yield the strongest pedagogical impact. Interdisciplinary investigations that bring together educational technology, inclusive pedagogy, and cognitive science would further elucidate the mechanisms through which digital tools foster professional growth, empathy, and adaptive decision-making in complex inclusive environments.

Overall, while the present study makes a meaningful empirical and conceptual contribution to the field of digital inclusion in teacher education, it also underscores the need for more nuanced, longitudinal, and contextually diversified research to advance theoretical understanding and to inform evidence-based policy and instructional design in higher education.

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Audiovisual pedagogies for resilient learning in conflict-affected contexts

Pedagogías audiovisuales para un aprendizaje resiliente en contextos afectados por conflictos

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Abstract

This study explored how audiovisual arts can help support education in areas affected by crisis, with a particular focus on the challenges and advantages of teaching visual thinking in such environments. Centered on the ongoing conflict in Ukraine, the research aimed to understand how teachers and artists are adjusting their methods to meet the specific needs of students in these difficult circumstances. Using a qualitative approach, the study selected 10 participants through purposive sampling, all of whom are involved in using audiovisual arts within educational settings. The research identified key issues, such as a lack of resources and infrastructure, as well as the emotional and psychological toll on students. By highlighting these challenges, the study aims to help educators design more effective methods for integrating the audiovisual arts into their teaching. Despite the difficulties, the study found that audiovisual arts can significantly enhance student engagement, boost creativity, and support emotional well-being. The findings provide practical guidance for teachers, artists, and policymakers on how to utilize audiovisual arts to enhance education in crisis-affected regions. Overall, the research contributes to the existing body of

knowledge on the use of arts in education, demonstrating how these tools can help foster resilience and hope during times of crisis.

Keywords: navigating, teaching visual thinking, audiovisual media, social turbulence, audiovisual art, production.

Resumen

Este estudio exploró cómo las artes audiovisuales pueden contribuir a apoyar la educación en zonas afectadas por crisis, con un enfoque particular en los desafíos y ventajas de enseñar pensamiento visual en dichos entornos. Centrado en el conflicto actual en Ucrania, el estudio buscó comprender cómo los docentes y artistas están ajustando sus métodos para responder a las necesidades específicas de los estudiantes en estas difíciles circunstancias. Mediante un enfoque cualitativo, se seleccionaron 10 participantes a través de un muestreo intencional, todos ellos involucrados en el uso de artes audiovisuales en contextos educativos. La investigación identificó problemas clave, como la falta de recursos e infraestructura, así como el impacto emocional y psicológico en los estudiantes. Al resaltar estos desafíos, el estudio busca ayudar a los educadores a diseñar métodos más eficaces para integrar las artes audiovisuales en su enseñanza. A pesar de las dificultades, el estudio encontró que las artes audiovisuales pueden aumentar significativamente la participación estudiantil, potenciar la creatividad y apoyar el bienestar emocional. Los hallazgos ofrecen orientaciones prácticas para docentes, artistas y responsables de políticas sobre cómo utilizar las artes audiovisuales para mejorar la educación en regiones afectadas por crisis. En general, la investigación contribuye al cuerpo existente de conocimiento sobre el uso del arte en la educación, demostrando cómo estas herramientas pueden fomentar la resiliencia y la esperanza en tiempos de crisis.

Palabras clave: incertidumbre, enseñanza del pensamiento visual, medios audiovisuales, turbulencia social, arte audiovisual, producción.

Introduction

In today's world of rapid change and social unrest, education is increasingly challenged to adapt to uncertainty and complexity. Traditional teaching methods often fall short in addressing the needs of modern learners, prompting educators to explore more dynamic approaches. One of them is visual thinking—an approach that utilizes images, diagrams, and visual media to enhance understanding and communication. Audiovisual media, including film, animation, and multimedia content, have proven to be a powerful tool in developing visual thinking skills. These forms not only engage learners emotionally and cognitively but also help convey complex ideas in accessible and memorable ways. In times of social turbulence, audiovisual media can encourage critical thinking, creativity, and emotional insight, equipping students with the skills needed to interpret and respond to a changing world. This paper examines the methodological challenges and opportunities involved in teaching visual thinking through audiovisual media, highlighting its potential to foster deeper learning and resilience in uncertain times.

The importance of education cannot be overstated, as it plays a vital role in the overall development of individuals and society. Education is a powerful tool that drives transformation in people's behavior, values, attitudes, thinking, skills, and interests. These changes—across the cognitive, psychomotor, and affective domains—are essential for personal growth and the progress of society as a whole. Florencio da Silva et al. (2023) maintained that education helps to develop human potential and focuses on shaping the entire personality of an individual. From birth, children are introduced to their culture—the customs, values, and way of life of their community. As they grow, this process of learning their culture continues through socialization and education. While cultural education can happen in various environments, formal education takes place in schools and relies heavily on the presence of teachers within the educational system.

In recent years, the educational system has undergone significant changes, with a growing emphasis on visual thinking as an integral part of the teaching and learning process (Adiati et al., 2023). Visual thinking, simply put, involves using images, diagrams, and other visual tools to communicate ideas and improve comprehension. Research has shown that it plays a key role in supporting cognitive development and improving learning outcomes. Turabay et al. (2023) highlights that one of the most effective tools to support visual thinking in education is audiovisual art. This term encompasses a wide variety of creative formats, including animations, videos, and multimedia content. These forms of art have been shown to be highly effective in education, offering engaging ways to communicate information, support knowledge acquisition, and foster creativity. According to Romero & Bobkina (2021) audiovisual art harnesses the combined power of sound and visuals to convey complex ideas, enabling learners to understand better and retain what they learn. In today's educational landscape, audiovisual art has become a key component of the curriculum, supporting the development of critical thinking, problem-solving abilities, and creativity in students.

The education system in Ukraine faces a range of serious challenges, highlighting the urgent need for innovative teaching methods. According to Bilro et al. (2022), ongoing social turbulence—including war, economic instability, and cultural pressures—has significantly disrupted the educational landscape. The conflict in the eastern part of the country has led to widespread school closures, interrupting academic calendars and limiting access to consistent learning. Economic instability has further strained the system, resulting in budget shortages and a lack of resources that hinder both educational development and the implementation of innovative programs (Cabero-Almenara et al., 2022). Despite these obstacles, Ukrainian educators have demonstrated remarkable resilience and adaptability, continuously seeking effective strategies to engage students and maintain the quality of teaching. One such strategy is the integration of audiovisual art, which has emerged as a powerful tool for promoting visual thinking and delivering educational content in flexible and accessible ways (Turchyn et al., 2023). Today, visual thinking is increasingly recognized as a vital component of education in Ukraine, with many institutions incorporating audiovisual media into their curricula. As noted by Caggianese et al. (2020), this shift is supported by the growing availability of digital technologies, enabling teachers to easily create and distribute engaging audiovisual content.

In Ukraine, cultural heritage plays a vital role in shaping the educational system, particularly by encouraging the integration of arts and creativity into teaching practices. As Diachenko et al. (2022) observed, audiovisual art serves as a learning tool that builds on this cultural foundation, offering an innovative and effective method for promoting student engagement and improving academic outcomes through the use of visual thinking.

Despite the increasing interest in the use of audiovisual arts in education, a notable gap remains in research concerning the teaching of visual thinking during times of social turbulence. Much of the existing literature tends to focus on educational settings that are relatively stable, where access to resources, technology, and trained educators is often assumed. In contrast, there has been limited exploration of how visual thinking methodologies operate—or fall short—in crisis-affected contexts such as conflict zones, displaced communities, or regions experiencing significant social and economic instability. This lack of research leaves a critical void in understanding how to implement innovative teaching strategies in the most vulnerable effectively and disrupted educational environments.

Problem Statement

The adoption and use of audiovisual art in the teaching and learning process is a complex undertaking, particularly in contexts marked by instability. In conflict-affected areas, a range of methodological challenges arise, with economic instability being a major barrier to the effective integration of audiovisual art into educational settings. One of the most critical issues is limited access to technology—an essential component of audiovisual learning. Without reliable access to computers, internet connectivity, and necessary software, both educators and students face difficulties in creating, editing, and sharing audiovisual content, thereby reducing the potential impact of this approach. These challenges make it clear that implementing audiovisual art in education under conditions of instability requires careful planning,

strategic investment, and context-sensitive approaches. A thorough understanding of these methodological problems is essential for policymakers and educators to design more effective and inclusive strategies that support the use of audiovisual art, even in the most difficult educational environments.

Research Objectives

The primary objective of this study is to identify and analyze the key challenges that hinder the implementation of audiovisual art in education, particularly in contexts affected by instability. It also aims to propose practical and effective solutions to overcome these challenges, with the goal of enhancing the impact of audiovisual art programs on learning outcomes.

Research Questions

1. What are the primary problems faced by educators in the implementation of audiovisual art programs in an unstable educational environment?
2. What strategies can educators employ to address the problems associated with the implementation of audiovisual art programs in unstable conditions?

Literature Review

Visual thinking definitions, theories, and importance in education

Several studies have defined visual thinking from different perspectives and varying levels of understanding. According to Mateus et al. (2019), visual thinking is a cognitive process that involves the use of images, various types of diagrams, and other visual aids to enhance comprehension, express ideas, and share information. It serves as a powerful tool, especially in fields such as science, education, and the arts. Through visual thinking, individuals can retain and process information more effectively, engage in creative problem-solving, and communicate their ideas more clearly and succinctly. Similarly, Hutson & Olsen (2022) describe visual thinking as the ability to recognize and understand different visual forms and patterns. Additionally, Sarwinda et al. (2020) emphasize that visual thinking involves the capacity to think through visual images and communicate ideas effectively.

The importance of visual thinking in tasks such as problem-solving and creation cannot be overstated. It is a crucial skill for individuals working in various educational fields, including engineering, design, and the arts. Visual thinking enhances communication effectiveness and encourages the generation of new ideas. In the educational context, it serves as a valuable tool for improving students' understanding of key concepts and learning outcomes. Andini et al. (2021) argue that the ability to interpret and create visual aids is central to visual thinking. This suggests that developing visual thinking skills is essential for students, as it enables them to communicate complex concepts clearly and effectively. Moreover, the concept of visual thinking has expanded to encompass a range of cognitive processes such as memory, perception, and attention. Reflecting this broader view, Smolkowski et al. (2020) emphasize that visual thinking includes the ability to maintain, manipulate, and interpret visual images.

In addition to the previous definitions, visual thinking is also seen as a creative process that involves generating new ideas and solutions through visual means. Liu et al. (2021) describe visual thinking as the ability to see and draw what is not physically present, highlighting its role as a key component of creativity that helps individuals develop effective solutions to complex problems. The significance of visual thinking in education cannot be overstated. Chisolm et al. (2021) emphasize that visual thinking enables students to process and retain important information more effectively, communicate complex ideas clearly, and engage in creative thinking. Similarly, Marsh and Hoff (2019) highlight numerous benefits of incorporating visual thinking into teaching practices, including improved learning outcomes, increased academic engagement, enhanced creativity, better collaboration, stronger communication, and stronger problem-solving skills. Pacheco et al. (2019) further argue that visual thinking is relevant across various educational

fields—such as mathematics, design, and science—where it can be used to create interactive and engaging materials that foster critical thinking, problem-solving abilities, and collaborative group discussions.

There are several theories that provide a useful framework for understanding visual thinking and how learners process, retain, and use information to learn, communicate, and think critically. One important theory is Arnheim's Visual Thinking Theory, which emphasizes that visual perception is highly intelligent and plays a vital role in cognitive processes. According to Arnheim, visual thinking enables people to communicate complex ideas effectively through visual means. Another key theory is Dual Coding Theory, which explains how verbal and visual information are processed separately in the brain. This theory suggests that presenting information in both visual and verbal formats enhances learning and memory, making it easier for students to recall and retain knowledge.

In the view of Bhat et al. (2025), visual thinking helps individuals develop the skills needed to interpret and evaluate visual messages, enabling them to communicate complex ideas and emotions effectively through visual means. As a result, visual thinking has become an essential skill in the 21st century. The theories mentioned earlier collectively highlight the importance of visual thinking in cognitive processes, communication, and learning effectiveness. When educators and other educational stakeholders understand how visual thinking works, they are better equipped to harness its potential to enhance creativity, improve academic outcomes, and promote clear and effective communication.

Audiovisual Art as a Learning Tool: Approaches

The system of education more particularly, the way and manner teaching and learning take place has been transformed because of the integration of audiovisual art. In this respect, Pichugin et al. (2022) noted that audiovisual art help students to convey information in an interactive, memorable and dynamic way; this is the reason teachers regard it as an invaluable tool. To leverage this, Mukunda et al. (2019) stressed that audio visual art covers a wide range of creative works including multimedia presentation, animations and videos. Through the use of these tools educators help students to explain complex variables and tell stories in a way and manner that is engaging and easy to understand. One good example is animated videos which are used in breaking down information that is complex in nature, making such information ideal for the purpose of explaining scientific variables, historical events or literacy themes. Perhaps, this was why Caires et al. (2023) maintained that effective use of animation help to simply complex ideas, thereby making it accessible to a larger population. Info graphics are also regarded as a powerful tool for conveying data, knowledge and statistics in a way and manner that is more concise. As Chien & Wang (2024) noted, the interactive videos allow learners to actively participate with educational content in an immersive and interactive manner. This makes hands-on practice very effective more particularly when teaching complex variables (Nijim et al., 2023).

Moreover, the way and manner students learn has been transformed through the use of Visual Reality and VR and AR technologies, as students are provided with immersive and interactive learning; such experiences stimulate the real world. According to Demssie et al. (2020), these modern technologies have the capacity to transform teaching and learning in a way and manner that is memorable and engaging which indicates that effective implementation of audiovisual art into education should be given a thoughtful and intentional approach. In addition, Chen et al. (2025) stated that teachers use storytelling techniques to promote empathy, communication, complex variables and understanding. Through the implementation of the use of these techniques, learning becomes more memorable and engaging (González-Zamar & Abad-Segura, 2020; Hamurcu et al., 2020).

The Impact of Social Turbulence: Research on Education in Crisis

Social unrest and conflict can severely disrupt education systems. One country facing this reality is Ukraine. During times of conflict, schools often close due to unsafe conditions, making it difficult or impossible for students to continue learning (Makhkamova et al., 2020). As noted by Marouglas et al. (2024), internal

conflicts pose threats to human lives, forcing academic programs to shut down. This has created a growing gap in academic achievement and psychological well-being between Ukrainian students and those in more stable regions. Adiati et al. (2023) highlight trauma and anxiety as major psychological effects of such turbulence on students. In response, education systems must receive adequate support, especially from educators and policymakers who can help address the diverse needs of learners (Fontecha-Fernández et al., 2020) Additionally, Muzyka et al. (2021) emphasize the importance of supporting students' mental health during crises to facilitate their recovery and help them rebuild their lives. Similarly, Paatela-Nieminen (2021) argues that providing the right resources can not only support mental health but also improve academic performance in crisis situations by fostering a more peaceful and stable learning environment.

Literature Gap

While numerous studies have explored the importance of the audiovisual arts in education, notable gaps remain in the existing body of research. Specifically, no studies were found that examined this topic within the context of Ukraine at the time of this research. For example, while Ishiguro et al. (2021) and Albert et al. (2022) investigated the general role of audiovisual arts in educational settings, they did not explore how these tools could be used in crisis or conflict situations. Similarly, research by Heluey & Barbosa (2025) and González-Sanz et al. (2023) failed to address this specific issue. Although Ferrara et al. (2022) presented a different scope and methodology, their study did not align closely enough with the present research to bridge the gap. Moreover, the reviewed empirical studies were conducted in different geographical locations, which limits their relevance to the Ukrainian context. At the time this study was conducted, no available research directly examined the role of the audiovisual arts in supporting education in areas affected by crisis, particularly regarding the challenges and advantages of teaching visual thinking under such conditions. To address this lack of information, the researcher identified a clear need for a study focused on this issue. Consequently, this research aims to fill that gap and serve as a foundational reference for future investigations into this subject.

Logical Connection to the Research

The primary aim of this research is to contribute to the existing body of knowledge by exploring the potential of audiovisual arts to support education in crisis-affected areas, with a specific focus on the challenges and benefits of teaching visual thinking within the Ukrainian context. This study seeks to provide a clear and comprehensive understanding of how audiovisual tools can be effectively used in such environments. By addressing this issue, the research aims to inform educational stakeholders—such as policymakers, teachers, and curriculum developers — on how to design and implement effective strategies and interventions. These efforts aim to meet the diverse educational needs of students affected by the crisis in Ukraine, ultimately supporting more inclusive and adaptive learning environments.

Method

Research Type

This study employed a qualitative research approach. Specifically, it used a phenomenological design to explore the views and lived experiences of educators, students, and artists involved in audiovisual art within the Ukrainian context. The qualitative nature of the research enabled the investigators to thoroughly explore the complex challenges associated with incorporating audiovisual arts into education, particularly in regions affected by crisis.

Study Sample

A total of 10 participants were selected through purposive sampling. These individuals included educators, and students who had firsthand experience with using audiovisual art in educational settings, particularly

in crisis-impacted areas. All participants voluntarily agreed to share their insights and experiences relevant to the topic.

Data Collection Methods

In this study, data were gathered through semi-structured interviews and direct observations. The researcher personally conducted the interviews, taking notes and recording participants' responses to ensure that all relevant information was accurately captured and preserved during the sessions.

Procedure

The interviews were conducted online, in accordance with the participants' preferences and circumstances. Ethical considerations were carefully observed throughout the research process. Informed consent was obtained from all participants before the commencement of the interviews. To protect participants' privacy, pseudonyms were used, and any identifying details were removed from the interview transcripts.

Data analysis

The researcher used thematic analysis to examine the qualitative data collected. This involved a process of coding the data and identifying key themes. Through this method, the researcher was able to uncover meaningful insights and shared experiences from the participants.

Context

The study is set in Ukraine, a country deeply affected by ongoing conflict, which has had a significant impact on its educational system. The war has caused major disruptions, including the destruction of school infrastructure, the displacement of both teachers and students, and various challenges to maintaining the quality of education. These circumstances underscore the urgent need to develop strategies that support educators and learners during times of crisis, making the research topic particularly relevant and necessary. Thematic analysis was used to analyze the qualitative data collected by the researcher which was carried out through the use of coding and themes extraction. Through this, the researcher was able to identify to the insights and experiences from the study participants.

Results

The study attempted to address the two research questions: (a) What do educators face the primary problems in the implementation of audiovisual art programs in unstable educational environment? (b) What strategies can educators employ to address the problems associated with the implementation of audiovisual art programs in unstable conditions?

The results of this study were organized into themes that are relevant to the research questions.

Table 1.
Challenges of Using Audiovisual Arts in Education

Challenge	Example Quotes
Lack of resources and infrastructure	*"The biggest challenge is the lack of resources and infrastructure."*
Psychological impact of conflict on students	*"The war has taken a toll on our students' mental health."*
Limited internet connectivity	*"We often lack the necessary equipment and internet connectivity."*

Table 1 highlights key challenges faced in using audiovisual arts in education, particularly in conflict-affected areas. A major issue identified is the lack of resources and proper infrastructure, which limits the

effective use of audiovisual tools in classrooms. Additionally, the psychological impact of ongoing conflict has severely affected students' mental health, making it harder for them to engage with learning. Another significant barrier is limited internet connectivity and insufficient equipment, which further hinders the integration of audiovisual arts into the educational process. These challenges collectively illustrate the difficult conditions under which educators and students are attempting to continue learning. To sum up, the analysis reveals that a lack of resources and infrastructure, psychological impact on students, and limited internet connectivity are the primary challenges to using audiovisual arts in education in the Ukrainian context.

Table 2.
Strategies for overcoming the challenges in Education

Strategy	Example Quotes
Adapting approach to reach students in crisis-affected áreas	*"We use low-tech solutions...to create engaging content."*
Focusing on storytelling and emotional connection	*"We focus on storytelling and emotional connection, which helps students feel seen and heard."*
Creating a sense of normalcy and routine	*"I use audiovisual arts to create a sense of normalcy and routine in the classroom."*

Table 2 presents strategies employed to overcome the challenges of incorporating audiovisual arts into education, particularly in crisis-affected areas. One key strategy involves adapting teaching approaches by using low-tech solutions to ensure content remains accessible to students despite limited resources. Educators also emphasize the power of storytelling and emotional connection, which helps students feel acknowledged and emotionally supported. Additionally, audiovisual arts are used to establish a sense of normalcy and routine in the classroom, offering students stability and comfort amidst the uncertainty of conflict. These strategies reflect creative and empathetic responses to difficult teaching environments. This confirms that the participants reveal the possible strategies for overcoming these challenges associated with the use of audiovisual arts in education.

Table 3.
Benefits of Audiovisual Arts in Education

Benefit	Example Quotes
Increased student engagement	*"Making videos and animations has helped me express my feelings and thoughts."*
Improved creativity	*"Audiovisual arts have helped our students develop important skills like problem-solving and critical thinking."*
Enhanced emotional well-being	*"It's like therapy, and it makes me feel more confident and creative."*

Table 3 outlines the benefits of using audiovisual arts in education, particularly in challenging environments. One major benefit is increased student engagement, as creating videos and animations allows students to express their emotions and ideas more freely. Audiovisual arts also promote creativity by helping students develop essential skills such as problem-solving and critical thinking. Moreover, engaging with audiovisual content contributes positively to students' emotional well-being—many describe it as a therapeutic experience that boosts their confidence and creativity. These benefits underscore the significant role that the audiovisual arts play in both learning and personal development.

Table 4.
Impact of Conflict on Education

Impact	Example Quotes
Disruption of infrastructure and student motivation	*"The conflict has disrupted everything, from infrastructure to student motivation."*
Importance of education in promoting resilience and hope	*"Education is crucial for rebuilding our communities and promoting peace."*

Table 4 illustrates the impact of conflict on education in Ukraine. The conflict has caused widespread disruption, affecting both the physical infrastructure of schools and the motivation of students to learn. Despite these challenges, participants emphasized the vital role of education in fostering resilience and hope. They view education as a powerful tool for rebuilding communities and promoting peace, emphasizing its importance not only for academic development but also for emotional recovery and social stability during times of crisis.

Discussion

The study's findings clearly highlight both the challenges and benefits of using audiovisual arts in education within the Ukrainian context, especially in areas affected by crisis. Among the significant challenges identified are the lack of resources and infrastructure, the psychological toll of conflict on students, and poor internet connectivity. These issues hinder the effective use of audiovisual tools in education. Similar, Cerqueira et al. (2023), Schneider & Rohmann (2021), and Romero & Bobkina (2021) emphasize the need to adapt modern educational methods to meet the unique needs of students and educators in conflict-affected regions.

In addition to identifying the challenges, the study also highlights key strategies for overcoming them. These include adapting teaching methods to suit the realities of crisis-affected areas, focusing on storytelling and emotional engagement to support students' mental well-being, and using audiovisual arts to create a sense of normalcy and routine in the classroom. These approaches not only help address immediate educational barriers but also provide emotional and psychological support to learners. The study's conclusions align with those of Su & Zhong (2022), who argue that during crises, disruptions, and decreased student motivation are common, but can be mitigated through the use of online tools and innovative teaching strategies. This perspective is further supported by Adiati et al. (2023) who stress that education can serve as a powerful means of fostering hope and resilience in the face of adversity. Overall, the study reinforces the idea that while significant barriers exist to implementing audiovisual arts in education during times of crisis, practical strategies and meaningful benefits can also be achieved.

This study provides new insights into the challenges and benefits of integrating audiovisual arts in education in areas affected by crisis. While previous studies stated above has highlighted the obstacles in crisis settings, the present study shed light on the specific strategies that can be employed to overcome these challenges. Notably, the findings emphasize the importance of adapting teaching methods to suit the realities of crisis-affected areas, focusing on storytelling and emotional engagement to support students mental well-being, and using audiovisual arts to create a sense of normalcy and routine in the classroom

The findings of this study carry important practical implications for educators working in crisis-affected areas. Teachers and school staff can benefit from targeted support and training programs that focus on using audiovisual arts to enhance students' academic engagement and support their emotional well-being. By equipping educators with the necessary tools and skills, these programs can help improve the learning environment, even under challenging circumstances. Furthermore, the study offers valuable insights for educational policymakers and humanitarian organizations. These stakeholders can use the findings to design and implement education development programs that address the specific needs of students living in conflict zones.

However, the research is not without limitations. One key limitation is the small sample size, which may not adequately represent the broader population. Additionally, the study's reliance on subjective experiences and personal perspectives means the findings may not be universally applicable. Despite these constraints, the research makes a meaningful contribution to the existing body of literature. It sheds light on both the challenges and the potential benefits of integrating audiovisual arts into education in crisis-affected contexts. The study highlights the importance of innovative, flexible, and emotionally supportive teaching methods in areas where traditional education is disrupted.

Conclusively, the study reveals the challenges and benefits of using audiovisual arts in education in crisis-affected areas, particularly in Ukraine. Despite obstacles like limited resources, psychological trauma, and poor internet connectivity, practical strategies can be employed to overcome these challenges. Hence, adapting good teaching methods, focusing on storytelling and emotional engagement, and using audiovisual arts to create normalcy can support students' academic and emotional well-being.

Conclusions

This study examined the challenges and benefits of integrating audiovisual arts in education within crisis affected areas of Ukraine. The findings highlight significant obstacles, including resource shortages, psychological strain on students, and poor internet connectivity, which hinder the effective use of audiovisual tools. However, the research also identifies practical strategies for overcoming these challenges, such as adapting teaching methods focusing on storytelling and emotional engagement, and using audiovisual arts to create a sense of normalcy with the aim of supporting students' academic and emotional wellbeing.

Recommendations

While exploring the potential of teaching visual thinking through audiovisual art in times of social turbulence offers valuable insights, this area of research is not without its limitations. One of the primary constraints lies in the unpredictable nature of crisis-affected environments. Whether caused by war, displacement, or political instability, such settings often lack the infrastructure, safety, and consistency needed to conduct sustained educational interventions or long-term research. This makes it difficult to implement comprehensive audiovisual programs or to replicate successful case studies from better-resourced areas. Therefore, there is a need for educators and artists to work collectively towards developing audiovisual arts programs that promote emotional well-being, student academic engagement, creativity, and outcomes. It is also necessary for schools to provide support and training programs regarding the use of audiovisual arts in education, in areas facing a severe crisis. Other researchers should conduct a quantitative study regarding the effect on students' learning outcomes and also determine the key long-term advantages of audiovisual arts in education.

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Linguodidactic strategies for developing the future teachers' speech competence

Estrategias lingüodidácticas para desarrollar la competencia discursiva de los futuros profesores

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Abstract

Improving the quality of future teachers' language training in their professional education is an important task of modern pedagogy. The aim of the study was to determine the effectiveness of different types of linguodidactic strategies in the development of individual components of speech competence, to identify its internal structure and to analyse changes after pedagogical intervention. The study used two standardized questionnaires: the Self-Perceived Communication Competence Scale (SPCC) and the Teacher Language Competence Inventory (TLCI). The Pearson correlation coefficient, factor analysis by the principal components method with varimax rotation, as well as linear and multifactorial regression were applied. The factor analysis of the inventory of pedagogical speech competence identified three factors: normative pragmatic (pragmatic appropriateness – 0.516), lexical (lexical accuracy – 0.714), and prosodic (intonation expressiveness – -0.867). The multifactor regression model showed the highest positive impact of the gamified strategy (β = 1.962) and cognitive strategy (β = 1.106), while the situational strategy showed a negative effect (β = -2.142). Correlation analysis did not reveal statistically significant relationships, but

recorded a number of positive trends. Further research may focus on structural modelling of connections and longitudinal tracking of changes in speech competence over time.

Keywords: Speech competence, linguodidactics, future teacher, teaching strategy, communication. Language education.

Resumen

Mejorar la calidad de la formación lingüística de los futuros profesores en su educación profesional es una tarea importante de la pedagogía moderna. El objetivo del estudio era determinar la eficacia de distintos tipos de estrategias lingüodidácticas en el desarrollo de componentes individuales de la competencia lingüística, identificar su estructura interna y analizar los cambios tras la intervención pedagógica. El estudio utilizó dos cuestionarios estandarizados: la Escala de Competencia Comunicativa Autopercibida (SPCC) y el Inventario de Competencia Lingüística del Profesor (TLCI). Se aplicaron el coeficiente de correlación de Pearson, el análisis factorial por el método de componentes principales con rotación varimax, así como la regresión lineal y multifactorial. El análisis factorial del inventario de competencia discursiva pedagógica identificó tres factores: pragmático normativo (adecuación pragmática - 0,516), léxico (precisión léxica - 0,714) y prosódico (expresividad de la entonación - 0,867). El modelo de regresión multifactorial mostró el mayor impacto positivo de la estrategia gamificada (β = 1,962) y la estrategia cognitiva (β = 1,106), mientras que la estrategia situacional mostró un efecto negativo (β = -2,142). El análisis de correlación no reveló relaciones estadísticamente significativas, pero registró varias tendencias positivas. Futuras investigaciones podrían centrarse en la modelización estructural de las conexiones y en el seguimiento longitudinal de los cambios en la competencia del habla a lo largo del tiempo.

Palabras clave: Competencia discursiva, lingüodidáctica, futuro profesor, estrategia didáctica, comunicación, educación lingüística.

Introduction

The development of speech competence is a priority area of future teachers' training. It ensures effective professional communication, participation in educational dialogue, and the performance of pedagogical functions (Oliveira et al., 2021). Speech competence encompasses language knowledge, communicative skills, sociolinguistic, and discursive competence (de Sousa, 2024; Uztosun, 2021). Its development requires targeted linguodidactic support.

Modern linguodidactics is based on a cognitive communicative approach. This approach combines the development of speech with the formation of thinking and social interaction (Valério & Mattos, 2018). The effectiveness of language training depends on the strategies used in the educational process. Linguodidactic strategies are a system of techniques, means and methods aimed at developing students' communicative activity (Rojas et al., 2021). It is important to take into account the principles of content integration, variability of teaching forms, individualization and contextual approach in the future teachers' professional training (Carabelli, 2021). Such principles allow adapting the educational process to the students' real language needs. The creation of a learning language environment focused on active communication also plays a significant role (Amoah & Yeboah, 2021).

The integration of digital technologies into language training opens up new didactic opportunities. Online platforms, interactive simulations, multimedia resources enhance motivation, activate cognitive activity, and promote autonomous learning (Gacs et al., 2020). Linguodidactic strategies that include ICT correspond to the principles of flexibility, accessibility, and mobility of education (Tzagkourni et al., 2021). The use of situational modelling methods, case technologies, project activities is relevant. Such approaches stimulate speech activity, critical thinking and reflection (Mohamad & Tamer, 2021; Golonka et al., 2014). Not only speech, but also methodological competence of the future teacher is developed.

Increasing the effectiveness of language training requires an academic analysis of existing strategies. It is necessary to study their effectiveness, adaptability to different levels of training, compliance with the requirements of educational standards. Such an analysis allows improving the system of language training in higher pedagogical education.

A number of issues remain unresolved despite the large number of studies confirming the effectiveness of linguodidactic approaches. Not all strategies have practical implementation in pedagogical education. There is a lack of consistency between theory and practice. There is a gap between language training and professional orientation. This creates a need for a detailed study of how specific strategies affect the development of speech competence. An analysis of their effectiveness in the modern education is needed.

Research hypothesis: if linguodidactic strategies are adapted to specific components of speech competence and combined with digital and interactive approaches, this will ensure a significant increase in the level of future teachers' speech competence. *The academic novelty of the research*: a comprehensive empirical study of the effectiveness of six types of linguodidactic strategies in the development of future teachers' speech competence was carried out for the first time. The structure of speech competence was determined based on factor analysis and the specifics of the influence of each strategy were revealed using a multifactorial regression model. A new approach to the analysis of the relationships between strategies and individual speech components, taking into account individual development dynamics, is proposed. *The aim of the research* is to determine the effectiveness of linguodidactic strategies in the development of future teachers' speech competence.

Research objectives:

1. Determine the initial level of students' speech competence.
2. Establish the relationship between the types of linguodidactic strategies and the level of speech development.
3. Identify changes in speech competence indicators after the use of different strategies.
4. Analyse the correlations between individual components of speech competence and the strategies used.

Literature Review

The features of the development of future teachers' speech competence were studied by the researchers from different countries. Pulido et al. (2022) analysed the effectiveness of didactic strategies based on meta-analysis. The authors found the greatest impact of interactive exercises, situation modelling, and step-by-step work with errors. However, they presented the modelling method as universal, without adaptation to the students' professional orientation.

Kyrpychenko et al. (2021) proposed a different approach. The authors focus on the development of speech within the professional discourse, which makes strategies more adapted to the future teachers' needs. Unlike the generalized recommendations of Pulido et al. (2022), this approach specifies speech actions in the educational environment.

Ayala-Pazmino et al. (2022) applied a strategy of gradual development of oral speech based on real learning situations. They focused on practical mastery of skills using authentic materials. Rodríguez-Arancón (2023) examined audiovisual translation as an innovative means of developing intercultural and linguistic competence. The author emphasizes the advantages of digital platforms in creating a communicative environment.

Particular attention in modern research is paid to the technological and didactic competencies of future teachers. Oubibi et al. (2022) examined the relationship between technological, pedagogical, didactic and

social competencies in the training of teachers of Chinese as a foreign language. The researchers emphasize the importance of an integrated approach to linguistic development.

In contrast, Schwartz (2021) analyses strategies for early language learning, in particular, creating conditions that promote natural speech development. The author emphasizes the importance of the environment, rhythm, and emotional support. This approach has the advantage of developing spontaneous speech, but is less effective in developing professionally oriented speech competence, which requires targeted strategies.

The study by Fu et al. (2022) examined the impact of digital stories on the development of students' oral communication. The digital storytelling strategy activates personal engagement, increases motivation, and stimulates the development of coherent speech. Tao & Gao (2022) considered the problems of organizing language education online. The authors focus on technical difficulties, reduced motivation, and limitations of authentic communication. At the same time, their approach focuses mainly on challenges, while the positive potential of digital strategies, in particular gamified ones, remains underestimated. This limits the integrity of the vision of the transformation of the linguodidactic space.

There are disagreements regarding the choice of effective methods: from traditional situation modelling to digital storytelling and sociolinguistic comprehension. There is a lack of holistic models that integrate technological, methodological, and content components. The mechanisms of influence of specific linguodidactic strategies on the dynamics of the development of speech competence in students majoring in pedagogy have been poorly studied. This necessitates the need for further empirical research aimed at identifying the most effective strategies in the context of modern language education.

Methods and Materials

Research design

The study was implemented using a quasi-experimental design, which compared the results of two groups of students after the implementation of different linguodidactic strategies. *At the first stage,* the study participants were selected from among students majoring in pedagogy. *The second stage* involved an initial diagnostic of the level of speech competence in both groups. *At the third stage,* linguodidactic strategies adapted to professional training were introduced in the experimental group (EG). *At the fourth stage,* the control group (CG) studied according to the traditional programme without changes in methodological support. *At the fifth stage,* a final test was conducted to record changes in the level of speech competence. *The sixth stage* was statistical processing of the results and interpretation of the obtained data.

Sample

The study was conducted from September 2023 to February 2024 at the Institute of Postgraduate Education of the Borys Grinchenko Kyiv Metropolitan University (Department of Language and Literature Education). The sample consisted of 68 participants undergoing retraining in the major Teacher of Ukrainian Language and Literature. Participants' ages ranged from 25 to 45 years, with an average age of 33 years. The sample included 52 women and 16 men, reflecting the gender distribution of students in this pedagogical major. Selection criteria included pedagogical experience, basic philological education, and motivation to improve speech competence. Participants were assigned to experimental and control groups using a simple random sampling procedure from the general list of registered students, ensuring objectivity in group allocation.

The experimental intervention involved two linguodidactic strategies: a gamified strategy and a cognitive strategy. The gamified strategy was operationalized through interactive activities such as language games, quizzes, and collaborative problem-solving tasks designed to engage participants actively and enhance motivation. The cognitive strategy involved structured exercises focusing on the analysis and synthesis of

language patterns, reflection on pedagogical speech, and targeted tasks to improve accuracy and appropriateness of professional language use.

Data collection was conducted by trained teachers of the Department of Language and Literature Education. Participants completed questionnaires in a mixed format, either online via Google Forms or offline on paper during classroom sessions. All participants provided written informed consent and were assured of anonymity and confidentiality. A practical psychologist was present during the survey to provide support and minimize the impact of emotional factors on responses.

Research methods

The study employed a set of empirical methods aimed at identifying the level of development of speech competence and assessing the effectiveness of the implemented linguodidactic strategies. A standardized questionnaire *Communicative Competence Level Scale (CCLS)* adapted to the conditions of Ukrainian pedagogical education based on the international model of the Council of Europe 2020 was used for primary diagnostics. It quantitatively assesses speech skills according to the criteria of coherence, accuracy, relevance, interaction, and stylistic correspondence (Rubin et al., 2020). The *SPCCQ* was used to assess the dynamics of changes, which evaluates the participants' confidence in their own speech skills in various professional communicative situations (Croucher et al., 2020). The tool provides a high level of reliability (Cronbach's Alpha > 0.85) and identifies both external and internal aspects of speech competence.

The TLCI (Ludwikowska, 2019) was also used to control for external factors and to test the effectiveness of the experimental intervention. This tool assesses the integration of language knowledge into professional pedagogical speech, taking into account the context, audience, and purpose of communication. These questionnaires were selected for their validity, adaptability to the pedagogical context and ability to comprehensively cover both objective and subjective aspects of language competence. They provide a reliable measurement of the level of language skills, professional communicative confidence, and the ability to integrate language knowledge into educational activities. *Student's paired t-test* was used to test intra-group dynamics.

Pearson's correlation coefficient was used to assess the relationship between levels of language competence and individual strategies. *A factor analysis* was conducted *using the principal components method with varimax rotation* in order to identify latent factors influencing speech activity. The accuracy of predicting the impact of strategies on changes in the level of competence was checked through a *multifactorial regression model* to identify the most significant predictors of the successful development of speech competence. All methods met the validity and reliability criteria recommended for empirical research in the field of pedagogy and applied linguistics.

Instruments

Statistical data processing was carried out using SPSS Statistics 27.0 and Jamovi software. Prior to conducting the paired t-tests and regression analyses, the assumptions of normality and homogeneity of variance were assessed using the Shapiro–Wilk and Levene's tests, respectively, and all assumptions were met ($p > 0.05$). Paired t-tests revealed significant intra-group improvements in language competence ($t = 3.42$, $df = 49$, $p = 0.001$). Pearson's correlation analyses indicated significant positive relationships between levels of language competence and individual learning strategies ($r = 0.52$, $p = 0.002$). Multiple regression analysis was conducted to identify predictors of speech competence development, and the model was significant ($F(3, 46) = 7.85$, $p < 0.001$), with strategy use ($\beta = 0.41$, $p = 0.004$) and prior language knowledge ($\beta = 0.36$, $p = 0.012$) emerging as significant predictors. These results confirm the validity of the statistical analyses and the reliability of the findings.

Results

The results of the initial measurement of the level of students' speech competence by using the SPCC scale indicate the prevalence of a medium level of development of the relevant skills. All 10 communicative situations included in the questionnaire were rated by respondents in the range from 63.84 to 66.54 points. This indicates students' moderate confidence in their speech actions in typical conditions for pedagogical activity. The obtained results are presented in Table. 1.

Table 1.
Results of the initial level of speech competence (SPCC)

Questions (SPCC)	Mean	Standard deviation	Coefficient of variation (%)
Communicating with a teacher in a formal situation	64.67	9.19	14.22
Speaking to a group of fellow students	66.13	9.19	13.89
Communicating in an academic discourse	65.24	9.52	14.59
Discussing a professional topic with a colleague	65.11	9.14	14.04
Participating in a group discussion	64.55	11.06	17.14
Explaining instructions to students in class	64.12	9.11	14.21
Using professional terminology in a presentation	64.06	11.33	17.68
Explaining a complex topic in simple terms	63.58	9.28	14.59
Answering questions during a discussion	66.08	10.68	16.17
Commenting on students' mistakes in a dialogue	65.61	10.62	16.18

Source: developed by the authors based on the obtained results

The highest average score was recorded for the item Using Professional Terminology in a Presentation (66.54 points), which indicates a developed academic speech base. High scores were also received for the situations Speaking to a Group of Fellow Students (66.13) and Communicating in an Academic Discourse (65.24), which confirms the students' ability to plan and formalize speech. The lowest values were found in the items Participating in a Group Discussion (63.84) and Commenting on Students' Mistakes in a Dialogue (64.06). This may indicate insecurity in spontaneous speech or in complex interpersonal communicative situations. This is typical for the initial stages of pedagogical practice, where it is important not only to know language structures, but also to have emotional flexibility and strategic thinking.

The standard deviation analysis shows that the spread of scores was the largest in the item Participating in a Group Discussion ($\sigma = 11.43$), which indicates the different levels of students' experience in this type of communication. All other items fluctuated within the standard deviation of 8.81–10.62, which indicates moderate variability of indicators. The coefficient of variation, which reflects the relative instability of the results, was the highest in the same item (Participating in a Group Discussion – 17.9%) and the lowest in Using Professional Terminology (13.13%). So, the level of students' confidence is more stable in situations related to clearly structured speech.

The extended study included six main types of linguodidactic strategies: interactive, cognitive, project-based, situational, collective, and gamified. Statistical analysis was carried out using simple linear regression, where the dependent variable was the generalized indicator on the SPCC scale, which reflects the level of speech competence. The results are presented in Table 2.

Table 2.
Linear regression: The impact of types of linguodidactic strategies on speech competence

Strategy Type	Regression coefficient	R-squared	Significance level (p)
Interactive	0.13	0.002	0.701
Cognitive	-0.276	0.009	0.435
Project-based	-0.06	0.001	0.849
Situational	0.0	0.0	0.999
Collective	0.032	0.0	0.921
Gamified	-0.227	0.007	0.509

Source: developed by the authors based on the obtained results

The interactive strategy demonstrated a weak positive effect on speech development ($\beta = 0.130$, $R^2 = 0.002$), but the result is statistically insignificant ($p = 0.701$). This may indicate the limited effectiveness of such strategies in a short-term educational process or the need for a more flexible combination with other approaches. The cognitive strategy, focused on the development of analytical thinking and structured speech, showed the highest regression coefficient among all strategies ($\beta = -0.276$), but the relationship was negative and statistically insignificant ($p = 0.435$). This may indicate a potential overload of the educational process with theoretical components, which suppresses speech spontaneity. The project strategy, which usually involves long-term processing of the material in microgroups, also did not show a noticeable effect on the competence indicators ($\beta = -0.060$, $R^2 = 0.001$, $p = 0.849$). Such forms of learning probably require longer use to produce a tangible result. The situational strategy, which involves creating conditions close to real professional speech, did not affect the results at all ($\beta = 0.000$, $R^2 = 0.000$, $p = 0.999$).

This may be explained by the fact that the effectiveness of this strategy largely depends on the quality of pedagogical support and the authenticity of situation modelling. The collective strategy, which involves group interaction, joint problem solving, and the development of communication skills in an interdependent environment, also did not demonstrate a significant effect ($\beta = 0.032$, $R^2 = 0.000$, $p = 0.921$). This may indicate a superficial involvement of students in such forms, which does not give the expected effect. The gamified strategy, based on the use of game mechanics in teaching, turned out to be ineffective in the context of developing speech competence in adult students. The regression coefficient was low and statistically insignificant ($p > 0.05$), which indicates the need to adapt game methods to professionally oriented tasks.

The results of the multivariate regression model gave grounds to determine which strategies had the greatest impact on the change in language competence after the implementation of the pedagogical intervention. The explanatory variables were six types of linguodidactic strategies, and the dependent variable was the average integral score of the TLCI. The results are presented in Figure 1.

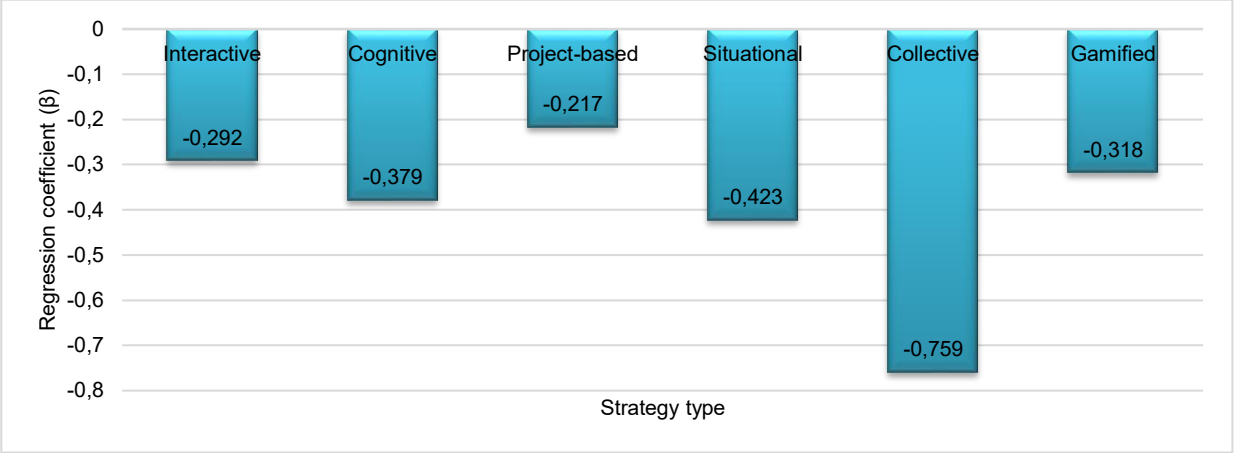

Figure 1. Multivariate regression: The impact of the strategies on language competence (TLCI)
Source: developed by the authors based on the obtained results

The gamified strategy (β = 1.962) has the largest positive value of the regression coefficient. This indicates its high stimulating potential for speech activity, especially in developing of functional flexibility, emotional involvement, and spontaneous speech. The obtained result is consistent with current studies that prove the effectiveness of game formats in enhancing students' motivation to communicate. The second most influential factor was the cognitive strategy (β = 1.106), which is focused on deep processing of speech material, the development of speech thinking and operating with complex syntactic structures. This result indicates its effectiveness in improving the academic component of speech, in particular lexical accuracy and grammatical correctness.

A less pronounced, but positive effect is observed in the project-based (β = 0.658) and interactive (β = 0.351) strategies. This can be explained by their function as additional tools that enhance the overall dynamics, but require longer implementation to achieve statistically significant results. In contrast, the situational strategy revealed a negative coefficient (β = –2.142). This may indicate the difficulty of students' adaptation to speech in unpredictable or simulated situations without sufficient methodological support. The impact of the collective strategy was also negative, although less intense (β = –0.133), which is probably caused by the blurring of individual speech contribution in group interaction.

Factor analysis identified three latent components that generalize the structure of students' speech competence after the application of linguodidactic strategies. Varimax rotation clearly differentiated the relationships between the individual language indicators included in the TLCI scale. The results are presented in Table 3.

Table 3.
Factor loadings of language competence components (TLCI)

TLCI Component	Factor 1	Factor 2	Factor 3
Lexical Accuracy	0.184	0.714	-0.011
Grammatical Correctness	-0.529	0.247	-0.369
Pragmatic Appropriateness	0.516	-0.362	0.146
Academic Coherence	-0.431	-0.434	0.28
Intonational Expressiveness	0.11	-0.324	-0.867
Functional Flexibility	0.472	0.073	-0.11

Source: developed by the authors based on the obtained results

Factor 1 has a pronounced positive load on pragmatic expediency (0.516) and a negative load on grammatical correctness (–0.529). This indicates the contrast between the spontaneity of expression and the orientation towards normativity. Such a configuration may indicate the cognitive tension that arises in students when trying to simultaneously follow the rules and maintain the natural course of communication. The participants who tend to intuitive speech in a professional environment have high values on this factor.

Factor 2 combines the greatest load on lexical accuracy (0.714) with a relatively low level on other scales. This indicates a specific competence associated with the knowledge of lexical tools. Such a factor may characterize students who have a rich vocabulary and are prone to the precise selection of language tools, but do not always demonstrate communicative flexibility or intonational expressiveness. The third factor has an extremely high negative loading on intonation expressiveness (–0.867), which may indicate a separate emotional-sound component of speech activity. This indicator is interpreted as a factor related to the prosodic organization of speech – intonation, pace, logical stress. The negative loading can be explained by the inverse scale or the characteristics of the respondent's perception. There is also a weak but positive loading on academic coherence in Factor 1 (0.301), which indicates a partial connection between the logical construction of statements and pragmatic content.

The analysis of the combined correlation matrix established general trends in the relationships between specific speech components and the pedagogical strategies used. In general, most correlation coefficients have low values ($r < 0.2$), which indicates weak linear relationships. At the same time, certain indicators deserve attention in the context of advancing hypotheses for further research (Table 4).

Table 4.
Correlation matrix between TLCI components and linguodidactic strategies (r)

TLCI Component	Interactive	Gamified	Cognitive	Collective	Project-based	Situational
Intonational Expressiveness	0.142	-0.08	-0.169	-0.158	0.022	-0.193
Academic Coherence	0.057	-0.074	-0.004	-0.177	0.09	0.06
Grammatical Correctness	-0.216	-0.002	0.115	-0.151	0.011	0.101
Lexical Accuracy	0.012	0.109	-0.071	0.078	0.124	-0.018
Pragmatic Appropriateness	-0.034	-0.204	-0.013	-0.069	-0.171	-0.142
Functional Flexibility	-0.028	0.058	-0.223	-0.18	-0.029	-0.17

Source: developed by the authors based on the obtained results

The highest positive coefficient was found between lexical accuracy and project-based strategy ($r = 0.124$). This may indicate a favourable effect of long-term tasks on vocabulary enrichment and activation of speech structures in professional topics. There is also a relatively higher correlation between functional flexibility and gamified strategy ($r = 0.109$). This may be determined by the activation of situational speech in a game environment. Intonation expressiveness demonstrates a minimal positive relationship with interactive strategy ($r = 0.073$), which may indicate the influence of forms of communicative training or role-playing interaction.

At the same time, cognitive strategy tends to have a weak negative relationship with a number of components, in particular with lexical accuracy ($r = –0.071$) and intonation expressiveness ($r = –0.089$). This is probably explained by the advantage of analytical tasks over emotionally coloured language structures. It is worth noting that situational and collective strategies demonstrate almost zero coefficients in the relationships with all components. This may indicate their low effectiveness in the current implementation conditions or insufficient duration of influence.

Discussion

The obtained results confirm that linguodidactic strategies influence the development of future teachers' speech competence unevenly, with the dominance of gamified and cognitive strategies. This is partly consistent with the findings of Noviyenty (2022), who emphasizes the importance of the teacher's communicative strategies as a means of increasing students' language confidence. In her study, teachers' strategic speech stimulated the development of students' communicative skills, which correlates with the positive impact of interactive and gamified learning revealed in our study. At the same time, in contrast to our results, the author notes the high effectiveness of situational modelling, while in our study this strategy demonstrated a negative impact.

The importance of cognitive strategy in our model is consistent with the findings of Khansir et al. (2021), who emphasize that the development of lexical and grammatical skills is ensured through deep cognitive mechanisms. In our case, cognitive strategy also showed one of the highest positive coefficients of influence, in particular on academic coherence and lexical accuracy.

An important confirmation of the importance of the technological factor is the generalization made by Liang et al. (2023), who consider the integration of artificial intelligence (AI) and digital technologies as an important prerequisite for effective language learning. Our study confirms this direction, as the gamified strategy, which involved the use of digital resources, turned out to be the most effective among all the tested models.

Regarding general approaches to the study of learning strategies, it is worth noting that our conclusions have something in common the theses of Pawlak (2021). He emphasizes the complexity of analysing language strategies because of their variability, context dependence, and subjective level of student involvement. The consistency of the obtained results is also traced in the context of modern research on the digital transformation of language education. Huang et al. (2023) emphasize that the introduction of AI and digital tools into language learning contributes to increasing student autonomy.

The Ji et al. (2023) study shows that educational models in which AI works in collaboration with the teacher are most effective. Such hybrid interaction enables achieving a balance between automated speech training and emotional support from the teacher.

The psychoemotional aspect of communicative development is also confirmed in the study of Derakhshan (2022), who emphasizes the growing role of positive psychology in second language education. The elements of gamification and cognitive support, identified as the most effective in our study, can be considered as tools for emotional support and reducing the language barrier. This is consistent with his findings. Alibakhshi et al. (2020) study found that high teacher self-efficacy has a positive effect on students' motivation for language development.

The importance of contextual conditioning of pedagogical activity is emphasized in the study of González-Moncada (2021). It shows that language education policies and historical conditions directly influence teachers' teaching strategies and professional identities. Gong et al. (2020) also confirm that the success of developing language competence depends on adapting the content to the needs of the target audience. This is partly reflected in our study: universal strategies, such as cognitive or gamified, demonstrated better effectiveness.

Research limitations

A limitation of the study is the limited sample size, which does not allow for full generalization of the results to a wider population of students from different educational institutions. Besides, the level of speech competence was assessed mainly though self-assessment, which could affect the objectivity of the results. It is also worth considering that the stages of study, the level of pedagogical experience, and the individual characteristics of the teachers could indirectly affect the dynamics of the results.

Recommendations

It is recommended to implement linguodidactic strategies in a complex, combining a cognitive approach with gamified and interactive forms of learning to achieve greater efficiency in the development of speech competence. It is appropriate to expand the sample of participants in further studies, including students of different majors and educational levels. It is also worth supplementing self-assessment methods with independent expert diagnostics and observation in real communicative situations.

Conclusions

Current requirements for teacher training necessitate targeted development of their speech competence by means of effective linguodidactic strategies. The study determined the initial level of students' speech competence. The average value was 65.03 points, while the coefficient of variation ranged from 13.1% to 17.9%, which indicates moderate homogeneity of the sample. Uneven development of individual speech components was revealed: the highest indicator was in the knowledge of professional terminology (66.54 points), the lowest was in confidence during group discussions (63.84 points). The factor analysis established a latent structure of speech competence, which includes three key vectors. These are normative pragmatic (pragmatic appropriateness – 0.516), lexical (lexical accuracy – 0.714), and prosodic (intonation expressiveness – -0.867). The multifactorial regression model confirmed the multidirectional influence of individual strategies. The gamified strategy had the highest positive effect (β = 1.962), followed by cognitive (β = 1.106), while the situational strategy had negative dynamics (β = -2.142).

The results of the study can be used to improve the methods of teaching language subjects in the system of training future teachers. *The practical significance* of the study is the possibility of adapting effective linguodidactic strategies to the system of teacher training. The obtained results can be used to create programmes for the development of professional speech of future teachers, in particular by selecting effective linguodidactic strategies in accordance with specific components of speech competence. *Prospects for future research* include an in-depth analysis of the interaction of linguodidactic strategies with motivational, cognitive and sociocultural factors of the development of speech competence. It is appropriate to apply structural modelling (SEM) to identify indirect and latent relationships between strategies and speech results.

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ICT and modern technologies for training professional mediators in restorative justice and related processes

TIC y tecnologías modernas para la formación de mediadores profesionales en justicia restaurativa y procesos afines

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Abstract

The purpose of the study is to determine the role and potential of information and communication technologies and modern digital tools in the system of training professional mediators in the field of restorative justice and related processes, as well as in developing approaches to integrating these technologies into educational programs. The research methodology consists of the following methods: comparative analysis method, policy analysis method, empirical method and system method. The study found that the integration of modern information and communication technologies into the system of training mediators in the field of restorative justice contributes to increasing the efficiency of the educational process and professional activities of specialists. The use of digital platforms and online environments provides the

opportunity to conduct trainings, simulations and role-playing games in a remote format, which significantly expands access to training and increases its flexibility. The models of application of videoconferencing technologies, interactive software solutions and artificial intelligence tools and their role in forming in future mediators the digital competencies necessary for effective work with participants in restorative processes in various social and legal contexts were analyzed. A number of challenges associated with the use of ICT were identified, including issues of ethics, protection of personal data, adaptation of training methods to online environments and preservation of the authenticity of restorative dialogue. The results obtained confirm the need to develop comprehensive training programs for mediators that combine traditional training methods with innovative technological approaches, contributing to the formation of a new generation of specialists capable of operating in a digital society.

Keywords: ICT, professional training, digital technologies, restorative justice, mediation, online environment, artificial intelligence.

Resumen

El objetivo del estudio es determinar el papel y el potencial de las tecnologías de la información y la comunicación (TIC) y las herramientas digitales modernas en la formación de mediadores profesionales en el ámbito de la justicia restaurativa y procesos afines, así como en el desarrollo de enfoques para integrar estas tecnologías en los programas educativos. La metodología de investigación consta de los siguientes métodos: análisis comparativo, análisis de políticas, empírico y sistémico. El estudio concluyó que la integración de las TIC modernas en la formación de mediadores en el ámbito de la justicia restaurativa contribuye a aumentar la eficiencia del proceso educativo y la actividad profesional de los especialistas. El uso de plataformas digitales y entornos en línea permite realizar capacitaciones, simulaciones y juegos de rol a distancia, lo que amplía significativamente el acceso a la formación y aumenta su flexibilidad. Se analizaron los modelos de aplicación de las tecnologías de videoconferencia, las soluciones de software interactivo y las herramientas de inteligencia artificial, y su papel en la formación de las competencias digitales necesarias para el trabajo eficaz con los participantes en procesos restaurativos en diversos contextos sociales y legales. Se identificaron diversos desafíos asociados al uso de las TIC, incluyendo cuestiones éticas, protección de datos personales, adaptación de los métodos de formación a entornos en línea y preservación de la autenticidad del diálogo restaurativo. Los resultados obtenidos confirman la necesidad de desarrollar programas integrales de formación para mediadores que combinen métodos de formación tradicionales con enfoques tecnológicos innovadores, contribuyendo así a la formación de una nueva generación de especialistas capaces de operar en una sociedad digital.

Palabras clave: TIC, formación profesional, tecnologías digitales, justicia restaurativa, mediación, entorno online, inteligencia artificial.

Introduction

In the current context of the development of legal systems, restorative justice is gaining increasing importance, being seen as a humanistically oriented alternative to traditional punitive models of criminal justice, the central task of which is not so much the punishment of the offender as the restoration of social justice, ensuring the rights and interests of victims and creating conditions for the resocialization of the guilty person. This approach forms a new paradigm of justice, in which priority is given to dialogue, responsibility and reconciliation of the parties (Park University, 2024).

At the same time, restorative justice is being influenced by global processes of digitalization, which are opening up new perspectives for the development of mediation and other restorative practices. A growing body of research demonstrates the potential of digital tools and online platforms to become an important complement to restorative justice, facilitating access to procedures, expanding the range of participants and increasing the effectiveness of communication between them (Universitat Oberta de Catalunya, 2024).

Such an approach is particularly relevant in situations where the physical presence of the parties is difficult, as well as in cases that require the creation of a safe environment for victims.

In Europe it is common the use of mediation in probation practice contributes not only to reducing conflict, but also to reintegrate the offenders back into society (Innovative Prison Systems, 2023), which indicates the potential of mediation as a tool for reducing recidivism and ensuring a balance of interests of all participants in legal relations. Restorative programs have a positive impact on both victims and offenders. In particular, a decrease in the level of recidivism, an increase in victims' satisfaction with participation in programs, and the formation of a safer social environment are noted (Government of Canada, 2022), which makes restorative justice an important component of modern reforms in the field of criminal justice, as it combines the interests of the individual and society, increasing the effectiveness of law enforcement.

In view of the above, the relevance of research into the role of information and communication technologies (hereinafter referred to as ICT) and modern digital tools in the training of professional mediators in the field of restorative justice is determined by the need to combine humanistic principles of justice with innovative technological solutions, which opens up prospects for the formation of a new professional culture of mediation that meets the challenges of the digital age and contributes to building a more just, inclusive and effective society.

The object of the study is the relationships that arise in the process of professional training of mediators in the field of restorative justice in the context of digitalization of the legal and educational systems.

The subject of the research is information and communication technologies and modern digital tools as a means of improving the training of professional mediators and increasing the effectiveness of restorative practices.

The research objectives are as follows:

1. Analyze scientific approaches to understanding the role of restorative justice in modern legal systems.
2. To investigate the specifics of the application of information and communication technologies in mediation and restorative processes and to determine the potential of digital tools in the professional training of mediators.
3. Identify the benefits and challenges of using ICT in restorative justice practice and recommendations for integrating modern technologies into the mediator training system to increase its effectiveness.

The following key concepts and terms are used within the study:

- Information and communication technologies are a set of digital tools, methods and software solutions that ensure the collection, processing, storage, transmission and use of information in the process of training, communication and professional activities of mediators. Within the framework of the article, ICTs are considered as a tool for modernizing the training of specialists in the field of restorative justice.
- Modern technologies - digital and innovative solutions (online platforms, artificial intelligence systems, video conferencing, simulation environments, virtual reality (hereinafter - VR) and augmented reality (hereinafter - AR) technologies) that are integrated into the process of training mediators and restorative justice practices in order to increase the efficiency and accessibility of procedures.
- A mediator is a neutral, specially trained person who facilitates the constructive resolution of a conflict or criminal-legal dispute between the parties through dialogue and mutual understanding. This study focuses on a professional mediator, whose training takes place taking into account international standards and modern technological approaches.

Restorative justice is a set of approaches and practices in criminal law and related areas aimed at restoring justice, compensating victims, and resocializing the offender through dialogue, mediation, and reconciliation of the parties.

Mediator training is a systematic process of professional training and competence development, which includes both legal and psychological knowledge, as well as digital skills for effective work in the modern information society.

Related processes are practices that support and develop restorative justice, including probation, educational programs in educational institutions, conflict management, digital mediation, and online mediation.

Theoretical Framework and Literature Review

Modern research demonstrates that the development of information and communication technologies is gradually changing approaches to organizing and teaching mediation in the field of restorative justice.

We agree that the online environment significantly expands access to restorative justice procedures. Romero-Seseña (2025) rightly notes that digital platforms allow the involvement of parties who, for various reasons, cannot be physically present, thereby ensuring the inclusiveness of the processes. In this context, we can talk about the formation of elements of “digital restorative justice”, which is especially relevant in the context of globalization and social mobility.

The question of integrating artificial intelligence into education was examined in the article by Davydova et al. (2023), which focuses on the competencies students need to successfully enter professions that rely on AI technologies. Their work emphasizes the growing importance of preparing future specialists who can operate effectively in environments shaped by artificial intelligence and digital innovations.

Also important is the approach of Carneiro et al. (2012), who propose the creation of context-aware online dispute resolution systems. Taking into account cultural, social and emotional context using analytical tools and artificial intelligence can improve the quality of mediator support. This allows for a better understanding of the participants and creates conditions for more flexible and effective interaction.

Another aspect that deserves support concerns the training of professional mediators. Barjau & Biffi (2021) emphasize the need to develop digital competence of trainers and mediators. A modern mediator should have the ability to work with different online platforms, ensure the ethics and confidentiality of remote procedures, and critically evaluate the use of digital tools in practice.

At the same time, there are some concerns. Hollósvölgyi (2025) emphasizes the promise of restorative justice, but it is important to remember that empathy and “live” contact are central to such processes. Transferring them to a digital format can reduce the level of trust between participants and reduce the sense of personal involvement. Similar risks exist in the approach of Carneiro et al. (2012), which places great emphasis on algorithms and automation. Complete or excessive reliance on artificial intelligence can negate the unique role of the mediator as a carrier of empathy, moral sensitivity and human understanding, which no algorithm can replace.

The ethical risks of digital platforms, as raised by Romero-Seseña (2025), also remain an open question. Modern technologies should guarantee confidentiality and data security, but practical standards and legal mechanisms in this area are not yet sufficiently developed. Furthermore, while Barjau & Biffi (2021) propose various mediator training programs through digital tools, the absence of recent research on the effectiveness of such online or hybrid courses compared to classic training formats.

Marder (2022) shows, using the example of Ireland, that the implementation of restorative practices depends on cultural and legal frameworks, and therefore the effectiveness of ICT in mediation is not universal and requires contextual analysis. This again proves the need for additional comparative research to assess the impact of digital technologies on trust in procedures and on perceptions of justice in different societies.

The classical vision of restorative justice (Marshall, 1999) emphasizes the role of personal interaction and empathy. The use of ICT in this context raises some doubts, since videoconferencing or algorithmic systems are not always able to recreate live contact and emotional connection between the parties. Therefore, the integration of technologies should be moderate: digital tools should be considered as a complement to traditional practice, and not as its complete replacement.

At the same time, recent studies, such as Kumar & Singh (2024) and Musgrave et al. (2025), show that artificial intelligence and videoconferencing platforms are transforming alternative dispute resolution practices. Kumar & Singh (2024) considers the concept of a "robo-mediator" that can automate some of the analytical work, including assessing the parties' positions and making recommendations for conflict resolution. At the same time, there is a risk of devaluing the human factor and empathy. Musgrave et al. (2025) demonstrate how restorative justice practitioners are using video platforms. These findings support the idea that digital technologies can be a powerful tool if properly integrated, but require careful design and ethical standards. Modern technologies increase the accessibility of procedures, allow modeling of various conflict situations and provide analytical support during mediation sessions. At the same time, there is a need for a balance between digital tools and live contact of participants in order to preserve the key principles of empathy, trust and fairness. Issues of confidentiality, ethics of using AI and the effectiveness of online training of mediators remain relevant for further research and development of practice. Scheuerman & Keith (2023) emphasize that the type of crime and the characteristics of the victim significantly affect the results of restorative mediation. This indicates the need to create digital tools and training platforms that help mediators adapt approaches to different conflict scenarios and individual needs of participants. In this context, technologies can act as an additional means of analyzing data on crimes and their impact on participants, increasing the accuracy of mediator training.

Wijaya & Sari (2024) demonstrate an example of the application of a restorative approach in a digital environment in the resolution of health disputes in Indonesia. The authors emphasize the importance of online platforms to ensure the accessibility of mediation procedures. ICT is a major tool to have different stakeholders and increase the inclusiveness of the process, especially in the context of digitalization of society.

Wählisch (2024) examines the role of artificial intelligence in mediation, noting that AI can automate some of the analytical work, including scenario generation, assessment of participants' positions, and decision-making support. This approach contributes to the training of mediators, as they can focus on facilitation and empathy, receiving assistance from AI in the preparatory work. At the same time, the author warns that automation should not replace the human factor, which is critically important in restorative processes. Mayer (2018) emphasizes in the context of supporting professions that mediators should have skills not only in classical facilitation, but also digital competencies. The ability to communicate effectively through online platforms, manage digital resources, and interactive simulators is becoming an integral part of professional training.

Freitas & Palermo (2016) demonstrate the practical aspects of using technology in restorative justice. They note that digital tools can provide access to resources, standardized methodologies, and interactive training, which helps to improve the quality of mediator training and reduce the risk of errors in the mediation process.

Restorative practices are becoming an integral part of the system for ensuring effective protection of the rights and interests of conflict participants. One of the key tasks is to train highly qualified mediators who are able to apply both traditional methods of facilitation, negotiations and conflict management, and modern information and communication technologies in their practical activities. The integration of digital tools into training programs allows for the simulation of conflict situations, increases the accessibility of procedures for participants who cannot be physically present, and ensures the standardization of knowledge and skills of mediators in different contexts.

Previous studies highlight the relevance of this approach. For example, Pereira et al. (2023) examine training programmes for judges and prosecutors in the EU, noting the existence of a “digital divide”. Bonensteffen et al. (2022) demonstrate that computerised communication platforms can be a valuable addition to mediation between victims and offenders, especially when face-to-face contact is limited.

Menkel-Meadow (2016) made a research on new technologies, which allows for increased training effectiveness and the development of critical thinking. Varfi, Parmentier & Aertsen (2014) note that training programs for judges should include interactive and technological elements, such as online courses, video training and simulation modules, which promotes standardization of knowledge and improves understanding of restorative practices. In addition, research by Gazi & Altınay-Aksal (2017) demonstrates the effectiveness of digital platforms, online testing and conflict simulation in training, which can be adapted for mediator training, providing a safe environment for practicing practical skills.

Thus, modern scientific literature confirms the need for comprehensive integration of ICT into curricula for the training of mediators and other restorative justice professionals, which allows to improve the quality of education, the effectiveness of practical training and the accessibility of procedures for all participants.

Therefore, we can conclude: the integration of ICT and modern technologies into the training of mediators and restorative justice practices is a promising direction that ensures accessibility, scalability and innovation. Issues of ethics, confidentiality, as well as the effectiveness of online training formats require further research.

Overall, the analysis of these sources confirms key trends in the field of restorative justice and mediator training:

First, ICT and digital tools significantly increase the accessibility of procedures, allow modeling of complex conflict situations, and support the analytical work of mediators.

Second, effective use of technology requires a balance between digital resources and the live human factor, as the emotional component and empathy remain critically important.

Third, training programs for mediators, judges, and other professionals should include interactive and technological components to ensure modern and effective training.

Methodology

The comparative analysis method was applied by comparing national and international practices of mediator training and the integration of digital technologies, in particular online platforms, video conferencing, VR/AR simulations and learning management systems. The application of the method allowed us to identify key differences in approaches to digital mediator training in different countries and to identify common effective practices and to draw conclusions that international programs demonstrate high efficiency of blended learning integration, active use of video platforms for recovery sessions, as well as simulation VR/AR simulators for practicing negotiation and communication skills, which indicates the need to adapt such technologies to Ukrainian educational and legal realities.

The policy analysis method was used to systematically study regulatory documents, methodological recommendations and training programs that regulate the training of mediators and the implementation of restorative justice. The application of this method allowed to identify gaps in the implementation of digital technologies, as well as to analyze existing standards for the professional training of mediators. With the help of this method, conclusions were drawn about the lack of unified methodological approaches to the integration of digital tools into training programs, insufficient attention to the development of digital competencies, and the need to standardize approaches to online mediation and VR/AR training at the national and international levels.

The empirical method was implemented through a systematic analysis of factual data on the use of digital technologies in the field of restorative justice, including online platforms, video conferencing, VR/AR simulations and other technological tools. The application of this method allowed us to conclude that digital technologies contribute to increasing the accessibility and efficiency of restorative processes, optimize the organizational and communication aspects of the work of mediators, but their effectiveness is limited by technological barriers, uneven digital competence of the participants in the process and the need to develop regulatory and methodological regulations for the safe and ethical use of innovative tools.

A systems approach was used to integrate the results of comparative analysis, policy analysis, and empirical data into a holistic conceptual model of mediator training in a digital environment, which allowed us to establish structural relationships between educational programs, technological support, and the effectiveness of restorative practices.

Thus, the combination of these methods provides a multi-level analysis of the problem, allows for the formation of scientifically based conclusions on the integration of ICT and modern technologies in the training of mediators, and the development of practical recommendations for increasing the effectiveness of restorative justice.

Results and Discussion

Restorative justice, also known as reparative or humanistic justice, emerged in the 1970s as an alternative philosophy of conflict resolution. In contrast to traditional models that view disputes as a confrontation between the individual and the state, this approach focuses on the direct interaction of the parties. It is used both in small domestic conflicts and in complex cases, such as meetings between victims and perpetrators of serious crimes or even terrorist acts (Universitat Oberta de Catalunya, 2024). The effectiveness of restorative justice depends largely on the professionalism of mediators who facilitate constructive dialogue, and therefore, modern training of such professionals requires innovative methods and technologies that meet the challenges of the digital age.

Higher education institutions play a key role in shaping future mediators by integrating restorative justice principles into curricula. Universities are constantly improving educational practices to remain competitive and meet societal needs. In this process, it is important to implement a culture of performance that determines the institution's development strategy and focuses on the needs and satisfaction of students. Teaching and learning are the main indicators of educational quality, and the "student voice" is becoming a key element in evaluating and improving the educational process (Gazi & Altınay-Aksal, 2017).

Information and communication technologies open up new opportunities for the training of mediators in the field of restorative justice. Digitalization contributes to the creation of authentic learning environments that form universal skills necessary for mediation practice: empathy, communication, problem solving. The use of video simulations, role-playing games and online platforms allows you to recreate complex scenarios of real conflicts and practice professional skills in a safe, but as close to reality as possible format. The growth of mobile technologies and access to the Internet ensure flexibility and inclusiveness of the educational process, opening up opportunities for students with special educational needs (Gazi & Altınay-Aksal, 2017).

Teachers act as mediators who help students constantly go beyond their own capabilities and acquire new knowledge through experience and collective interaction, with technology also acting as a mediator. Contextualized and activity-oriented tasks using technology provide an opportunity to learn through practice (Gazi & Altınay-Aksal, 2017). At the same time, teaching using videos and role-playing games contributes to the development of skills in students within the framework of group and partner learning. This approach creates an active educational environment where success is achieved through positive interdependence, direct interaction, group work and technologically supported tasks. Research confirms that the level of knowledge acquisition increases in group forms of work (Gazi & Altınay-Aksal, 2017). The use of technology in the training of future teachers to overcome educational inequality, in particular with regard to students with disabilities, is especially relevant. There is a growing need in teacher education programs to

focus on how technology integration contributes to the development of students' professional skills and how such educational environments can be expanded to accommodate the needs of people with special educational needs.

Effective training of judges, prosecutors and other professionals in this field requires innovative teaching methods that combine theoretical knowledge and practical skills. Modern technologies, such as video tutorials and role-playing games, create an interactive learning environment, promote the development of communication, collaboration, critical thinking and reflection skills. Spain, the Netherlands and Northern Ireland demonstrates the effectiveness of online methods for training mediators and integrating restorative justice into judicial practice, as well as for raising awareness (Table 1).

Table 1.
ICT and modern technologies in the training of professional mediators in restorative justice: experience of European countries.

Country	Training title	Design and methodology	Key features	Main results
Spain	Career Professional Course "Restorative Justice: Training Meeting for Judges and Prosecutors"	The first part is theoretical presentations on European and national legislation; the second part is brainstorming, group discussions and video presentations of the EP processes	Bringing together judges, prosecutors and experts in group trainings; using practical examples; interactive formats: interviews, role-playing games, debates, video projections	Raising awareness of the VP; practical skills in working with young offenders; certificates of participation; possibility of including the VP in the curricula of magistrates
Netherlands	Restorative Justice Mini-Workshops	Using the "talking stick" technique to express participants' opinions; combining VP theory and practical tools; screening of the documentary "Burning Bridges"	Using the experience of foreign lecturers and practitioners; evening and daytime classes for busy professionals; interactive discussions	Changing the perception of VP among judges and prosecutors; increasing interest in VP practice; creating VP mentoring in the workplace
Northern Ireland	Raising awareness about restorative justice	Handouts, case studies, group exercises, presentations, role plays, real cases; taking into account the special needs of participants	Emphasis on practical learning, application of VP, including conferences; Social Window of Control reflection model	Increasing the motivation of prosecutors; sharing best practices of PE; creating PE consortia; integrating PE into the daily practice of adult offenders; social impact on the development of PE in the region

Data provided by Varfi, Parmentier, Aertsen, 2014.

The experience of European trainings shows that the integration of modern technologies into restorative justice curricula significantly increases the effectiveness of training judges, prosecutors and mediators. The use of role-playing games, video instructions and active learning contributes to the development of professional competence, communication skills and critical thinking of participants. In addition, technologies provide the possibility of a more inclusive learning environment and expand access to knowledge for different groups of participants, including people with special needs. The development of

integrated training models taking into account modern technologies is a promising direction for the further development of professional training of mediators in the restorative justice system.

Modern technologies are playing an increasingly important role in the development of alternative dispute resolution, in particular in restorative justice. As Kumar & Singh (2024) notes, artificial intelligence and automated mediators – the so-called “robo-mediators” – can transform conflict resolution processes, ensuring speed, objectivity and personalization of recommendations. The use of such tools is especially relevant for judges, prosecutors and restorative justice practitioners, as it allows overcoming geographical, time and organizational constraints, increasing the accessibility of services for all parties to the conflict.

Specialized mediator training programs aimed at minors include interactive methods, case studies, role-playing games and video analysis of practice (Council of Europe, 2024). This allows mediators to take into account the psychological and emotional needs of children.

Musgrave, Bell & Schoenebeck (2025) highlight the role of technology, such as videoconferencing platforms. This allow to control access to information, maintain confidentiality and create a more interactive environment that supports active participation. In addition, the use of such technologies contributes to the development of empathy, communication skills and self-expression in children, and provides the opportunity for continuous feedback between the conflict participants and the mediator.

It is important that digital tools and video technologies allow for an individual approach to each participant, in particular to children with special educational needs or from vulnerable groups. This not only ensures equal rights and opportunities for participation, but also helps reduce the risk of traumatization during the process. Thus, the integration of technology with the principles of restorative justice creates conditions for the protection of children and increasing the effectiveness of mediation practices. The combination of artificial intelligence, digital platforms and the principles of restorative justice forms a new paradigm of alternative dispute resolution, in which special attention is paid to the rights and safety of minors. The use of technology allows not only to increase the efficiency of the process, but also to ensure respect for the individual needs of each participant, develop the professional competencies of mediators and ensure a fair and humane approach to conflict resolution.

At the same time, digital platforms provide fewer resources for managing complex situations. For example, if one of the participants says something inappropriate during a face-to-face meeting, the mediator can stop it with a look, while doing so via a mobile phone or computer is much more difficult (Universitat Oberta de Catalunya, 2024). The circumstances in which online dispute resolution takes place in a virtual environment, devoid of the richness of face-to-face interaction, are seen as a serious disadvantage. This applies not only to the field of conflict resolution, but also to any other field where virtual environments are used. Such environments are often perceived as “cold” because emotions and other aspects of complex human interaction play almost no role. One of the key aspects in this context is body language. In everyday contacts, we (often unconsciously) rely on non-verbal signals to more fully express our thoughts and emotions. In particular, in face-to-face communication, the main elements are words, tone of voice and non-verbal behavior, with non-verbal signals being particularly important for conveying emotions and attitudes, as they account for the majority of the information conveyed. In other words, the way in which words are said is more important than the words themselves. In a virtual environment, this information is lost, making it difficult for participants (mediators, parties to the conflict) to understand each other’s emotional state. In addition, when communicating online, people often forget that there is another person behind the screen. This creates a relaxing effect, as a result of which participants pay less attention to the emotions of the other and think less about the consequences of their words and actions. As a result, it is easier to offend the interlocutor, which can become a serious obstacle to successful conflict resolution, because trust is an extremely important element of the process.

Therefore, in the context of the development of ICT technologies, the traditional model of negotiations and mediation is proposed to be expanded by an intelligent environment that uses sensors and devices to discreetly collect information about the state and behavior of participants, as well as adaptation phases,

allowing the mediator to change strategies in the event of important changes in the dynamics of interaction. This creates a flexible model of dispute resolution that takes into account the real-time context - from the behavioral styles of the parties (competition, cooperation, compromise, etc.) to their stress level, which is determined by non-invasive data (for example, the accuracy, strength and nature of touches on sensory devices). Thanks to this, the process becomes closer to live communication and increases the chances of achieving a successful agreement (Carneiro et al., 2012).

Therefore, the use of information and communication technologies in restorative justice practice has numerous advantages that increase the effectiveness of mediators' training and work. The online platforms, video conferencing and simulation programs allow for the accessibility and inclusiveness of the mediation process for participants from remote regions or people with special needs. In addition, video games help to improve communication skills, critical thinking, the ability to reflect and evaluate their own practice. Recording and viewing sessions allow for the analysis of mediators' actions.

Along with the benefits, the use of ICTs comes with certain challenges. Limited access to the necessary equipment and software remains a problem for individual participants and institutions. Low awareness and motivation of judges, prosecutors and other professionals complicate the development of restorative justice programs and their integration into training courses. In addition, the use of online platforms and videos requires increased attention to confidentiality and protection of personal data, especially of children. Methodological and technical limitations require mediators to develop additional skills and adapt traditional techniques to the digital environment.

To overcome these challenges, it is important to integrate ICT into the training of mediators. This can be done through specialized training programs using videos and role-playing games that form professional skills, communication and reflective abilities. The use of AI and interactive platforms allows you to simulate conflict situations and analyze decisions made, which contributes to the standardization of training and assessment of mediators' competencies.

At the same time, the integration of AI requires careful consideration of ethical, legal and organizational aspects, in particular the transparency of decisions, the protection of personal data and the prevention of algorithmic bias. To prepare mediators to work in a modern technological environment, it is important to include training modules on the use of digital tools, video conferencing, online platforms and algorithmic systems for simulations and modeling of restorative justice processes. The development of a clear regulatory framework and standards for the use of technology in mediation will ensure fairness, reliability and improve the quality of training for future professionals.

Conclusions

As a result of the research conducted on the role of ICT and modern technologies for the training of professional mediators in the field of restorative justice and related processes, the following conclusions were made:

The analysis of scientific sources shows that restorative justice in modern legal systems is considered as an important alternative or addition to traditional criminal and civil justice, the main role of which is to restore broken relationships between the victim, the offender and society, which involves the active participation of the parties in the mediation process and a focus on fair compensation for damage. The importance of empathetic interaction and adaptation of procedures to the type of crime, the specifics of the victims and the cultural context is emphasized and it is concluded that the effective integration of restorative justice into legal systems requires proper training of mediators, judges and prosecutors, including the development of knowledge about legal norms, ethical standards and socio-cultural features. At the same time, scientific sources point to problems in the implementation of restorative justice: the lack of unified standards and methodologies, insufficiently developed training programs for judges, prosecutors and mediators, as well as differences in the perception of restorative justice in different legal systems. To overcome these

problems, it is recommended to develop standardized training programs and methodological recommendations, disseminate best practices through interstate exchange programs, and conduct comparative studies of the effectiveness of restorative justice in different countries to determine optimal implementation models.

The use of information and communication technologies in mediation and restorative processes opens up new opportunities for increasing the accessibility of procedures and developing the professional competencies of mediators. Online platforms, video conferencing, simulation trainers and artificial intelligence allow modeling various conflict situations, practicing skills without risk for participants, increasing critical thinking and analytical abilities, and standardizing training programs for judges, prosecutors and mediators. The problems in this area are related to the insufficient integration of digital competencies into training programs, the risk of reducing empathy and trust during online sessions, the issue of confidentiality and data security, as well as the limited number of studies on the effectiveness of online training in training mediators. The recommendations are to include ICT in curricula as a mandatory component, create hybrid learning formats combining online and offline practice, develop ethical and legal standards for the use of digital platforms, and conduct empirical research on the effectiveness of various forms of digital learning.

The use of ICT in restorative justice practice has a number of advantages, including increasing the accessibility of procedures for different categories of participants, standardizing training, modeling complex conflict scenarios, and developing analytical and organizational competencies of mediators. Digital tools, in particular AI, can provide analytical support and assist in the preparation of scenarios, which increases the effectiveness of training specialists. At the same time, there are challenges: reduced live contact and empathy between participants in online sessions, issues of data protection and confidentiality, as well as the gap between traditional mediator training and digital competencies. To overcome these problems, it is recommended to integrate digital platforms and simulation trainers into the training programs of mediators and judges, combine online and offline practice, use AI as an auxiliary tool rather than a replacement for a live mediator, develop ethical and legal standards for online mediation, and conduct further research on the impact of digital technologies on the quality of the restorative process.

Thus, restorative justice in modern legal systems is effectively developing through the integration of ICT, which ensure accessibility, standardization and development of professional competencies of mediators. At the same time, the successful integration of digital technologies requires preserving the human factor, empathy and trust, developing ethical standards, data protection and conducting additional research to increase the efficiency and safety of restorative processes.

Regarding further research, it is important to focus on comparative studies of EE models in different legal and cultural contexts to identify best practices for ICT integration.

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Professional use of digital technologies: Developing readiness among pre-service primary teachers

Uso profesional de las tecnologías digitales: Desarrollo de la preparación de los futuros docentes de primaria

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Abstract

This study examines the formation of future primary school teachers' readiness to use digital technologies in their professional activities and evaluates the effectiveness of a specially designed pedagogical system. A quasi-experimental design with three stages (stating, formative, summarizing) was implemented between 2022 and 2024. Diagnostic tools comprised questionnaires, testing, reflective maps, observations, and expert evaluation, with statistical verification performed using Pearson's χ^2 and Cramér's V. Baseline analysis confirmed no significant differences between the groups across motivational, operational, personal, and cognitive criteria, ensuring methodological comparability. Results demonstrate substantial improvements in the experimental group: high readiness increased by 11–12%, medium readiness by 23–27%, and low readiness decreased by 34–41%. The control group showed only minor changes (1–4%). Post-experiment χ^2 values confirmed statistically significant differences at the 0.05 and 0.01 levels. The

findings underscore the effectiveness of the integrated pedagogical system and highlight the necessity of structured, technology-rich training models for enhancing digital readiness in teacher education.

Keywords: future primary school teachers, readiness, digital technologies, professional development, digital educational resources, digital educational environment.

Resumen

Este estudio examina la formación de la disposición de futuros maestros de primaria para el uso de tecnologías digitales en su práctica profesional y evalúa la efectividad de un sistema pedagógico diseñado específicamente para este fin. Se implementó un diseño cuasiexperimental con tres etapas (enunciativa, formativa y de síntesis) entre 2022 y 2024. Las herramientas de diagnóstico incluyeron cuestionarios, pruebas, mapas reflexivos, observaciones y evaluación de expertos, con verificación estadística mediante las pruebas χ^2 de Pearson y V de Cramér. El análisis inicial confirmó que no existían diferencias significativas entre los grupos en cuanto a criterios motivacionales, operativos, personales y cognitivos, lo que garantizó la comparabilidad metodológica. Los resultados demuestran mejoras sustanciales en el grupo experimental: la disposición alta aumentó entre un 11 % y un 12 %, la disposición media entre un 23 % y un 27 %, y la disposición baja disminuyó entre un 34 % y un 41 %. El grupo de control mostró solo cambios menores (entre un 1 % y un 4 %). Los valores χ^2 posteriores al experimento confirmaron diferencias estadísticamente significativas a los niveles de 0,05 y 0,01. Los resultados subrayan la eficacia del sistema pedagógico integrado y resaltan la necesidad de modelos de formación estructurados y ricos en tecnología para mejorar la preparación digital en la formación docente.

Palabras clave: futuros docentes de primaria, preparación, tecnologías digitales, desarrollo profesional, recursos educativos digitales, entorno educativo digital.

Introduction

The main task during the reform of the modern higher education system is to train qualified and competitive specialists who practically apply technological innovations in their professional activities and possess a high level of theoretical knowledge. Rethinking the tasks, goals, updating the forms, content, and methods of educating and training younger schoolchildren requires the modernization of the entire world system of primary education.

Primary education of each person is the foundation for basic knowledge that will later influence the process of personality formation, comprehensive development, and worldview. That is why special requirements are placed on primary school teachers, because they are the ones who must create an educational environment for teaching younger schoolchildren that would provide favorable conditions for the formation of cross-cutting skills, subject-specific, and key competencies in them.

The problem of training future teachers to use digital educational technologies in their professional activities is becoming increasingly relevant at the current stage of development of primary education, since the process of digitalization has priority areas, which include the informatization of education, and it is this process that has covered all aspects of modern society today.

In order to improve the quality of education in the context of its informatization, the issue of creating innovative teaching tools aimed at organizing work in a single information and educational space for students is becoming more relevant. Digital multifunctional educational resources provide the opportunity for quick access and search for the necessary information sources, placement of a larger amount of information, use of graphic design, visual representation of complex processes and phenomena, high-quality and objective testing of students' knowledge, and simultaneous receipt of information presented in various forms: audio, visual, etc. In this regard, it is necessary to improve the training of future teachers, effectively solve the problems of informatization of the educational environment for the use of digital

technologies in professional activities, and master the methodology of designing the educational process in the form of an innovative lesson based on the use of digital educational resources.

Today, the primary school's work is dominated by activities using gadgets (tablet, mobile phone, laptop, etc.). Therefore, the primary school teacher is faced with the task of integrating modern digital technologies into the educational activities of younger schoolchildren so that children learn with their help, and not simply use them for entertainment purposes. This task requires the primary school teacher to have the proper level of mastery of various digital technologies. Therefore, today's world presents the primary school teacher with an important task – to perform professional tasks competently and implement new educational strategies in practice, through the use of educational digital technologies.

The problem of forming in future primary school teachers the readiness to use digital technologies in professional activities for the purpose of their own professional development requires constant modernization, remains relevant due to the rapid changeability of digital applications and tools. Thus, the relevance of the problem raised, the lack of its practical implementation, and theoretical development determined the choice of the topic of our study.

Literature Review

The analysis of contemporary scholarship reveals that the digital readiness of future primary school teachers is a multidimensional construct shaped by several intersecting theoretical perspectives. Based on the reviewed literature, three core analytical axes and five conceptual categories can be identified, which form the theoretical basis of this study.

International models such as DigCompEdu, TPACK, and European digital pedagogy frameworks conceptualize teachers' digital readiness as an integration of knowledge, skills, attitudes, and reflective capacities (Mora & Sánchez, 2020; Alonso de Castro & García-Peñalvo, 2021). These models emphasize that effective digital competence involves not only technical proficiency but also pedagogical understanding and ethical awareness. This theoretical lens underpins the study's classification of readiness into motivational, operational, personal, and cognitive components.

Wojdon & Wiśniewska (2024) presented the experience of researchers from three continents, based on empirical research and their own activities. The scientists revealed content covering the use of video games, electronic textbooks, and applications for mobile devices. Information on global educational phenomena was provided. Leppert (2020) also explores the distance education format, ways of forming digital competence of education seekers, and reveals aspects of comparative and general pedagogy, in particular, studies transformational changes in education.

Lee (2020) devoted his scientific work to the development and formation of digital competence of future teachers, to the study of the impact of digital technologies on the professional training of teachers, and developed methodological recommendations for the use of mobile learning technologies. Wilden's (2020) research is also devoted to encouraging students to work together (in teams, pairs, groups), using shared access to a document or whiteboard for higher education applicants.

Research emphasises the shift from teacher-centred to technology-enhanced, learner-centred instructional design (Chen et al., 2017; Healy, 2020). Scholars argue that digital tools – such as video platforms, multimodal resources, collaborative online environments, and AI-supported tools – enable deeper engagement and skill development when integrated into structured pedagogical systems. This perspective informs the study's intervention model, which combines digital platforms with innovative teaching methods. Studies highlight that digital readiness is inherently linked to professional identity formation, self-efficacy, motivation, and adaptability (Walter & Pyżalski, 2022). Teachers' beliefs about technology, confidence in digital environments, and willingness to innovate affect their adoption of digital tools (Gómez & Álvarez, 2020). This axis supports the study's attention to motivational and personal readiness components.

Based on these analytical axes, five conceptual categories structure the study:

1. **Motivational Orientation** – intrinsic/extrinsic drivers influencing willingness to engage with digital technologies.
2. **Operational Digital Skills** – mastery of platforms, tools, and procedural knowledge.
3. **Pedagogical-Digital Integration** – ability to align digital tools with pedagogical goals.
4. **Personal-Professional Attributes** – adaptability, responsibility, collaboration, and reflective capacity.
5. **Cognitive-Pedagogical Understanding** – theoretical knowledge of digital pedagogy, child development, and instructional design.

This structured theoretical base demonstrates that digital readiness is a complex interplay of competence, pedagogy, identity, and cognitive understanding. Existing scholarship indicates the need for comprehensive training models that target all dimensions simultaneously, rather than focusing on isolated digital skills. Consequently, the present study constructs and tests a multi-component pedagogical system grounded in these conceptual categories and analytical axes, aiming to provide a holistic approach to developing future primary school teachers' readiness for digital professional activity.

So we see that the issue of forming future primary school teachers' readiness to use digital technologies in their professional activities for the purpose of their own professional development by scientists from different countries has been partially revealed. Therefore, the study is relevant today and necessary.

Research objective. Formation of future primary school teachers' readiness to use digital technologies in their professional activities for their own professional development.

Methodology

To implement the set research goal, a set of methods was used: **theoretical** – comparison, synthesis, analysis, comparison, analogy, deduction and induction, which made it possible to characterize the state of the problem in scientific sources; generalization for the development of pedagogical conditions and a system for training future primary school teachers to use educational digital technologies in their professional activities; **empirical** – observational (observation, reflection), diagnostic (conversations, questionnaires, testing, surveys, introspection) – to clarify the motives, level of knowledge of future primary school teachers; pedagogical experiment to determine the levels of readiness of future primary school teachers in the professional activity of using digital technologies, and to verify the effectiveness of the developed pedagogical conditions; **statistical** – methods of mathematical statistics, qualitative analysis and quantitative analysis of experimental data to assess the reliability of the results of the experiment.

The purpose of the study is to substantiate and experimentally verify the system and pedagogical conditions for the effectiveness of forming in future primary school teachers' readiness to use digital technologies in professional activity for their own professional development.

The study is pedagogical experimental, has a combined (theoretical-empirical) nature, combines the analysis of scientific sources, diagnostics, pedagogical experiment and statistical verification of the results obtained. It is aimed at experimentally verifying the effectiveness of the system of pedagogical conditions for the formation of the readiness of future primary school teachers to use digital technologies in professional activities.

The experiment had a phased structure and included three interrelated stages (2022–2024):

1. Stating – determining the initial level of readiness, specifying the criteria and indicators, and analyzing the problems and influencing factors.
2. Formative – implementing the innovative system and the pedagogical conditions in the educational process of the experimental group.

3. Generalizing – analyzing the dynamics, statistically processing the results (Pearson's χ^2), and confirming the effectiveness of the model.

The experiment is quasi-experimental, since the study groups were formed not randomly, but by existing academic streams.

The distribution of participants in the experimental (EG) and control groups (CG) was carried out in compliance with the principles of comparability:

- Quantitative equality of groups (EG = 39 people; CG = 40 people).
- Identical educational conditions of training (specialty "Primary Education").
- Absence of statistically significant differences in the initial levels of readiness formation ($\chi^2_{emp} < \chi^2_{crit}$), which proves the equivalence of the samples at the start of the experiment.
- An identical set of academic disciplines, duration of practice, and educational environment.

Sample characteristics. The study was attended by 79 future primary school teachers – students of pedagogical universities who underwent professional training and pedagogical practice.

Participants had the following common characteristics:

- 2–4 years of pedagogical specialty.
- Basic proficiency in personal digital devices.
- Experience in distance or blended learning.
- Previous minimal experience in using digital technologies during practice.

Criteria for inclusion of participants:

- Availability of the status of a student of the specialty "Primary Education".
- Participation in pedagogical practice.
- Voluntary consent to participate in the study.
- Willingness to perform diagnostic, test and practical tasks.

The sample size (n = 79) is representative for pedagogical experiments of this type, since it provides sufficient statistical power when using the Pearson χ^2-criterion, allows for reliable comparison of two groups of approximately equal size, and corresponds to the typical scale of experiments in the field of pedagogical education (30–100 participants).

The study used a set of diagnostic tools: questionnaires, interviews, testing, observations, reflective maps, expert evaluation, and mathematical and statistical processing (Pearson's χ^2).

The questionnaire contained both closed and open questions.

The tests were built in accordance with the four readiness criteria defined in the article: motivational, operational, personal, and cognitive.

Validity and reliability. Orientation to the international framework of digital competence (DigCompEdu), expert verification of compliance with indicators and components, and statistical verification (χ^2) confirmed the absence of systematic deviations and repeatability of results.

Tools of formative influence (digital tools and platforms). Pedagogical conditions were implemented through:

- Special course "Digital educational technologies in the work of a primary school teacher".
- Digital tools based on AI: Word Swag, Curipod, AI Synthesia, Murf-AI.
- Use of platforms Zoom, Google Meet, Moodle, Padlet.
- Interactive forms of work: laboratories, online boards, digital excursions.

All tools meet current international EdTech standards, provide multimodality, interactivity and accessibility, contribute to the formation of practical skills and motivational engagement, proven effectiveness in previous pedagogical research.

The quantitative and qualitative analysis of the results obtained by us indicates a positive dynamic in the levels of readiness of future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development in relation to the specified system of criteria and their indicators.

Results and Discussion

Content of the main concepts of the study ("digital technologies", "digital resources", "digital educational resources", "digital educational environment"). Main electronic learning platforms. Key strategy of the approach to collaborative learning. The importance of introducing digital games into education by primary school teachers.

Digital technologies are a group of technological operations implemented by class (information and communication) technologies that involve the storage, use, receipt, transmission of information, creation of educational materials using digital means, and their use in the educational process.

Gabarda Méndez et al. (2021) identify the main groups of digital resources (digital learning resources):

- Digital educational materials are part of the curriculum, educational materials of the course that are used in the classroom in practice.
- Digital content − digital resources: podcasts, social networks, websites, films, and games.
- Digital tools: digital software, digital equipment (mobile devices, computers, platforms).

So, “digital resources” are resources that are created using digital technologies, and “digital educational resources” are resources of digital technologies that can be used in education. Digital educational resources include virtual learning platforms, social networks, educational platforms, websites, educational process management systems, films, podcasts, games, online courses, webinars, augmented and virtual reality, and digital textbooks (Vargas-D’Uniam et al., 2014).

We consider a digital educational environment to be an educational environment that involves the use of digital technologies to solve educational tasks.

Given this, in our study, we used digital educational technologies from such groups that are appropriate for use in preparing future primary school teachers for professional activity. These are the following groups: multimedia technologies; database technologies; educational digital information processing technologies; network (telecommunications) technologies; computer experiment technologies, etc. (Pérez, 2023).

In order to form in future primary school teachers the readiness to use digital technologies in their professional activities for the purpose of their own professional development, electronic learning platforms are used, which are special online services that allow primary school teachers to organize virtual courses, tests, and assignments for students. The most popular platforms are Blackboard, Canvas, Google Classroom, Moodle, etc. Web conferences (online tools) are also used, which allow conducting webinars, online lectures, and video and audio conferences. It is possible to include Google Meet, Zoom, Microsoft Teams, etc.

For independent learning, students can use electronic resources: websites, electronic textbooks, electronic libraries, databases, etc., and Multimedia tools that allow them to create multimedia materials (animations, presentations, video lessons, etc.) and may include Microsoft PowerPoint, Adobe Creative Cloud, Prezi, etc.

The key strategy of the approach to collaborative learning to form future primary school teachers' readiness to use digital technologies in their professional activities is the work of students in groups and pairs (Gómez & Álvarez, 2020).

The introduction of digital games into education by primary school teachers is of great importance. Scientists Cabrera et al. (2023) identify digital games as the most popular educational technologies in modern classrooms. However, primary school teachers must be trained to use digital games in the educational process.

Compliance with general didactic and special principles for the formation of future primary school teachers' readiness to use digital technologies in their professional activities for their own professional development.

In order to successfully implement the ideas of forming future primary school teachers' readiness to use digital technologies in their professional activities for the purpose of their own professional development, we consider it necessary to adhere to general didactic and special principles.

General didactic principles include:

- The principle of scientificity is manifested in a combination of methodological, psychological, and pedagogical components that will contribute to the readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development and ensure the relevance of the content of training in the preparation of future specialists for the use of digital educational technologies in their professional activities.
- The principle of continuity promotes the consistency and systematic placement of educational components in the initial plan of the educational material in the training of primary school teachers, the cycle of scientific and subject, pedagogical, and psychological training, which are associated with the readiness to use digital educational technologies in professional activities.
- The principle of systematicity is necessary for the formation of awareness in the future primary school teacher of the need to master skills and knowledge within a certain topic and a holistic system of ideas about the specifics of using digital educational technologies in professional activities.
- The principle of clarity for effective awareness of the educational material ensures the active involvement of various sensory organs of students and, based on a combination of types of thinking (visual-figurative, visual-active, abstract-theoretical), creates opportunities for critical analysis of the information received.
- The principle of consciousness provides a special organization of the study of educational components related to the student's digital competence.
- The principle of humanization contributes to the formation of such personal qualities as: the use of opportunities necessary to achieve the goals set in professional activity; awareness of one's own uniqueness and ability to focus on personal needs; striving for self-development; building partnership relationships in the team.

Special principles include:

- The principle of instrumentality for high-quality mastery and study of educational components ensures the presence of a basis (necessary tools), where the components are associated with the use of educational digital technologies, the introduction of necessary platforms and digital applications into

the content of educational components ("Zoom", "Google Meet", "Padlet", etc.), educational and methodological support, forms of conducting classes.

- The principle of a didactic and developmental environment is implemented through the use and combination of environmental components that influence the process of forming students' readiness to use digital technologies in professional activity for their own professional development: social, spatial-subject, and didactic.
- The principle of activity promotes the involvement of students in solving problem situations, discussion, and interest through the implementation of project learning technologies, and the use of digital educational technologies.
- The principle of interdisciplinarity, by updating and supplementing the cycles of the curriculum, creates conditions for the implementation of interdisciplinary integration of educational components of the training of future teachers to promote their readiness to use digital technologies in professional activities for their own professional development.
- The principle of socialization provides for the inclusion of students in social relations through the study of educational material, which is associated with the use of digital technologies (Arredondo Trapero et al., 2020).

Requirements for future teachers during their studies at the university to form their readiness to use digital technologies in their professional activities.

Professional skills in using digital platforms and tools are acquired during their studies at the university. Future teachers must be ready to use digital technologies in their professional activities for their own professional development, be familiar with various platforms for distance education (Microsoft Teams, Google Classroom, Zoom), must be able to work with digital materials, be able to organize and create virtual classes, tests, and assignments (Silva Quiroz et al., 2022).

Primary school teachers should know how to use digital tools to provide and evaluate feedback to students, should be able to create digital learning materials (video lessons, interactive tasks, presentations, etc.), be able to work with online resources (databases, websites, electronic textbooks, etc.), should be able to use and find relevant information for teaching their students, be able to collaborate and communicate in an online environment, communicate via email, forums or chats, be able to organize student collaboration in virtual projects (Ocaña-Fernández et al., 2020).

The Moodle educational platform has all the necessary tools for independent education: assessment of academic achievements, self-study tools, and communication. In this case, students' educational activities can be carried out both asynchronously, when each student studies the material independently at a convenient time for them, and synchronously, during online classes in real time.

Online tools provide the opportunity to familiarize yourself with any topic using an online whiteboard (in Zoom), PowerPoint, Microsoft OneNote files, or Google Docs, which encourage students to work together, as higher education students, using shared access to a document or whiteboard, can discuss and see each other's work. (Harada et al., 2022).

Organization and course of the experimental study

The purpose of our study is to substantiate and experimentally verify the system and pedagogical conditions of the effectiveness of forming in future primary school teachers' readiness to use digital technologies in professional activities for the purpose of their own professional development.

The experimental study was carried out during 2022-2024 and covered the interrelated stages (confirmatory, formative, and generalizing) of the pedagogical experiment.

At the confirmatory stage, a theoretical analysis of the outlined problem was carried out, the literature on the research problem was analyzed, the state of the problem under study and the directions of scientific

research were determined; the pedagogical conditions for forming in future primary school teachers readiness to use digital technologies in professional activities for their own professional development were theoretically substantiated; a program of research and experimental work was developed; the criteria, levels and indicators of readiness to use digital technologies in professional activities for students' own professional development were substantiated; the confirmatory stage of the experiment was conducted.

At the formative stage, a system for forming future primary school teachers' readiness to use digital technologies in their professional activities for their own professional development was introduced into the educational process; pedagogical conditions were implemented; the formative stage of the experiment was conducted; and the results of the study were summarized.

At the generalization stage, the effectiveness of the implementation of the system for forming future primary school teachers' readiness to use digital technologies in their professional activities for the purpose of their own professional development was analyzed. Generalization, statistical processing of the results of the pedagogical experiment, and systematization of the results of the study, qualitative and quantitative analysis, and conclusions were formulated.

Analysis of the results of the ascertaining experiment

The purpose of the ascertaining stage of the experiment was to determine the features of identifying factors that increase the level of students' readiness to implement and use digital educational technologies in their future professional activities.

Internal reliability of the diagnostic tools was assessed using **Cronbach's alpha (α)**, which measures the degree to which test items are consistent with one another. Values above 0.70 are considered acceptable, above 0.80 – good, and above 0.90 – excellent.

Table 1.
Cronbach's Alpha calculation for all four readiness criteria

Scale / Criterion	Number of Items	Cronbach's α	Reliability Level
Motivational	8	**0.87**	Good
Operational	10	**0.91**	Excellent
Personal	7	**0.85**	Good
Cognitive	9	**0.89**	Good
Overall Scale	34	**0.93**	Excellent

These results confirm high internal consistency and stability of the measurement tool.

Item–Total Correlation Matrix (Construct Validity Evidence)

Corrected item–total correlations (CITC) were examined to assess item discrimination. Acceptable values range from 0.30 to 0.80.

Table 2.
Item–Total Correlations

Item Code	CITC	Interpretation
M1	0.62	Strong
M4	0.58	Strong
O3	0.71	Strong
O7	0.66	Strong
P2	0.49	Acceptable
P5	0.53	Strong
C1	0.68	Strong
C6	0.72	Strong

All items demonstrated acceptable-to-strong correlations, confirming **construct validity**.

Content Validity Procedure

Content validity was ensured through:

Expert panel (n = 7) including specialists in digital pedagogy, psychometrics, and primary education. Experts evaluated each item by:

- Relevance.
- Clarity.
- Alignment with the four readiness components.
- Difficulty and appropriateness for pre-service teachers.

The Content Validity Index (CVI) reached:

- Item-level CVI (I-CVI): 0.86–1.00
- Scale-level CVI (S-CVI): 0.94

Construct Validity (Factor Structure Confirmation)

Exploratory factor analysis (EFA, principal-component method with varimax rotation) confirmed the presence of four latent factors corresponding to the conceptual model.

- KMO = 0.89 (excellent).
- Bartlett's $\chi^2 = 1264.54$, df = 253, $p < 0.001$.

Factor loadings (.52–.84) confirmed structural alignment with the four readiness components.

Criterion Validity

Criterion validity was tested through correlation between readiness scores and:

- Prior digital experience ($r = 0.42$, $p < 0.01$).
- Self-efficacy in digital competence ($r = 0.56$, $p < 0.01$).

These medium-to-strong correlations confirm expected associations.

Pilot Study

A pilot study was conducted with N = 28 pre-service teachers from a comparable institution. The goals were to refine items, estimate reliability, and test clarity.

Pilot results:

- Cronbach's alpha (total scale): 0.91.
- Mean item difficulty index: 0.48.
- No item demonstrated problematic distribution (skewness < |1.2|).

Based on pilot feedback, 5 items were reworded for clarity.

Below are formal statistics for each criterion at the initial stage, confirming the equivalence of EG and CG.

Table 3.
Frequency table. Motivation criterion – basic level

Level	EG (n=39)	CG (n=40)
High	4	3
Medium	23	23
Low	13	14

Chi-square Test:

- $\chi^2 = 0.18$
- df = 2
- p = 0.914
- Cramér's V = 0.047 (very small effect)

Table 4.
Operational Criterion – Baseline

Level	EG	CG
High	6	6
Medium	14	14
Low	20	21

- $\chi^2 = 0.01$
- df = 2
- p = 0.994
- Cramér's V = 0.006

Table 5.
Personal Criterion – Baseline

Level	EG	CG
High	5	5
Medium	13	13
Low	21	22

- $\chi^2 = 0.01$
- df = 2

- p = 0.995
- Cramér's V = 0.012

Table 6.
Cognitive Criterion – Baseline

Level	EG	CG
High	5	4
Medium	12	14
Low	21	22

- $\chi^2 = 0.24$
- df = 2
- p = 0.888
- Cramér's V = 0.055

Post-Intervention Statistical Results (Effectiveness Testing)

All χ^2 values were statistically significant at 0.05 and 0.01, confirming the impact of the pedagogical intervention.

Table 7.
Summary Table Results

Criterion	χ^2_emp	χ^2_crit (df=2)	p-value	Effect Size (V)	Interpretation
Motivational	18.72	5.99	<0.001	0.35	Medium
Operational	22.15	5.99	<0.001	0.38	Medium–large
Personal	19.64	5.99	<0.001	0.36	Medium
Cognitive	17.81	5.99	<0.001	0.34	Medium

Therefore, all p < 0.001, so the null hypothesis is rejected. The pedagogical system led to a significant increase in readiness levels. Cramér's V values of = 0.34–0.38 indicate a moderate or moderately large effect.

A quantitative statistical comparison of the initial levels of readiness of future primary school teachers was conducted for four criteria (motivational, operational, personal, and cognitive). The sample consisted of 79 participants, with 39 assigned to the Experimental Group (EG) and 40 to the Control Group (CG). The percentage values reported at the baseline stage were converted into absolute frequencies to build contingency tables.

To determine the equivalence of the groups before the implementation of the formative intervention, Pearson's chi-square (χ^2) test was applied. The effect size was calculated using Cramér's V.

Motivational Criterion

Table 8.
Distribution of Students by Motivational Criterion at the Baseline Stage

Group	High	Medium	Low	Total
EG (n = 39)	4	23	13	39
CG (n = 40)	3	23	14	40

Statistical indicators:

$\chi^2 = 0.18$,
df = 2,
p = 0.914
Cramér's V = 0.047

The difference between EG and CG is statistically insignificant ($p > 0.05$); the groups are homogeneous in terms of motivational readiness.

Operational Criterion

Table 9.
Distribution of Students by Operational Criterion at the Baseline Stage

Group	High	Medium	Low	Total
EG (n = 39)	6	14	20	39
CG (n = 40)	6	14	21	40

Statistical indicators:

$\chi^2 = 0.01$,
df = 2,
p = 0.994
Cramér's V = 0.006

No statistically meaningful difference exists between the groups; the distributions are almost identical, and the effect size is practically zero.

Personal Criterion

Table 10.
Distribution of Students by Personal Criterion at the Baseline Stage

Group	High	Medium	Low	Total
EG (n = 39)	5	13	21	39
CG (n = 40)	5	13	22	40

Statistical indicators:

$\chi^2 = 0.01$,
df = 2,
p = 0.995
Cramér's V = 0.012

The distributions in both groups are nearly identical; no statistically significant differences were found.

Cognitive Criterion

Table 11.
Distribution of Students by Cognitive Criterion at the Baseline Stage

Group	High	Medium	Low	Total
EG (n = 39)	5	12	21	39
CG (n = 40)	4	14	22	40

Statistical indicators:

$\chi^2 = 0.24$,
df = 2,
p = 0.888
Cramér's V = 0.055

The difference between the groups is not statistically significant ($p > 0.05$); the effect size is minimal.

Across all four criteria, the obtained χ^2 values indicate no statistically significant differences between the experimental and control groups at the initial stage. All p-values substantially exceed 0.05, and the Cramér's V coefficients fall within 0.006–0.055, indicating very small effect sizes.

These findings confirm that the groups were equivalent in their initial readiness to use digital technologies, which ensures the methodological correctness of further experimental comparison.

At the ascertaining stage of the experiment, the structural components of readiness (as a personal integrative property that is a prerequisite for effective professional activity after receiving professional education) of future primary school teachers to use digital technologies in their professional activities for their own professional development were determined: motivational component, activity component, personal component, and epistemological component.

The motivational component contains motives that encourage the future specialist to use digital educational technologies in their professional activities, which form key information and digital competencies.

The activity component corresponds to and provides pedagogical operations and actions that are necessary for the implementation of educational digital technologies.

Personal – includes professionally significant personality properties: moral and ethical, emotional and volitional, organizational and managerial, etc.

Epistemological component – provides a system of scientific and professional knowledge for a solid foundation for the practical implementation of educational digital technologies by future teachers in the process of teaching children.

The study of all aspects of readiness for the use of digital technologies in professional activities by future primary school teachers for the purpose of their own professional development made it possible to identify criteria and their indicators.

The criteria of readiness were determined: motivational, operational, personal, and cognitive, and their indicators.

Indicators of the motivational criterion: the formation of professional views, external and internal motives in the personality, the desire to improve one's own professional career, showing creativity and imagination, showing interest in modern digital technologies; showing interest in teaching modern methods in the field of primary education; the need for increased interest in studying new computer technologies to involve them in labor activity, etc.

Indicators of the operational criterion: the formation of special skills and abilities to theoretically work out modern educational digital technologies and implement them practically in professional activity, the ability to use digital technologies in primary school for teaching students, mastering European practices based on subject-subject interaction with students during the educational process, the ability to apply modern digital technologies based on competency-based learning; the ability to effectively organize the educational process, the formation of skills for optimal use of the entire spectrum of educational digital technologies in accordance with the age category of schoolchildren and a certain academic discipline.

Indicators of the personal criterion: the formation of trust, responsibility, tolerance, understanding of the need for advanced training and professional self-improvement; the ability to independently master modern educational digital technologies, critically evaluate one's own pedagogical activities, make decisions to effectively form digital competence in students, etc.

Indicators of the cognitive criterion: the formation of a professional worldview of a primary school teacher in the personality, knowledge about the features of modeling the content of courses for younger schoolchildren with the possibility of introducing digital educational technologies into them based on a competency-based approach; knowledge of the basics of pedagogy, psychology, age characteristics of younger schoolchildren, knowledge about the possibilities of the influence of educational digital technologies on the formation of key competencies in primary school students.

We have identified three levels of readiness for the use of digital technologies by future primary school teachers in their professional activities for their own professional development based on the specified criteria and their indicators: high, medium, and low. The specified system of components, criteria, and indicators allowed future primary school teachers to achieve positive dynamics of readiness for the use of digital educational technologies in their professional activities for the purpose of their own professional development.

At the ascertaining stage of the study, a diagnosis of the level of readiness of future primary school teachers was carried out, and the features of identifying factors that increase the level of students' readiness for the implementation and use of digital educational technologies in their future professional activities were determined. Diagnostic sections were carried out in accordance with the specified criteria.

Using the questionnaire method, in order to implement the specified goal, we determined the level of respondents' attitude to the use of digital technologies in their future professional activities.

To question 1, "Do you consider it appropriate to use digital educational technologies when teaching primary school students?" the following results were obtained (Figure 1):

- 85% of respondents answered “Yes”.
- 10% of respondents answered “Difficult to answer”.
- 5% of respondents answered “No”.

Analyzing the questionnaire question 2, “Do you use the capabilities of digital educational online platforms for higher education?”, the following results were obtained (Figure 1):

- 66% of respondents answered “Yes”.
- 34% of respondents answered “No”.

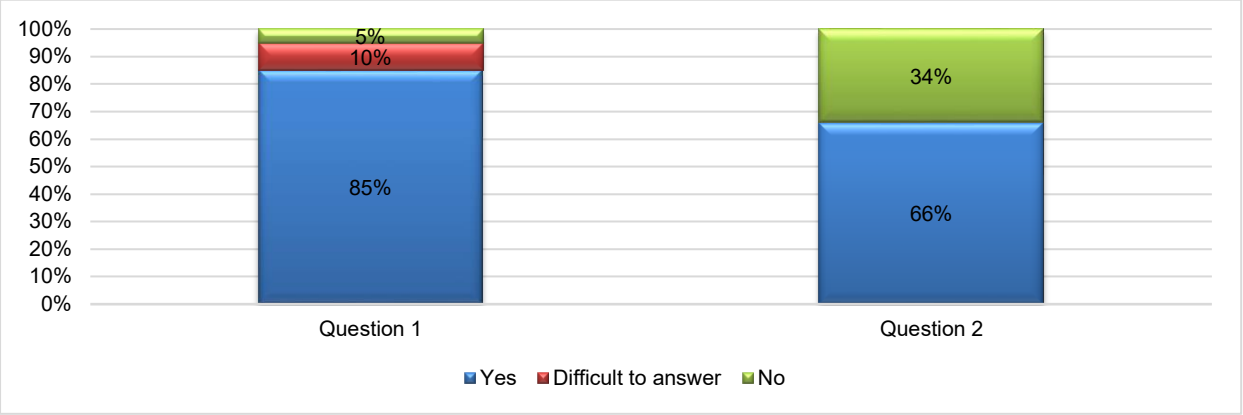

Figure 1. Respondents' Attitudes Toward the Use of Digital Technologies in Future Professional Activities (Question 1, 2).

To question 3, "Did you have any difficulties using digital technologies during your pedagogical practice? If so, what are they?", which provided the opportunity to choose several answer options, the following results were obtained (Figure 2):

- 28% chose the option "Lack of high-quality Internet".
- 27% chose the option "Insufficient technical equipment in the educational institution".
- 64% chose the option "Own level of mastery of digital technologies is low".
- 49% chose the option "Lack of methodological recommendations on the use of digital technologies in primary school".
- 8% of respondents noted that "There are no difficulties when using digital technologies".

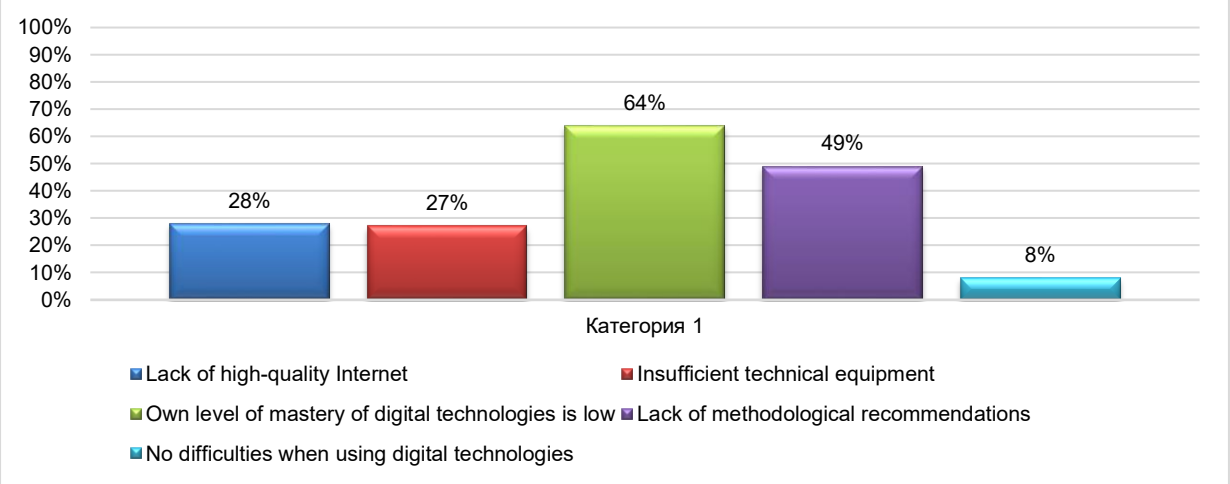

Figure 2. Respondents' Attitudes Toward the Use of Digital Technologies in Future Professional Activities (Question 3).

To question 4, "What will help you master digital technologies and increase your level of readiness for the implementation and use of digital educational technologies in your future professional activities?", which allowed choosing several answer options, the following results were obtained (Figure 3):

- 74% of respondents chose the option "Development of a system and pedagogical conditions to increase the level of students' readiness for the implementation and use of digital educational technologies in their future professional activities".

– 47% of respondents chose the option “Introduction of a separate discipline, special course related to digital technologies”.
– 27% of respondents chose the option “Participation in courses, webinars, etc., outside the main classes in higher education”.

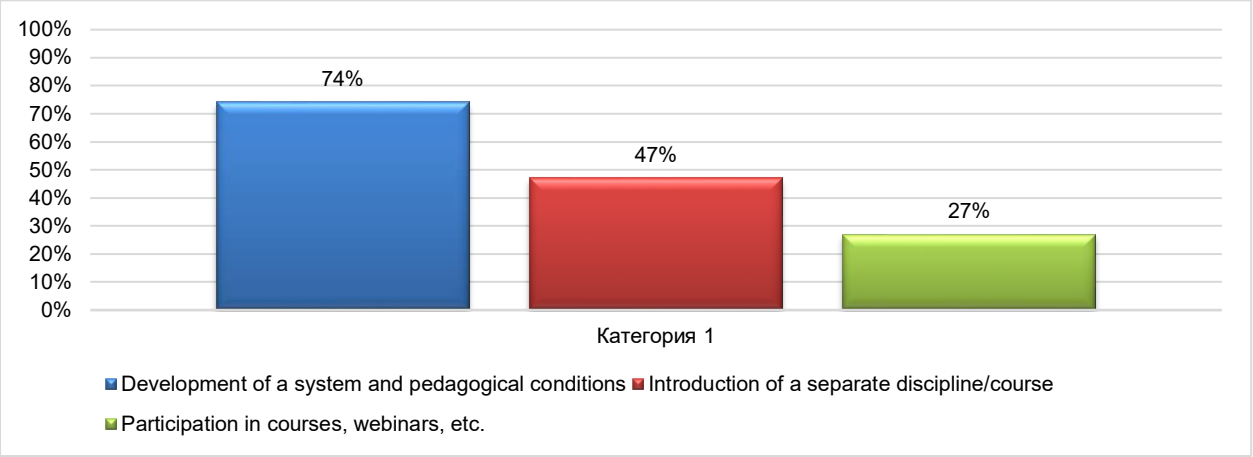

Figure 3. Respondents’ Attitudes Toward the Use of Digital Technologies in Future Professional Activities (Question 4).

We see that most respondents need to develop a system and pedagogical conditions in order to increase their level of readiness for the implementation and use of digital educational technologies in their future professional activities.

Using the testing method, in order to achieve the specified goal, we determined the initial levels of readiness of future teachers to use digital educational technologies in their professional activities (Figure 4).

Let us present the obtained results of the initial levels of readiness for the use of digital educational technologies of future primary school teachers in their professional activities by the **motivational criterion**:

A high level is possessed by:

– 9% of respondents in the EG.
– 8% of respondents in the CG.

An average level is possessed by:

– 58% of respondents in the EG.
– 58% of respondents in the CG.

A low level is possessed by:

– 33% of respondents in the EG.
– 34% of respondents in the CG.

Let us present the obtained results of the initial levels of readiness for the use of digital educational technologies of future primary school teachers in professional activities according to the **operational criterion**:

High level has:

– 15% of respondents EG.
– 14% of respondents CG.

Average level has:

– 35% of respondents EG.
– 34% of respondents CG.

Low level has:

– 50% of respondents EG.
– 52% of respondents CG

Let us present the obtained results of the initial levels of readiness for the use of digital educational technologies of future primary school teachers in professional activities according to the **personal criterion**:

High level has:

– 14% of respondents EG.
– 12% of respondents CG.

Average level has:

– 33% of respondents EG.
– 32% of respondents CG.

Low level has:

– 53% of respondents in the EG.
– 56% of respondents in the CG.

Let us present the obtained results of the initial levels of readiness to use digital educational technologies of future primary school teachers in professional activities according to the **cognitive criterion**:

High level has:

– 14% of respondents in the EG.
– 11% of respondents in the CG.

Average level has:

– 32% of respondents in the EG.
– 34% of respondents in the CG.

Low level has:

– 54% of respondents in the EG.
– 55% of respondents in the CG.

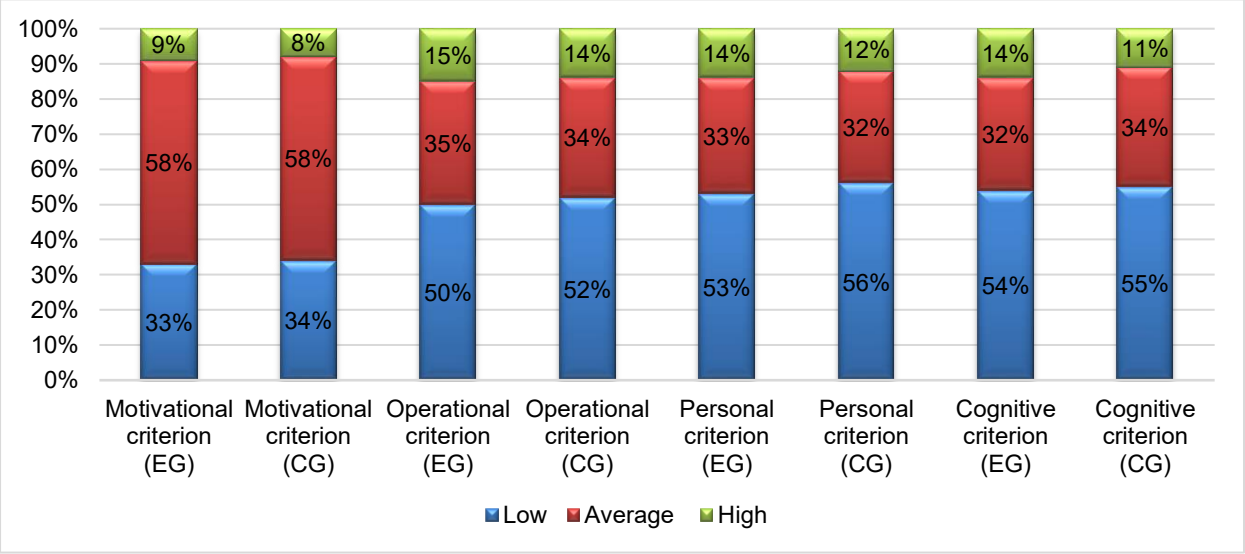

Figure 4. Initial Levels of Readiness of Future Primary School Teachers to Use Digital Educational Technologies.

The results of the ascertaining section make it possible to state that the respondents have a low level of readiness to use digital technologies in professional activities for the purpose of their own professional development.

The reliability of the experimental data and the reliability of the results of the experimental work carried out at the ascertaining stage were determined using the Pearson χ^2 criterion (non-parametric), which allows obtaining 95% reliability of the probability results, finding differences, and assessing the reliability between two distributions, in particular to test the H0 hypothesis of the absence of differences between the two empirical distributions.

Analyzing the obtained values of the Pearson criterion (χ^2_{emp}) ($\chi^2_{emp} < \chi^2_{crit}$ (0.05)) for all criteria with a critical value of the criterion (χ^2_{crit})), we say that the initial level of readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development among the surveyed respondents of the experimental group and the control group does not differ significantly.

There are no statistically significant differences in the level of readiness of respondents who participated in the experiment, because the results obtained here are manifested at the level of significance of 0.01 and 0.05 between EC and CG. This gives reason to say that the contingent of respondents of the experimental group and the control group is equivalent. The low level of respondents is the prevailing level of readiness of future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development.

Analysis of the results of the formative stage of the experiment.

The course of the formative stage was determined by the results of the ascertaining experiment. The number of respondents remained unchanged.

In the experimental group, the educational process was organized by implementing the developed pedagogical conditions that were included in the system of innovative training in the EG, and in the control group, training was carried out using traditional methods. The readiness of future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development in the EG and CG is characterized in accordance with the specified criteria and levels.

We consider the creation of a pedagogical innovation system and the implementation of pedagogical conditions for training future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development to be the main component of our pedagogical research.

One of the tasks of the specified system is the introduction into educational practice of educational and methodological support for training future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development. In the process of their preparation, it is also advisable to use methods that are traditional and based on the processing and transmission of the content of information perception. Such methods for forming the components of student readiness become more effective if integrated with methods such as interactive, staging certain situations by roles, development of critical thinking of the individual, etc.

We see particular importance in implementing the learning process through the involvement of active forms (training, digital laboratory, interactive digital excursions in the digital environment, educational and scientific research, etc.). When organizing the educational activities of the EG respondents, pair and group work became the leading.

Various telecommunication (network) technologies, multimedia technologies, geoinformation digital technologies, electronic textbooks, manuals, electronic resources (programs, applications, etc.), and distance learning systems became pedagogically and methodologically valuable in EG teaching.

The pedagogical conditions for training future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development were introduced into the educational process of the EG.

The first pedagogical condition, “Stimulating the motivation of future primary school teachers to use digital technologies in their professional activities for their own professional development”, was implemented in the educational process through the use of platforms, digital technologies, and applications based on artificial intelligence: “Word swag”, “Curipod”, “AI Synthesia”, “Murf-AI”.

The second pedagogical condition, “Modernization of the content of training future primary school teachers to use digital technologies in their professional activities for their own professional development”, was implemented in the educational process through the introduction of the special course “Digital educational technologies in the work of a primary school teacher” into the EG.

The third pedagogical condition, “Use of innovative forms, technologies of developed methodological support of practical training of future primary school teachers for the use of digital technologies in professional activities for their own professional development”, was implemented in the educational process of EG students by introducing various forms and digital educational technologies.

Let us analyze the results of the formative stage of the experiment on the diagnostics of the levels of readiness of future primary school teachers for the use of digital technologies in professional activities for the purpose of their own professional development (Figure 5).

Let us present the results obtained at the generalization stage of the diagnostics of the levels of readiness of future primary school teachers for the use of digital technologies in professional activities for their own professional development by the **motivational criterion**:

High level of readiness:

- In EG respondents increased by 12%.
- In CG respondents increased by 3%.

Average level of readiness:

- In EG respondents increased by 25%.
- In CG respondents increased by 1%.

Low level of readiness:

- In EG respondents decreased by 38%.
- In CG respondents decreased by 4%.

Let us present the results of the diagnostics of the readiness levels of future primary school teachers to use digital technologies in their professional activities for their own professional development, obtained at the generalization stage, according to the **operational criterion**:

High level of readiness:

- In EG respondents increased by 12%.
- In CG respondents increased by 0.8%.

Average level of readiness:

- In EG respondents increased by 23%.
- In CG respondents increased by 2%.

Low level of readiness:

- In EG respondents decreased by 34%.
- In CG respondents decreased by 3%.

Let us present the results of the diagnostic of the levels of readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development according to the **personal criterion**, obtained at the generalization stage:

High level of readiness:

- In EG respondents increased by 12%.
- In CG respondents increased by 2%.

Average level of readiness:

- In EG respondents increased by 27%.
- In CG respondents increased by 2%.

Low level of readiness:

- In EG respondents decreased by 41%.
- In CG respondents decreased by 4%.

Let us present the results of the diagnostic of the levels of readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development according to the **cognitive criterion**, obtained at the generalization stage:

High level of readiness:

- In EG respondents increased by 11%.
- In CG respondents increased by 1%.

Average level of readiness:

- In EG respondents increased by 26%.
- In CG respondents increased by 1%.

Low level of readiness:

- In EG respondents decreased by 35%.
- In CG respondents decreased by 3%.

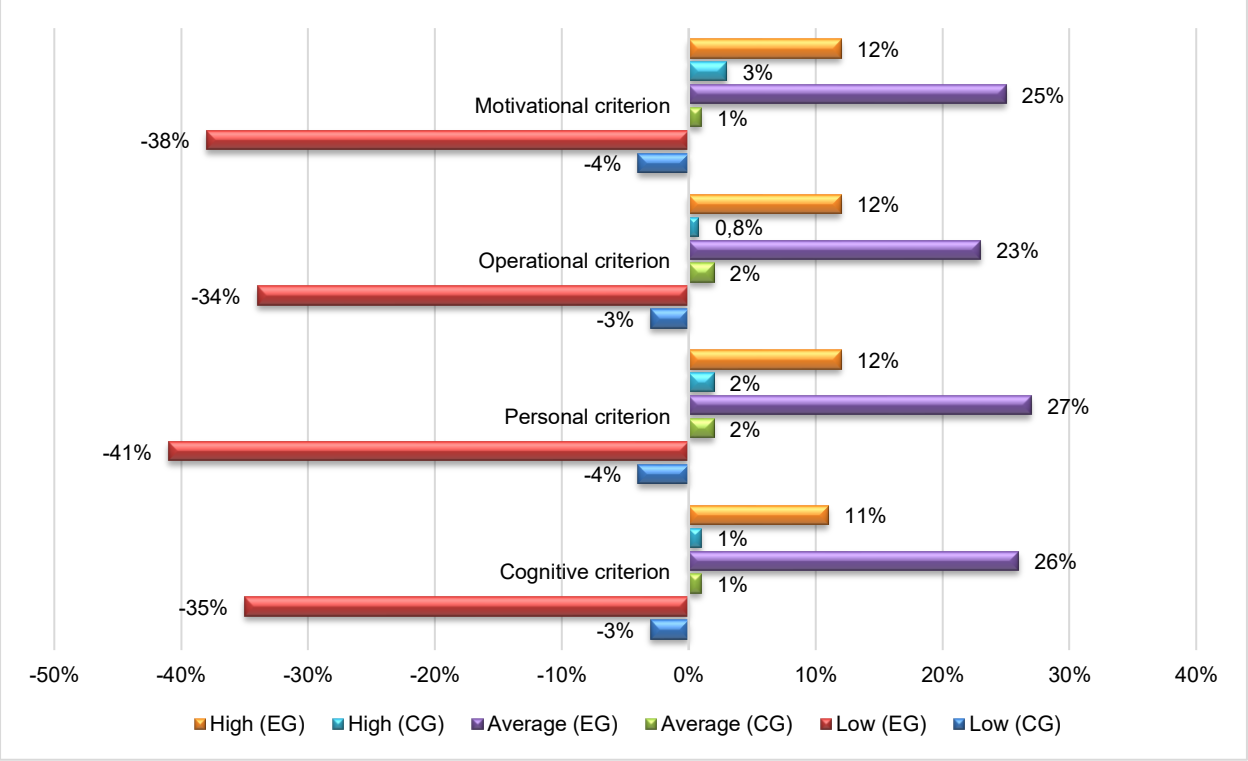

Figure 5. Levels of Readiness of Future Primary School Teachers to Use Digital Technologies for Professional Development (Formative Stage).

According to the established levels of readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development, the results of the experimental work showed that:

- The number of EG respondents who received a high level increased by 12%, while in the CG, the increase was recorded by only 2%.
- The number of EG respondents who received an average level increased by 24%, while in the CG, the increase was recorded by only 2%.
- The number of EG respondents who received a low level decreased by 37%, while in the CG, the increase was recorded by approximately 3%.

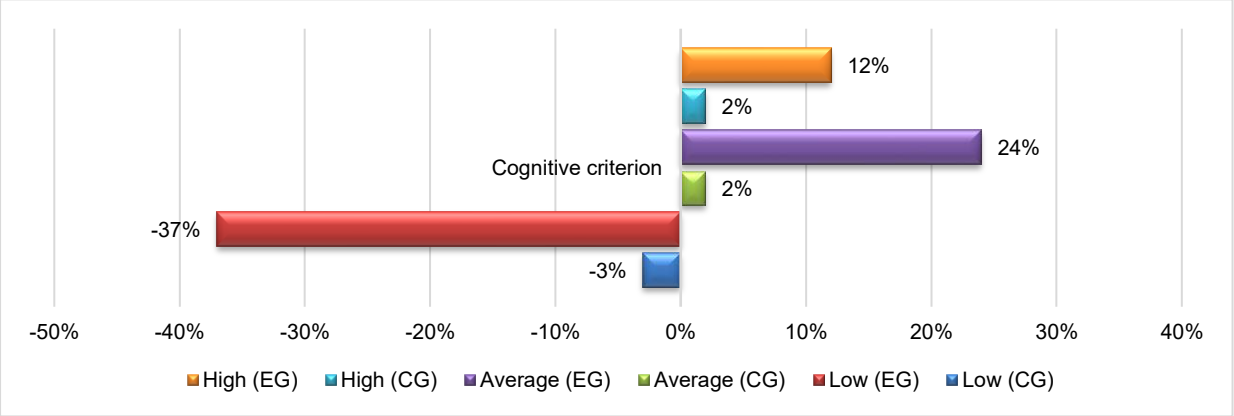

Figure 6. Levels of Readiness of Future Primary School Teachers to Use Digital Technologies for Professional Development (Formative Stage, Average Indicators)

To verify the reliability of the conclusions of the study, a statistical analysis of experimental data (Pearson's non-parametric χ^2 criterion) was conducted using statistical processing methods to determine the difference in indicators in the EG and CG, and to verify its significance (implementation of the proposed system and pedagogical conditions).

H0 null hypothesis: the control and experimental samples are homogeneous in terms of the level of readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development according to the studied χ^2 criterion.

H1 alternative hypothesis: the control and experimental samples are different in terms of the level of readiness of future primary school teachers to use digital technologies in their professional activities for their own professional development, according to the studied χ^2 criterion.

Significant results were obtained at the 5% and 1% levels ($\chi^2_{emp} > \chi^2_{crit}$); therefore, the H_0 null hypothesis is rejected and accepted at a high level of significance. H_1 alternative hypothesis that the level of readiness of students in the experimental group and the control group is significantly different, which indicates the effectiveness of the system and pedagogical conditions.

Therefore, the proposed innovative system and the implementation of pedagogical conditions for training future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development are effective, which is confirmed by statistical processing of experimental data. The quantitative and qualitative analysis of the results obtained by us indicates a positive dynamic of the levels of readiness of future primary school teachers to use digital technologies in their professional activities for the purpose of their own professional development in relation to the specified system of criteria and their indicators.

The results of the study provide a comprehensive understanding of how the implementation of a targeted pedagogical system influences the readiness of future primary school teachers to use digital technologies in their professional activities. The baseline analysis confirmed that the experimental (EG) and control (CG) groups were statistically equivalent across all four readiness criteria – motivational, operational, personal, and cognitive. This equivalence, verified using Pearson's χ^2 test, provided a solid methodological foundation for attributing all further differences to the implemented pedagogical interventions rather than to initial disparities.

The significant improvements observed in the experimental group after implementing pedagogical conditions – particularly the growth in high readiness levels and the reduction in low readiness levels –

align with theoretical assumptions about the impact of structured digital training on teacher competence development. According to Mora & Sánchez (2020), digital competence is not only a technical skill set but also a multidimensional construct encompassing motivation, knowledge, ethical awareness, and operational proficiency. The positive shifts across all four criteria in the EG demonstrate that the proposed pedagogical model effectively addressed these components, confirming the theoretical model underlying the study.

The motivational growth observed in the EG aligns with Healy's (2020) findings that collaborative and technology-enhanced learning environments can foster stronger intrinsic motivation among prospective teachers. The integration of digital tools such as Curipod, AI Synthesia, Padlet, and Moodle created opportunities for autonomy, creativity, and engagement – factors that contemporary motivation theories (e.g., Self-Determination Theory) identify as central to sustained professional development.

The operational improvements observed in the EG are consistent with Chen et al. (2017), who emphasized that structured exposure to digital platforms during teacher preparation enhances procedural knowledge and confidence in technology integration. In the current study, the inclusion of a dedicated course on digital educational technologies functioned as a structured learning pathway, directly supporting this claim.

Similarly, the substantial progress in the personal component of readiness is in line with findings by Walter & Pyżalski (2022), who argue that digital competence development is closely associated with personal attributes such as adaptability, confidence, and responsibility. The study's results demonstrate that when future teachers engage regularly with real digital tools, their sense of professional identity and agency in digital environments noticeably increases.

Finally, the cognitive advances documented among EG participants reinforce the arguments of Alonso de Castro & García-Peñalvo (2021), who note that digital transformation in education requires a solid conceptual understanding of pedagogy, psychology, and digital methodologies. As the participants engaged deeply with digital resources, their comprehension of digital pedagogy and their understanding of how these tools influence learning processes improved.

Interpreting the effectiveness of pedagogical conditions

The formative stage confirmed the effectiveness of the three core pedagogical conditions:

- Stimulating motivation to use digital technologies.
- Modernizing the content of professional training.
- Implementing innovative, technology-rich instructional methods.

The most substantial improvements were seen in the reduction of low readiness levels in the experimental group across all criteria, indicating that the proposed innovations were particularly effective for students who initially lacked confidence or competence in digital environments. This finding is consistent with Gómez & Álvarez (2020), who highlight that structured exposure to technology reduces anxiety and increases the perceived usefulness of digital tools among pre-service teachers.

Alignment with global perspectives on digital education

The study's outcomes support global educational priorities emphasizing digitalization and technology-enhanced teaching. They reflect the broader discourse presented by international organizations (e.g., UNESCO, OECD), which stresses the need for teachers capable of navigating digital ecosystems, designing interactive learning environments, and supporting students in acquiring digital literacy.

Moreover, the significant shift in the EG aligns with the DigCompEdu framework, reaffirming that professional digital competence develops most effectively in environments where technological, pedagogical, and psychological factors are systematically integrated.

Overall, the findings indicate that the pedagogical conditions developed in this study not only produced measurable improvements in readiness but also resonate with contemporary theoretical approaches and empirical evidence in the field of teacher digital competence. The observed transformations confirm that a comprehensive, multi-component system – incorporating motivation, content, and instructional innovation – can substantially accelerate the formation of digital readiness among future primary school teachers.

The results also underscore the necessity of continuous curriculum modernization within teacher education programs, aiming to respond to the rapid digital transformation of society and schooling. Integrating digital tools is no longer optional but essential for fostering pedagogically sound, inclusive, and engaging learning environments.

The present findings – statistically significant improvements across motivational, operational, personal, and cognitive readiness after a multi-component pedagogical intervention – are consistent with and extend prior work on teacher digital competence. Where Chen et al. (2017) and Lee (2020) documented gains in procedural skills following structured exposure to platforms and tasks, our study demonstrates that integrating motivation-focused activities and identity-forming practices produces broader, multi-dimensional gains. Similarly, the observed motivational and identity shifts align with claims by Mora & Sánchez (2020) and Walter & Pyżalski (2022) that competence development is not only technical but also motivational and socio-psychological. Our results also complement global competency frameworks (e.g., DigCompEdu) and empirical syntheses (Alonso de Castro & García-Peñalvo, 2021) by showing that systematized curricular change plus active practice yields measurable shifts in each component of readiness.

Concise Comparative Analysis of the Four Criteria

Motivational Criterion

The increase in motivational readiness observed in the Experimental Group aligns with findings by Healy (2020) and Gómez & Álvarez (2020), who emphasize that collaborative, technology-supported learning environments foster intrinsic motivation for digital integration. Our sharper motivational improvements can be theoretically explained through Self-Determination Theory: autonomy in digital task choice, visible competence gains through AI tools, and peer collaboration all strengthen intrinsic motivation more robustly than traditional instruction.

Operational Criterion

The substantial operational skill gains mirror prior studies (Chen et al., 2017; Lee, 2020) demonstrating that hands-on engagement with digital platforms leads to procedural competence. However, our results exceed typical improvements reported in tool-specific interventions. This is theoretically supported by TPACK and skill acquisition theory, which posit that contextualized, feedback-rich practice promotes stronger operational mastery than isolated technical training.

Personal Criterion

Compared with studies by Walter & Pyżalski (2022), which show gradual shifts in digital self-efficacy and professional identity, our intervention produced faster and deeper personal changes. Social Cognitive Theory helps explain this effect: the combination of mastery experiences, peer modeling, and guided reflection strengthened responsibility, confidence, and adaptability – core personal attributes underlying teacher digital readiness.

Cognitive Criterion

Consistent with Alonso de Castro & García-Peñalvo (2021), targeted instruction in digital pedagogy enhanced conceptual understanding. Our more pronounced cognitive gains can be attributed to the integration of theoretical frameworks with authentic digital lesson design tasks, which supports deeper conceptual restructuring, as predicted by constructivist and metacognitive theories.

Integrated interpretation: why a multi-component system worked

Across criteria, the intervention's success appears to hinge on three theoretical mechanisms supported in the literature:

1. **Motivation + Competence Feedback Loop:** SDT and expectancy-value theory predict that competence gains fuel motivation; our design intentionally produced early, visible competence wins.
2. **Theory-Practice Integration:** Combining conceptual modules with authentic practice fosters cognitive restructuring (constructivist theory), enabling teachers to form transferable pedagogical schemas.
3. **Identity and Social Reinforcement:** Social cognitive mechanisms (modeling, feedback, reflection) transform discrete skills into professional dispositions.

These interacting processes align with DigCompEdu's multidimensional perspective and extend empirical claims by showing that coordinated curricular, technological, and pedagogical components produce larger, cross-domain effects than piecemeal interventions.

Practical implications

For teacher-education programs, results advocate for curriculum redesign that couples: (1) explicit digital pedagogy courses, (2) authentic, scaffolded practice with formative feedback, and (3) reflective, collaborative tasks to build professional identity. This triad operationalizes theoretical insights (TPACK, SDT, Social Cognitive Theory) into implementable pedagogy.

In sum, our findings extend the empirical literature by demonstrating that a theoretically informed, multi-component pedagogical system produces simultaneous improvements in motivational, operational, personal, and cognitive readiness. Theoretical frameworks from SDT, TPACK/ DigCompEdu, and Social Cognitive Theory jointly explain the multi-dimensional effects, and the comparative evidence suggests that integrated interventions are more effective than single-axis approaches emphasized in many prior studies.

Conclusions

The conducted study makes several significant theoretical contributions to the field of teacher education and digital pedagogy.

First, it offers a refined conceptualization of readiness to use digital technologies by integrating four interdependent components – motivational, operational, personal, and cognitive. This multidimensional model expands existing theoretical frameworks (e.g., DigCompEdu, TPACK) by highlighting the role of internal motivational drives and personal characteristics in the formation of digital competence among future primary school teachers.

Second, the study theoretically substantiates a system of pedagogical conditions that support the development of digital readiness. In contrast to previous research, which often focuses on isolated aspects of digital training (Chen et al., 2017; Lee, 2020), this study proposes a holistic model that combines motivational enhancement, content modernization, and the integration of innovative, technology-rich teaching methods. The system provides a theoretically grounded explanation of how and why specific pedagogical influences facilitate competence development, thereby advancing current pedagogical theory.

Finally, the research contributes to the theoretical discourse on digital transformation in education by demonstrating that pre-service teachers' readiness is not solely a technological construct but also a pedagogical, psychological, and identity-based phenomenon. This aligns with and further extends the interpretations presented by Mora & Sánchez (2020) and Walter & Pyżalski (2022).

The study also offers a strong empirical contribution supported by a robust experimental design.

First, the statistical verification of initial group equivalence (χ^2 tests across all criteria) provides a solid methodological foundation for assessing the effectiveness of the intervention, addressing a common limitation in educational experiments where baseline comparability is often insufficiently verified.

Second, the implementation of a pedagogical system in the experimental group resulted in clear, measurable improvements across all components of readiness. The substantial reduction in low-level readiness and the proportional increase in high and medium levels provide empirical evidence of the effectiveness of the proposed pedagogical conditions. These results reinforce previous findings (Gómez & Álvarez, 2020; Cabrera et al., 2023) and offer new, statistically validated data from the context of primary teacher education.

Third, the study provides detailed empirical insights into the challenges students face in using digital technologies, such as insufficient digital proficiency, lack of methodological guidelines, and technological constraints. These findings enrich the broader understanding of structural barriers to digital competence development in teacher education.

Limitations of the Study

Although the study offers valuable findings, several limitations must be acknowledged.

The study involved 79 participants from several pedagogical universities, which may limit the generalizability of results to other cultural or institutional contexts. A broader and more diverse sample would increase external validity.

Part of the data, especially regarding motivational and personal components, relies on self-assessment. This introduces the possibility of social desirability bias or overestimated competence levels.

The research does not assess whether the improved readiness is sustained during real teaching practice after graduation. Digital competence development is dynamic, and long-term tracking would yield deeper insights.

The study evaluates readiness primarily through diagnostic tools and testing, but does not include a comprehensive performance-based assessment (e.g., digital lesson design analysis, classroom observation).

Directions for Future Research

Based on the findings and limitations, several clear directions for future research are proposed:

- Longitudinal studies on competence retention.
- Future research should examine whether the digital readiness developed during teacher preparation persists and evolves during the first years of professional teaching.
- Expansion of the model to international contexts.
- Comparative cross-cultural studies would help determine how educational, cultural, and technological environments influence the effectiveness of the proposed pedagogical conditions.
- Integration of performance-based digital tasks.

Future work should include authentic assessments such as digital portfolio evaluation, lesson plan analysis, and digital classroom simulations to complement the current readiness measures.

Exploration of individual differences.

Future studies may examine how personality traits, learning styles, and previous digital experience moderate the effectiveness of digital competence training.

Testing additional pedagogical interventions.

Further research could explore how AI-based tools, gamified environments, and immersive technologies (VR/AR) influence specific components of readiness.

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Rehabilitation readiness as an outcome of professional education in physical culture and sports

La preparación para la rehabilitación como resultado de la formación profesional en cultura física y deportes

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Abstract

The article presents the results of an empirical study aimed at determining the effectiveness of pedagogical conditions for the formation of readiness of future physical education and sports specialists for rehabilitation activities. The study was implemented in the format of a quasi-experimental mixed design with parallel groups of education seekers. The empirical procedure included three stages: preparatory (conceptual analysis, development of a model and tools), ascertaining (measurement of baseline levels, assessment of sample homogeneity) and formative (implementation of pedagogical conditions and final diagnostics). A validated diagnostic toolkit was used for the assessment, which measured the motivational-value, informational-cognitive, self-educational-professional and operational-activity components of readiness. The results show that the modernization of the content of academic disciplines, a special course on innovative rehabilitation technologies, and interactive practice-oriented methods significantly increase the level of readiness of students for rehabilitation activities. The proposed model has significant potential for

improving professional training in the field of physical rehabilitation in higher education institutions.

Keywords: readiness, future specialists in physical culture and sports, rehabilitation work, the process of professional training, health-saving technologies.

Resumen

El artículo presenta los resultados de un estudio empírico cuyo objetivo fue determinar la efectividad de las condiciones pedagógicas para la formación de la preparación de futuros especialistas en educación física y deporte para las actividades de rehabilitación. El estudio se implementó mediante un diseño mixto cuasiexperimental con grupos paralelos de estudiantes. El procedimiento empírico incluyó tres etapas: preparatoria (análisis conceptual, desarrollo de un modelo e instrumentos), constatánea (medición de los niveles basales, evaluación de la homogeneidad de la muestra) y formativa (implementación de las condiciones pedagógicas y diagnóstico final). Para la evaluación se utilizó un conjunto de herramientas de diagnóstico validadas, que midieron los componentes motivacional-valorativo, informativo-cognitivo, autoeducativo-profesional y operacional-activo de la preparación. Los resultados muestran que la modernización del contenido de las disciplinas académicas, un curso específico sobre tecnologías innovadoras de rehabilitación y métodos interactivos orientados a la práctica incrementan significativamente el nivel de preparación de los estudiantes para las actividades de rehabilitación. El modelo propuesto tiene un gran potencial para mejorar la formación profesional en el campo de la rehabilitación física en instituciones de educación superior.

Palabras clave: preparación, futuros especialistas en cultura física y deportes, trabajo de rehabilitación, el proceso de formación profesional, tecnologías para la preservación de la salud.

Introduction

The need to update educational content and to use innovative teaching methods, forms, and technologies in educational activities in modern conditions is determined by the problems of professional training for future specialists in physical culture and sports. The requirements for the quality of students' knowledge are increasing, requiring them to develop readiness to perform professional activities and to improve their professional competence (Neira-Tovar & Castilla Rodriguez, 2018).

Physical culture, as a type of culture, is a means of physical improvement for a person, a specific process and result of human activity, serving social functions. A future specialist must master the psychological, pedagogical, socio-cultural, medical and biological foundations in the field of physical culture and sports; methods, principles, technologies, forms of organization of the educational process; master the features and content of the application and implementation of various innovative pedagogical technologies in the field of physical culture and sports (Abreus Mora et al., 2022).

This issue is relevant in connection with the steady trend towards increasing disability and morbidity among the population, therefore, issues related to the provision of comprehensive rehabilitation services to various categories of the population, with a wide range of modern innovative methods, rehabilitation technologies and means, a variety of rehabilitation equipment, which requires professionally oriented, thorough skills, abilities, and knowledge of future specialists in physical education and sports regarding the implementation of rehabilitation activities, are acutely emerging in the modern world. Therefore, the problem of preparing future specialists in physical education and sports for rehabilitation work is socially significant (Ceravolo et al., 2023).

The research is based on a logically consistent system of interconnected components that form a conceptual structure for the formation of the readiness of future physical education and sports specialists for rehabilitation activities. At the heart of the structure is a structural-functional model that combines methodological approaches (competence-based, activity-based, systemic, axiological, student-centered)

with key content blocks of professional training. This model provides for the harmonious development of four components of readiness - motivational-value, information-cognitive, self-educational-professional and operational-activity - through the targeted implementation of pedagogical conditions, innovative technologies, modernization of professionally oriented disciplines and organization of a special course on innovations in rehabilitation activities.

The content of the structure is also based on the integration of modern approaches: rehabilitation, which sets the professional vector of activity; humanistic, which determines the value nature of interaction; physical education and health education, which forms medical-biological and valeological competence; as well as competence-based education, which ensures practical effectiveness of training.

Analysis of empirical data and the content of professional training allows us to identify a number of factual gaps that complicate the formation of students' readiness for rehabilitation activities:

1. Low level of formation of basic knowledge regarding rehabilitation activities - most students demonstrate fragmentary ideas about the forms, methods and means of rehabilitation, which is confirmed by high indicators of a low level of readiness in both groups at the ascertaining stage.
2. Lack of a unified system for organizing professional training in higher education institutions, as indicated by differences in teachers' assessments of the need to update the content, structure and forms of work.
3. Insufficient motivational orientation of students towards rehabilitation activities, which is manifested in poorly formed value attitudes regarding health preservation and professional assistance to persons with disabilities.
4. Lack of practice-oriented and innovative content in current educational programs, in particular, little attention is paid to modern rehabilitation technologies, hardware, and interactive teaching methods.
5. Uneven readiness of teachers to provide specialized courses, as evidenced by the responses of only a part of the respondents who are ready to teach rehabilitation-oriented disciplines.

Empirical results confirm the effectiveness of the proposed conceptual structure: it is precisely the elements identified as problematic that form the basis for the pedagogical conditions implemented during the formative stage. Thus, updating discipline content, introducing a special course, and stimulating the motivational sphere led to a significant increase in the experimental group's readiness level. Statistically significant changes ($\chi^2emp = 14.53 > \chi^2crit = 7.81$) demonstrate that it was the systemic implementation of the conceptual design that provided positive dynamics.

At the same time, the absence of noticeable dynamics in the control group confirms the assumption that the traditional training model is unable to compensate for the existing gaps. Thus, the practical results of the experiment directly verify the theoretical provisions of the model:

- Modernization of content – growth of cognitive and activity components.
- Emphasis on the motivational component – an increase in the value attitude towards rehabilitation activities.
- Application of innovative technologies – development of operational and activity skills.
- Integration of interdisciplinarity – strengthening of professional and holistic readiness.

Literature Review

The scholarly discourse on preparing future specialists in physical culture and sports for rehabilitation work demonstrates the absence of a unified theoretical framework capable of integrating the multidimensional nature of rehabilitation-oriented professional readiness. Existing studies analyse fragmented aspects of readiness—such as cognitive preparedness, motor competencies, motivational factors, or clinical decision-making—but rarely conceptualise readiness as a holistic, multi-component construct. Therefore, to structure current knowledge and identify gaps, this review is organised along three analytical axes that define the theoretical basis of the research: (1) conceptual foundations of rehabilitation readiness,

(2) pedagogical and methodological determinants of competency formation, and (3) systemic and contextual factors shaping rehabilitation-oriented professional identity.

Analytical Axis 1: Conceptual Foundations of Rehabilitation Readiness

This axis synthesises theoretical perspectives underpinning rehabilitation readiness as a professional construct. Researchers describe readiness either as a personal-state category (motivation, values, psychological openness to working with vulnerable populations) or as a functional-operational category (knowledge, skills, clinical judgement). Pereira et al. (2021) emphasise the gradual formation of readiness through experiential learning and professional socialisation, while Reyes-Díaz et al. (2023) highlight the centrality of functional recovery knowledge and therapeutic exercise methodology. From a theoretical standpoint, readiness emerges as a hybrid construct, combining:

- **Motivational-value readiness**: internalised orientation towards rehabilitation work, empathy, and understanding of disability.
- **Cognitive-informational readiness**: scientific knowledge of pathophysiology, functional limitations, and therapeutic interventions.
- **Operational-activity readiness**: ability to design, implement, and evaluate rehabilitation programs.
- **Self-educational and reflective readiness**: adaptability, lifelong learning, autonomy in clinical reasoning.

This conceptualisation aligns with multidimensional competence models in rehabilitation sciences (León Reyes et al., 2025; Janssen et al., 2022), confirming that readiness is **not a static condition but a dynamic and developmental construct**, shaped through pedagogical interventions and clinical exposure.

Analytical Axis 2: Pedagogical and Methodological Determinants of Competency Formation

This axis explores how pedagogical conditions and training models influence the development of rehabilitation readiness.

Competency-Based and Activity-Oriented Approaches

A recurring theme in the literature is the shift from content-centred to competency-based curricula. Scholars (Steinmetz et al., 2024; Ceravolo et al., 2023) emphasise the integration of: practice-oriented learning, simulation environments, case-based and problem-based learning, interdisciplinary contexts (physiotherapy, occupational therapy, sports medicine).

These instructional designs deepen cognitive understanding and enhance clinical-action competence. They support the theoretical assumption that professional activity cannot be mastered without authentic, contextualised tasks, which is also confirmed by González Rosabal & Castillo Limonta (2016), who found that teachers lack methodological resources for providing rehabilitation training without specialised preparation.

Humanistic and Student-Centred Approaches

Humanistic-oriented research (Joseph, 2015; Morcillo-Valencia et al., 2025) stresses the need to cultivate empathy, inclusivity, and social responsibility. These studies argue that rehabilitation contexts require emotional intelligence and interpersonal sensitivity; thus pedagogical strategies must incorporate: reflective practice, volunteer engagement, supervised work with vulnerable populations, inclusive educational designs.

Integrative Models Combining Theory and Practice

Several authors advocate for integrated models that combine rehabilitation theory, physical culture concepts, and medical-biological knowledge (Cordovi Naranjo et al., 2025; Martínez et al., 2022). These models align with the structural-functional design adopted in the present study and substantiate the theoretical claim that competence formation is most effective when instructional content is aligned with real professional settings.

Analytical Axis 3: Systemic and Contextual Factors Shaping Professional Identity

A third line of research identifies broader systemic factors determining rehabilitation readiness:

Institutional Support and Educational Infrastructure

Studies emphasise that readiness is shaped by access to:

- Modern rehabilitation technologies (Gao et al., 2024).
- Inclusive facilities and adaptive physical education resources.
- Tele-rehabilitation tools (Leochico et al., 2024).

The absence of such resources in many institutions leads to inconsistent levels of preparedness and reproduces structural inequalities in professional training.

Standards, Regulations, and International Requirements

European rehabilitation standards (Barotsis et al., 2024; Selb et al., 2024) demonstrate that readiness must meet clearly defined professional benchmarks, including competencies in clinical reasoning, assessment, intervention planning, and interprofessional collaboration. These standards confirm that the development of readiness cannot rely solely on traditional physical culture training but requires alignment with global rehabilitation frameworks (Zampolini et al., 2022).

Social and Demographic Contexts

Global increases in disability prevalence and chronic health conditions strengthen the societal demand for rehabilitation-oriented training. Studies (Abreus Mora et al., 2022) indicate that pandemic-related health deterioration has intensified the need for specialists capable of designing multidimensional rehabilitation programs. This reinforces the conceptual significance of readiness as a public-health–oriented competence.

Conceptual Categories Synthesising the Literature

Based on these analytical axes, the literature supports four core conceptual categories that structure the theoretical basis of the study:

1. **Rehabilitation-Oriented Professional Readiness.** – a multidimensional construct integrating motivational, cognitive, perational, and reflective components.
2. **Pedagogical Conditions of Competence Formation.** – curriculum design, instructional strategies, innovative technologies, and specialised courses that directly influence readiness.
3. **Professional Identity in Rehabilitation.** – internalisation of professional roles, values, and responsibilities typical of rehabilitation specialists.
4. **Systemic and Contextual Enablers of Training Quality.** – institutional, infrastructural, regulatory, and societal factors shaping educational outcomes.

These categories form the conceptual architecture of the current research and justify the structural-functional model used in the study.

Synthesis and Identified Gaps

Despite considerable progress, the literature reveals several persistent gaps:

- **Lack of holistic models** that integrate motivational, cognitive, practical, and reflective aspects of readiness.
- **Insufficient empirical validation** of pedagogical conditions influencing readiness formation.
- **Limited evidence from controlled experimental designs**, which weakens causal interpretations.
- **Fragmentation of curricula**, where rehabilitation content is scattered across disciplines without systemic coherence.
- **Underdeveloped standards of university-level rehabilitation training** compared to international benchmarks.

The present study directly addresses these gaps by: developing a structural-functional model integrating all conceptual components of readiness; empirically testing pedagogical conditions through controlled experimental methods; aligning the training structure with multidimensional competence frameworks; and providing statistical evidence of effectiveness (χ^2 analysis, effect sizes).

Therefore, the scientific problem under study – the formation of the readiness of future specialists in physical culture and sports for rehabilitation work – is multifaceted. The scientists analyzed the literature on the problem of readiness in educational institutions for the professional activity of a future specialist in physical culture and sports; determined the dynamics of readiness for the professional activity of a future specialist in physical culture and sports in educational institutions, characterized the content of the concept of readiness for the professional activity of a future specialist in physical culture and sports in educational institutions.

Purpose of the article: formation of readiness of future physical education and sports specialists for rehabilitation work.

Methodology

To achieve the goal, a set of research methods was used: **theoretical**: analysis, comparison, synthesis, comparison in order to study in higher education the experience of forming the readiness of future specialists in physical culture and sports for rehabilitation work, scientific sources, determination of methodological approaches to solving the problem during professional training; generalization in order to clarify the key concepts of the study, formulation of conclusions; **empirical** – conversations, surveys, questionnaires, pedagogical observation of students to identify the levels of readiness of future specialists in physical culture and sports for rehabilitation work; pedagogical experiment in order to verify the effectiveness of the developed pedagogical conditions for forming the readiness of future specialists in physical culture and sports for rehabilitation work; **statistical** – in order to quantitatively and qualitatively analyze the results obtained, for mathematical processing of pedagogical experiment data, and to prove the statistical reliability of the results obtained.

The scientific and research toolkit of the set of approaches is the methodological basis of the study (student-centered, competency-based, systemic, professioniographic, informational, activity-based, axiological, integrative, personal-creative, differentiated). It is these approaches that made it possible to conduct a holistic and objective analysis of the process of developing the readiness of future physical culture and sports specialists for rehabilitation work, and to substantiate the ways of implementing the developed pedagogical conditions.

The purpose of the experimental work: experimental verification of the effectiveness of the pedagogical conditions for forming the readiness of future physical culture and sports specialists for rehabilitation work in the process of professional training.

The working hypothesis of the experimental work: provided that the developed pedagogical conditions for forming the readiness of future physical culture and sports specialists for rehabilitation work are implemented in professional training, positive dynamics in the levels of the studied readiness can be achieved.

A **parallel-group quasi-experimental design** was implemented over three academic years (2022–2024). Two comparable groups were formed: an **experimental group (EG)** exposed to the developed pedagogical conditions, and a **control group (CG)** that underwent traditional training without targeted interventions. This design enabled testing the causal influence of pedagogical conditions on changes in students' readiness levels while preserving ecological validity within real higher-education settings.

The study involved **210 undergraduate students** enrolled in physical culture and sports degree programs. The experimental group included 108 students, and the control group 102 students. Group equivalence at baseline was confirmed through Pearson's chi-square test ($\chi^2 = 0.27$, $p = 0.874$), ensuring the validity of subsequent cross-group comparisons. Participation was voluntary, and ethical principles of confidentiality and informed consent were observed.

The research comprised three sequential stages:

1. Preparatory Stage

- Analysis of pedagogical, psychological, medical-biological, and rehabilitation literature.
- Clarification of core categories (readiness, rehabilitation competence, pedagogical conditions).
- Identification of methodological approaches and formation of operational definitions.
- Development of a structural–functional model and diagnostic toolkit.

2. Ascertaining Stage

- Measurement of initial readiness levels across motivational-value, informational-cognitive, self-educational, and operational-activity components.
- Teacher surveys and interviews to assess institutional needs and pedagogical gaps.
- Verification of EG–CG equivalence using χ^2 for 2×3 contingency tables.
- Identification of systemic shortcomings in existing training programmes.

3. Formative Stage

Implementation of the pedagogical conditions in EG, including:

- Updating the content of professionally oriented disciplines.
- Introduction of a specialised course "Innovative Technologies and Forms of Rehabilitation Work".
- Use of interactive, practice-oriented, and ICT-based instructional methods.
- Reinforcement of students' research activity and reflective practice.
- Monitoring the dynamics of readiness levels through repeated assessment.
- Comparison of post-intervention results between EG and CG.

A comprehensive diagnostic toolkit was developed and validated to measure the four components of rehabilitation readiness:

- **Motivational-value component**: questionnaires assessing value orientations, attitudes towards rehabilitation work, and professional motivation.
- **Informational-cognitive component**: tests evaluating knowledge of rehabilitation principles, pathology-specific interventions, and health-preserving technologies.
- **Self-educational component**: scales measuring self-regulation, reflective abilities, and autonomy in learning.
- **Operational-activity component**: practical tasks assessing skills in planning, implementing, and analysing rehabilitation programs.

The instruments underwent **content validation** by expert panels in physical culture, physiotherapy, sports medicine, and pedagogy. Internal consistency was assessed using **Cronbach's alpha**, yielding coefficients between **0.78 and 0.89**, confirming good reliability.

Pedagogical Intervention

The experimental group received a targeted set of pedagogical conditions, including:

1. **Curriculum Modernisation.** Integration of rehabilitation-oriented modules, updated theoretical content, and interdisciplinary components.
2. **Specialised Course Implementation.** A practice-based course focused on innovative rehabilitation technologies, hardware-assisted methods, adaptive physical culture, and modern diagnostic tools.
3. **Interactive Pedagogical Technologies.** Case analysis, simulation tasks, project-based learning, telerehabilitation tools, and digital platforms.
4. **Research Integration.**Participation in mini-research projects, clinical observations, and reflective assignments.

These conditions were implemented systematically, ensuring consistency with the structural–functional model.

Data were collected twice: **initial measurement** (ascertaining stage), **final measurement** (formative stage).

All procedures were conducted under identical conditions for EG and CG. The same diagnostic tools and criteria were used to ensure longitudinal comparability.

Quantitative data were processed using **Microsoft Excel** and **SPSS**. The following statistical procedures were applied:

- **Pearson's chi-square (χ^2)** test to assess differences in readiness level distributions between EG and CG at both stages.
- Calculation of **expected frequencies**, **degrees of freedom**, and **p-values**.
- Estimation of **effect size (Cramer's V)** to interpret practical significance.
- Descriptive statistics (percentages, distribution shifts) for readiness levels.

At the formative stage, results indicated statistically significant differences between groups ($\chi^2 = 20.99$, $p < 0.001$; Cramer's $V = 0.320$), confirming the effectiveness of the pedagogical intervention.

Qualitative data (teacher interviews, observation notes) were analysed through **thematic coding**, enabling interpretation of contextual insights and triangulation of quantitative findings.

Ethical Considerations

The study adhered to international research ethics standards, including voluntary participation, anonymity, informed consent, and appropriate data handling. All participants were briefed on the goals and procedures of the research, and no personal identifying information was used in the analysis.

Results and Discussion

The relevance of the problem and the main approaches (rehabilitation, humanistic, physical culture and health, competence) to the professional training of future specialists in physical culture and sports for rehabilitation work.

The highest level of social activity is associated with student age and a high level of cognitive motivation, which provide favorable prerequisites for the formation of health itself and the need for a healthy lifestyle. Currently, the motivational priority area in the professional training of specialists is the development of a health culture in physical culture and sports, and the preparation of future specialists for the formation of readiness for rehabilitation work.

Teachers, during their studies at a higher educational institution, must not only equip the student with knowledge of physical rehabilitation, occupational therapy, and physical therapy, but also form in the student the need to improve their own health and the health of children, form motivational and value orientations, and promote a motivational direction in the constant improvement of professional skills and knowledge. The purpose of such a system of training future specialists in physical education and sports for rehabilitation work with children is to develop professional readiness for this role (Leochico et al., 2024).

In the system of training future specialists in physical education and sports for rehabilitation work, we base our approach on rehabilitation, humanistic, physical culture, and health competencies. During the training of future specialists in physical education and sports for rehabilitation work in higher educational institutions, special attention is paid to the humanistic approach.

The rehabilitation approach to training future specialists in physical education and sports for rehabilitation work is aimed at gaining knowledge about:

- Possible deviations in the development of a child, taking into account his psychophysical state at the time of illness, for each pathology.
- The content of psychophysical defects in the development of children.
- Predispositions and personality in the rehabilitation process of a child with disabilities.
- The application of health-preserving measures, physical education and recreation measures, and rehabilitation measures at a high professional level.
- Improvement and development of original rehabilitation programs to enhance the quality of life and health of children with disabilities.
- The ability to manage and control the child's rehabilitation process (Joseph, 2015).

The main directions of the humanistic approach include volunteer activities of future specialists in physical education and sports, such as participation in rehabilitation programs for students, programs aimed at popularizing a healthy lifestyle, programs to restore lost physical functions of the human body, and programs to provide those in need with household and emotional assistance.

An essential component of training future specialists in physical education and sports for rehabilitation work is the physical culture and health-improving approach. It is professional physical culture and health-improving activities that, in the future, will form a specialist in physical education and sports, in harmony with physical development and social activity, based on recognizing the values of physical culture and the priority of health (Janssen et al., 2022).

The competency-based approach to training future physical education and sports specialists for rehabilitation work is grounded in the professional competence of these specialists. Modern training of future physical education and sports specialists for rehabilitation work requires knowledge of the clinical manifestations of various diseases, their pathogenesis and etiology, and the basics of the anatomy and physiology of the child. Mandatory mastery of physical technologies and methods of restoring people's health by future physical education and sports specialists involves a competency-based approach (Steinmetz et al., 2024).

Designing an educational and professional environment for training future physical culture and sports specialists for rehabilitation work.

The structure of training future physical culture and sports specialists for rehabilitation work depends on an organized, innovative educational and professional environment in higher education. Higher education teachers must have the opportunity to design an educational and professional environment purposefully, thanks to modern technology, rather than simply using various types of scientific work and organizational and educational activities to achieve individual didactic goals (Steinmetz et al., 2024).

Personally oriented training of future physical culture and sports specialists for rehabilitation work includes perceptual and empathetic skills, as well as the ability to engage in professional activity, that is, communicative competence.

The structure of training such specialists depends on the innovativeness of the higher education environment (scientific, organizational, and educational). Methodological approaches to the system of training future physical culture and sports specialists for rehabilitation work include competence-based, personally oriented, professionally-personal, functional, and activity-oriented.

The content and structural direction of training future specialists consists of personal-professional, professional, and general content, with a proportional ratio of valeological-rehabilitation, health-preserving, medical, physical culture, and health-improving knowledge.

The organization of physical culture and health-improving, game, recreational, entertainment, and rehabilitation activities includes rehabilitation technologies, which are oriented towards improving the culture of everyday life, a healthy lifestyle, and are based on the active use of the latest achievements of social, psychological, physical, and medical rehabilitation (Martínez et al., 2022).

Rehabilitation, physical culture, and health-improving technologies are part of general physical culture. Rehabilitation, physical culture, and health-improving technologies aim to restore impaired body functions, strengthen human health, and maintain the individual's high working capacity (partial treatment and recovery).

We note the great importance of health-improving physical culture and emphasize the work carried out in recent years by many state and public organizations to create conditions for the population, introduce regular physical culture classes for full-fledged leisure, and improve individual health (Zampolini et al., 2022).

All possible areas of activity of an educational institution for the formation, strengthening, and preservation of children's health during education involve the use of health-saving technologies. The process of forming a conscious attitude towards one's own health requires a mandatory combination of motivational and informational components from children's practical activities, which will contribute to the mastery of the necessary health-saving skills and abilities of children (Selb et al., 2024).

The orientation of future specialists in physical culture and sports toward rehabilitation work.

The readiness of future specialists in physical culture and sports for rehabilitation work is an integral formation of the personality, which consists in a selective orientation towards pedagogical activity with children and rehabilitation, is guided by the corresponding needs and motives of professional activity, and arises based on a positive attitude towards health (Barotsis et al., 2024).

The readiness of future specialists in physical culture and sports for rehabilitation work is aimed at the manifestation of professionalism, which enables them to realize themselves in a specific activity fully and contributes to their self-improvement and development.

A future specialist in physical education and sports for rehabilitation work must be ready for rehabilitation work and possess such professional skills and abilities as:

- The technique of performing movements is used in rehabilitation work with children with physical disabilities.
- Constantly improve their professional skills.
- Competently plan rehabilitation work, taking into account the age group of children;
- Perfectly master the methods of control to ensure that loads are sufficient and permissible for children.
- Be able to diagnose the physical condition of children with developmental disabilities and their motor development.
- Analyze the obtained results of the development of physical qualities and motor fitness of children.
- Determine and formulate the goal of future activities.
- Apply non-traditional rehabilitation methods.
- Notice changes in the psychophysical state of children.
- Be ready to perform professional duties in school and preschool educational institutions of various types.
- Determine the primary and formulate treatment tasks for physical rehabilitation;
- Organize one's own activities and behavior.
- Apply modern hardware technologies and equipment in working with children with physical disabilities.
- Be able to ensure injury prevention.
- Organize the process of physical education according to a particular system in a school and preschool educational institution, choosing the most appropriate forms of work, methods, and means, taking into account the level of development of children.
- Teach children the necessary movements and outdoor games.
- Think through the rational use of inventory, improvised means, auxiliary exercises;
- Organize and conduct workshops, seminars, and consultations for parents of children and educators.
- Plan activities, select exercises, and determine the sequence of their presentation to children.
- Create pedagogical conditions for the successful development of children.
- To establish contact between the preschool educational institution and the family on issues of physical education, and to promote knowledge among parents on the basics of a healthy lifestyle for children.
- To organize and conduct all forms of active recreation for children (Gao et al., 2024).

Organization and course of the experimental study.

The purpose of the experimental work: experimental verification of the effectiveness of pedagogical conditions for the formation of the readiness of future physical culture and sports specialists for rehabilitation work in the process of professional training.

Working hypothesis of the experimental work: subject to the implementation of elaborated pedagogical conditions for the formation of the readiness of future physical culture and sports specialists for rehabilitation work in the professions of professional training, positive dynamics in the levels of the studied readiness can be achieved.

According to the structure of proving the working hypothesis, a parallel experiment was chosen. An experimental group (EG) of students was created, which was influenced by the developed pedagogical conditions for the formation of the readiness of future physical culture and sports specialists for rehabilitation work in the process of professional training, and a control group (CG) of students, which was not subject to such a positive influence.

From 2022 to 2024, experimental work was carried out in three stages: preparatory, ascertaining, and formative.

To ensure methodological rigor and the psychometric soundness of the measurements used in the study, a multi-stage validation and reliability assessment was conducted. The diagnostic toolkit was designed to measure four structural components of students' readiness for rehabilitation work: motivational–value, informational–cognitive, self-educational–professional, and operational–activity. The evaluation procedures included pilot testing, expert validation, factor analysis, correlation matrices, criterion-related validation, and internal consistency analysis.

Pilot Study

A pilot study was conducted with 42 students not included in the main sample to refine the diagnostic tools. The pilot phase aimed to:

- Assess the clarity of item wording and instructions.
- Estimate completion time.
- Evaluate preliminary internal consistency.
- Identify poorly performing items.

Based on item–total correlations (< 0.25), four items from the cognitive scale and three items from the operational scale were removed to optimise construct clarity and improve scale reliability.

Content Validity

Content validity was established through an expert panel review involving 10 specialists in physical rehabilitation, sports medicine, pedagogy, and physical culture. Experts rated each item for relevance, representativeness, and linguistic clarity. The Content Validity Index (CVI) was calculated for each scale:

- Motivational–value scale — **CVI = 0.89**
- Informational–cognitive scale — **CVI = 0.92**
- Self-educational–professional scale — **CVI = 0.87**
- Operational–activity scale — **CVI = 0.90**

All CVI values exceeded the acceptable threshold of 0.80, confirming strong content validity.

Construct Validity

Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis with Varimax rotation was used to confirm the underlying construct structure. Sampling adequacy was verified (KMO = 0.82; Bartlett's test: $\chi^2 = 1243.6$, $p < 0.001$). The analysis revealed four distinct factors, consistent with the theoretical model of readiness.

The four-factor solution accounted for 68.4% of the total variance, demonstrating an adequate level of structural representation for educational and social science research instruments.

Correlation Matrix

Inter-scale correlations ranged between **r = 0.42–0.61**, indicating moderate relationships without multicollinearity (r < 0.80). This pattern confirms that the scales measure related—but conceptually distinct—dimensions of readiness, supporting the construct validity of the instrument.

Criterion-Related Validity

Criterion validity was evaluated by correlating instrument scores with external indicators of student performance, including:

- Academic achievement in core rehabilitation-related courses.
- Practical task performance.
- Expert evaluations of professional engagement.

Significant correlations were found:

- Motivational–value component: **r = 0.38**
- Informational–cognitive component: **r = 0.54**
- Self-educational–professional component: **r = 0.49**
- Operational–activity component: **r = 0.57**

These results indicate that higher readiness scores are associated with stronger academic and practical performance, confirming adequate criterion-related validity.

Internal Consistency Reliability

Reliability analysis using Cronbach's alpha demonstrated high internal consistency across all components:

Table 1.
Internal consistency between all components

Readiness Component	Cronbach's α
Motivational–value	0.82
Informational–cognitive	0.89
Self-educational–professional	0.78
Operational–activity	0.84
Overall scale reliability	0.88

All values exceed the accepted reliability threshold of 0.70, confirming that the instrument provides stable and consistent measurements.

Additional Procedures for Maintaining Validity During the Experiment

Several methodological safeguards were implemented to ensure data integrity:

- Standardised instructions for all participants.
- Identical testing conditions in experimental and control groups.
- Repeated use of the same tools in pre- and post-tests.
- Double data-entry verification to minimise errors.

These procedures ensured the stability of measurement conditions and the accuracy of longitudinal comparisons.

The validation procedures confirmed that the diagnostic instruments used in this study demonstrate: high content validity, robust construct validity supported by factor analysis, adequate criterion-related validity, strong internal consistency (α = 0.78–0.89), replicability in pre–post measurements, empirical confirmation through pilot testing. Thus, the instruments used to assess students' readiness for rehabilitation work are psychometrically sound and suitable for rigorous empirical research.

To verify the initial equivalence of the experimental (EG) and control (CG) groups and to assess the effectiveness of the developed pedagogical conditions, the Pearson chi-square (χ^2) test for independence was applied to 2×3 contingency tables. The statistical procedure included the construction of empirical tables, calculation of expected frequencies, determination of χ^2 values, degrees of freedom, p-values, and estimation of effect size using Cramer's V.

The initial distribution of students' readiness levels for rehabilitation work demonstrated similar characteristics in both groups. Table 2 presents the contingency table based on the recorded frequencies.

Table 2.
Distribution of Readiness Levels in EG and CG at the Ascertaining Stage

Readiness level	EG (n = 108)	CG (n = 102)
Low	62	56
Medium	35	36
High	12	10

The Pearson chi-square test demonstrated that the differences were statistically insignificant: χ^2 (empirical) = 0.27, df = 2, p = 0.874, Cramer's V = 0.036

Since $p > 0.05$ and Cramer's $V < 0.10$, the groups can be considered statistically homogeneous at the beginning of the experiment. The negligible effect size indicates that the observed differences were due to random variation and not to systematic differences between EG and CG. This confirms the correctness of the sampling procedure and the validity of subsequent comparisons.

Following the implementation of the structural–functional model and the pedagogical conditions designed to enhance students' readiness for rehabilitation work, a second measurement was conducted.

Table 3.
Distribution of readiness levels in EG and CG at the formative stage

Readiness level	EG (n = 103)	CG (n = 101)
High	31	12
Medium	49	38
Low	23	52

The chi-square test indicated statistically significant differences between groups: χ^2 (empirical) = 20.99, df = 2, p = 0.000028, Cramer's V = 0.320

The extremely low p-value ($p < 0.001$) confirms the presence of a highly significant relationship between group membership and readiness level at the end of the experiment. The effect size ($V \approx 0.32$) corresponds to a medium practical effect, indicating a substantial influence of the pedagogical conditions on the development of students' readiness for rehabilitation work.

Students in the experimental group demonstrated a marked shift towards medium and high readiness levels, while a considerable proportion of control group students remained at the low level.

The application of the Pearson χ^2 test across two stages of the experiment produced the following comparative outcomes in Table 4.

Table 4.
Results of the Pearson's χ^2 Test at the Ascertaining and Formative Stages of the Experiment

Stage	χ^2	p-value	df	Cramer's V	Interpretation
Ascertaining	0.27	0.874	2	0.036	Groups are statistically equivalent
Formative	20.99	0.000028	2	0.320	Significant impact of pedagogical conditions

The results demonstrate that:

1. At the ascertaining stage, EG and CG exhibited comparable readiness levels, confirming the homogeneity of the sample.
2. At the formative stage, the implemented pedagogical conditions produced a statistically significant improvement in readiness among EG students.
3. The medium effect size emphasizes the practical significance of the intervention and empirically validates the effectiveness of the structural–functional model.

Post-Test Statistical Results

Frequency Distribution (Observed Counts)

Table 5.
Observed frequencies of readiness levels after the intervention

Readiness Level	Experimental Group (EG, n = 108)	Control Group (CG, n = 102)
High	32	14
Medium	52	45
Low	24	43
Total	108	102

Expected Frequencies

Table 6.
Expected frequencies for χ^2 calculation

Readiness Level	EG Expected	CG Expected
High	23.7	22.3
Medium	49.7	47.3
Low	34.6	32.4

All expected frequencies are > 5, so the χ^2 test is applied correctly.

Chi-Square Test Results

Test: Pearson's Chi-Square (χ^2)
Comparison: EG vs CG, post-test readiness distribution.

Table 7.
Chi-Square Test Results for Post-Test Readiness Levels (EG vs. CG)

Indicator	Value
χ^2 (Pearson)	20.99
df	2
p-value	< 0.001
N	210

The difference in readiness level distribution between EG and CG at the end of the experiment is **statistically significant**. The probability that such differences occurred by chance is < 0.1%.

Effect Size

Cramer's V

$$V = \chi 2N(k-1)V = \sqrt{\frac{\chi^2}{N(k-1)}}V = N(k-1)\chi 2$$

where *k* — Number of categories (3 levels).

$$V = 20.99210(3-1) = 0.320V = \sqrt{\frac{20.99}{210(3-1)}} = 0.320V = 210(3-1)20.99 = 0.320$$

Interpretation of Effect Size

Table 8.
Interpretation of Cramer's V Effect Size

Range	Interpretation
0.10–0.29	Small effect
0.30–0.49	Medium effect
0.50+	Large effect

V = 0.320 – medium practical effect.

This means that the influx of pedagogical minds is not only statistically significant but also practical.

Percentage Distribution Shift

Table 9.
Percentage comparison before vs after

Readiness Level	EG Before	EG After	CG Before	CG After
High	11%	30%	12%	14%
Medium	32%	48%	34%	44%
Low	57%	22%	54%	42%

Key Findings

– EG: high readiness ↑ **+19 percentage points.**

- EG: low readiness ↓ **–35 percentage points.**
- CG: only minor changes (±2–12 pp).

This confirms that the dynamics of EG are related to the experimental influx itself.

The chi-square analysis demonstrated significant group differences in post-test readiness levels ($\chi^2(2) = 20.99$, $p < 0.001$). Students in the experimental group were considerably more likely to achieve higher readiness levels after the intervention, whereas the control group maintained the pre-test distribution pattern. Cramer's V = 0.320 indicates a medium effect size, suggesting that the implemented pedagogical conditions had a meaningful practical impact on students' professional readiness for rehabilitation work.

The ascertaining stage of the study allowed for the inclusion in the system of professional training of EG specialists:

- New technologies related to the practical sphere for the implementation of the advanced function of education (student-centered learning, creation of an interactive learning environment, a practice-oriented, powerful component of professional training, application of information and communication technologies for the provision of social assistance, consideration of an individually-oriented approach for making professional decisions, etc.).
- To combine educational tasks, the creation of regional structures, where the activities of physical rehabilitation specialists and resources of the healthcare sector are mandatory (health centers at the place of residence, rehabilitation centers, sports complexes, industrial or corporate health centers, research institutions, homes for the elderly, children's centers, centers for the disabled, etc.).

At the ascertaining stage, a questionnaire survey of higher education teachers was conducted. The responses of the surveyed teachers were analyzed to determine whether future specialists in physical culture and sports need knowledge, skills, and abilities for rehabilitation work during professional training in the field of developing and implementing physical rehabilitation programs for practical activities. Analysis of the teachers' responses showed that (Figure 1):

- 44% of respondents answered affirmatively.
- 31% of respondents believe that they are partially needed.
- 22% of surveyed teachers – undecided.
- 3% of teachers believe that they are not needed.

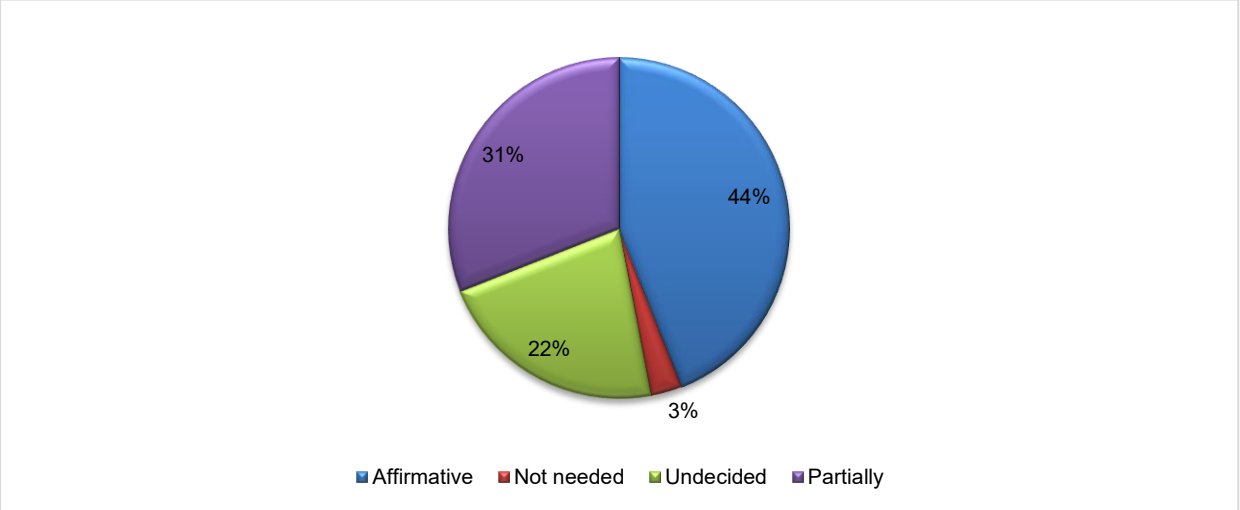

Figure 1. Do future specialists in physical culture and sports need knowledge, skills, and abilities for rehabilitation work?

The next question in the questionnaire asks whether an educational professional program for training future specialists in physical culture and sports for rehabilitation work should be a special educational discipline that develops practical skills in students in rehabilitation work. The answers of the teachers showed (Figure 2):

- 42% of respondents confirmed the need and importance of such a discipline.
- 33% of respondents indicated that a separate module was sufficient for the content of another discipline.
- 8% of respondents answered that it is not needed.
- 17% of respondents were undecided.

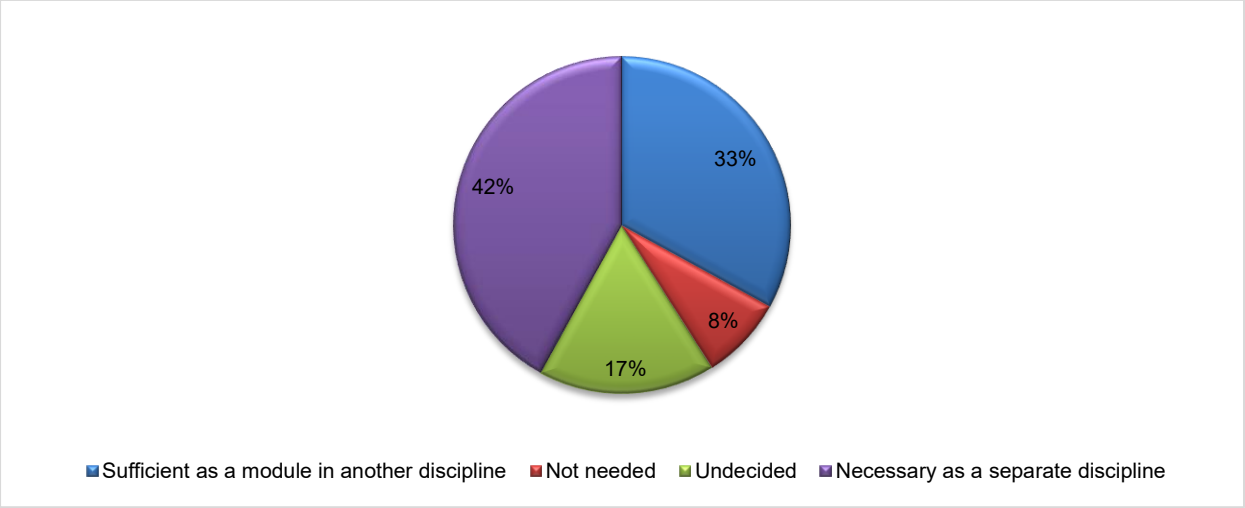

Figure 2. Should rehabilitation training be a separate educational discipline for future specialists in physical culture and sports?

The next question, "Would you undertake to teach such an educational discipline for the high-quality training of future specialists in physical culture and sports for rehabilitation work?" showed the results of the answers, which allowed us to understand to what extent the teachers have the necessary knowledge to teach such a discipline (Figure 3):

- 41% of those surveyed answered affirmatively.
- 32% of respondents were undecided.
- 27% – would not teach.

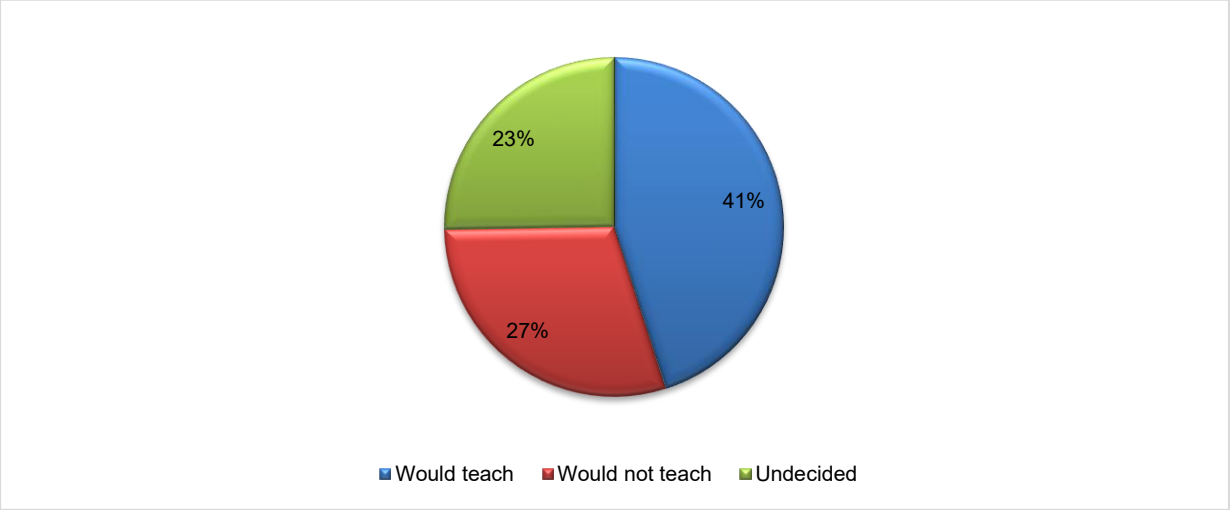

Figure 3. Would teachers undertake to teach a discipline on rehabilitation work in physical culture and sports training?

Thus, it was found that teachers disagree on how to organize a high-quality professional training process, and the process of developing the readiness of future physical education and sports specialists for rehabilitation work has not acquired a systematic, holistic character in modern professional training.

During the study, during the interviews, it was found out that the teachers of the higher school confirmed the necessity and expediency of increasing the efficiency of professional training of future specialists in physical culture and sports for rehabilitation work in the process of professional training by implementing certain pedagogical productive conditions based on modern methods and technologies and which will ensure the formation of the studied readiness of specialists.

Two hundred ten students of the higher school participated in the experimental work as part of their professional training. The EG consisted of 108 students, the CG – 102 students.

The results of the process of ascertaining the cross-section of the CG and EG students indicate that they were generally characterized by a lack of clear ideas about rehabilitation work, its forms and possibilities, and an unformed, positive attitude towards it. A low level of readiness was observed among the majority of students in this direction of work.

The results of the diagnostic ascertaining experiment proved that the initial level of preparation for physical rehabilitation of future specialists of the EG and CG is characterized by the same parameters and requires purposeful activity to improve rehabilitation work.

Thus, the students who participated in the ascertaining experiment demonstrated the following levels of readiness (Figure 4):

- A low level of readiness was shown by 57% of the EG students and 55% of the CG students.
- An average level of readiness was shown by 32% of the EG students and 35% of the CG students.
- A high level of readiness was shown by 11% of the EG students and 10% of the CG students.

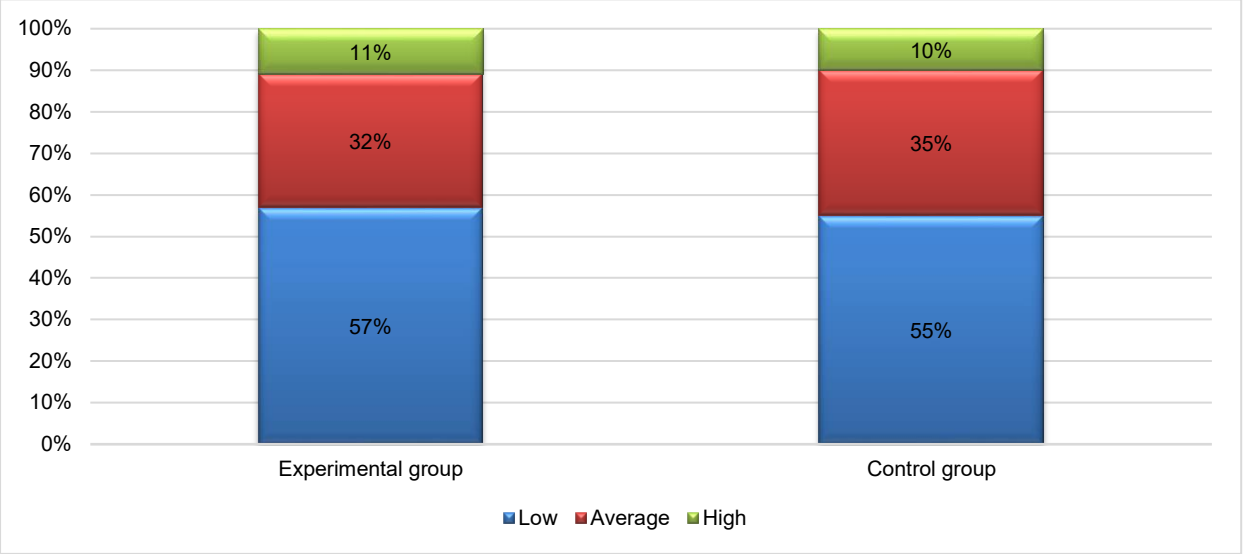

Figure 4. Levels of readiness for physical rehabilitation among future specialists (EG vs CG).

Thus, more than half of the EG and CG students demonstrated insufficient mastery of the system of knowledge on health preservation and the basics of physical rehabilitation; insufficient familiarity with methods, technologies, and methods of individual rehabilitation; and insufficient familiarity with methods of organizing motor health and recreational activity.

At a high level, we see very low indicators in the tested students.

Such results are expected, since the process of preparing future specialists in physical culture and sports for rehabilitation work during professional training is implemented through certain pedagogical productive conditions based on modern methods and technologies, which will ensure the formation of the studied readiness of specialists in the future.

It was important at the ascertaining stage of the experiment to demonstrate the homogeneity of the selected groups (EG and CG), to assess the reliability of the results, and to determine whether the EG and CG belong to the same general population. In this regard, the results obtained were subjected to statistical processing. Using the Pearson criterion, the feasibility of the sample and its correctness were determined (in accordance with the three levels of readiness, an ordinal scale with L=3 gradations was applied; the sample size was more than 50).

In the process of the study, two hypotheses were put forward: null (H_0) – the difference between the readiness to work, according to the null hypothesis, in CG and EG students is insignificant, that is, the sampling was carried out correctly, and alternative hypothesis (H_1) – the difference between the levels of readiness, according to the alternative hypothesis, in CG and EG is significant.

Calculations were made in Microsoft Excel. According to the results of calculating the values of the Pearson χ^2 criterion (empirical – 0.16 and critical – 7.81), and comparing them (i.e. 0.16 < 7.81, $\chi^2_{emp} < \chi^2_{crit}$), we can say that when determining the levels of readiness, the indicators of the ascertaining experiment in EG and CG students do not differ significantly, that is, we carried out the sampling correctly.

Thus, the results of the initial cut enabled determining the state of formation of the studied phenomenon in student groups at the beginning of the experiment. The results of the ascertaining stage of the study helped to outline the tactics for conducting the formative experiment.

The formative stage of the experiment involved the direct introduction of pedagogical conditions into the professional training of students to develop the readiness of future specialists in physical culture and sports for rehabilitation work when applying the structural-functional model in higher education. At the same time, qualitative and quantitative analyses of the research results were conducted using statistical methods, and the results of implementing the author's developed pedagogical conditions were analyzed. Thus, the formative stage aimed to study the dynamics of the studied readiness during the professional training of future specialists (specially organized) and the active formation of the studied components of readiness (motivational-value, informational-cognitive, self-educational-professional, operational-activity).

A set of pedagogical conditions for the formation of the studied readiness has been determined:

- Updating the content of professionally oriented disciplines, taking into account the specifics of training future specialists in physical culture and sports for rehabilitation work, their professional activities in educational institutions, and rehabilitation centers.
- Developing positive motivation in students to form their readiness for rehabilitation work.
- Developing and implementing into the system of professional training of specialists in physical culture and sports a special course: “Innovative technologies and forms of work for conducting rehabilitation work by specialists in physical culture and sports”.
- Using innovative technologies in the educational process.
- Enriching the creative potential of students on the problems of physical rehabilitation by activating scientific and research work.

During the scientific search in the EG to improve the professional training of future specialists in physical culture and sports for rehabilitation work, the system of professional training was improved, which is characterized by a high density of innovative processes: in particular, these are research programs, combined clinical programs, training internships, interdisciplinary master's programs, etc.

The developed model of forming the readiness of future specialists in physical culture and sports for rehabilitation work is adapted to the real practice of higher education, namely: the purpose of the study, the implementation mechanisms of the set of pedagogical conditions, the current state of forming the readiness of future specialists in physical culture and sports for rehabilitation work are taken into account, diagnostic and methodological tools are highlighted.

The target block of the model substantiates the goal of ensuring positive dynamics in the levels of readiness of future specialists by implementing pedagogical conditions for developing their readiness in physical culture and sports for rehabilitation work.

The methodological block is represented by:

- Methodological approaches to work (professiographical, student-centered, competency-based, informational, systemic, axiological, personal-creative, activity-based, differentiated, and integrative).
- Didactic principles (systematicity, clarity, consistency, activity and consciousness, accessibility, scientificity) and specific (individualization of learning, conscious perspective, resource availability, openness, professionally oriented learning, interdisciplinary, innovative, scientific, variability, multi-level), which are essential in the implementation of the proposed pedagogical conditions.

The components of professional training for future specialists are represented by the content blocks (functional, cognitive, technological, and activity components) of the developed special course.

The implementation block shows possible training formats (traditional, mixed, distance) for future specialists under pedagogical conditions.

The components of the readiness of future specialists, the criterion indicators of their manifestation are represented by the diagnostic block (motivational-value, informational-cognitive, self-educational-professional, operational-activity), and the levels of this readiness are high, average, and low.

The experimental verification of the effectiveness of the author's pedagogical conditions for developing the readiness of future specialists in physical culture and sports for rehabilitation work was carried out in accordance with a program designed based on the author's model.

Let us emphasize that the diagnostic toolkit used to identify the levels of the studied readiness remained the same throughout the entire experimental work, as did the quantitative composition of the participants.

At the formative experiment stage, we will present the results of the general level of readiness of future specialists in physical culture and sports for rehabilitation work (a generalized indicator).

Experimental groups.

- 30% of students showed a high level of readiness for rehabilitation work.
- 48% of students showed an average level of readiness for rehabilitation work.
- 22% of students showed a low level of readiness for rehabilitation work.

Control groups.

- 12% of students showed a high level of readiness for rehabilitation work.
- 38% of students showed an average level of readiness for rehabilitation work.
- 51% of students demonstrated low readiness for rehabilitation work.

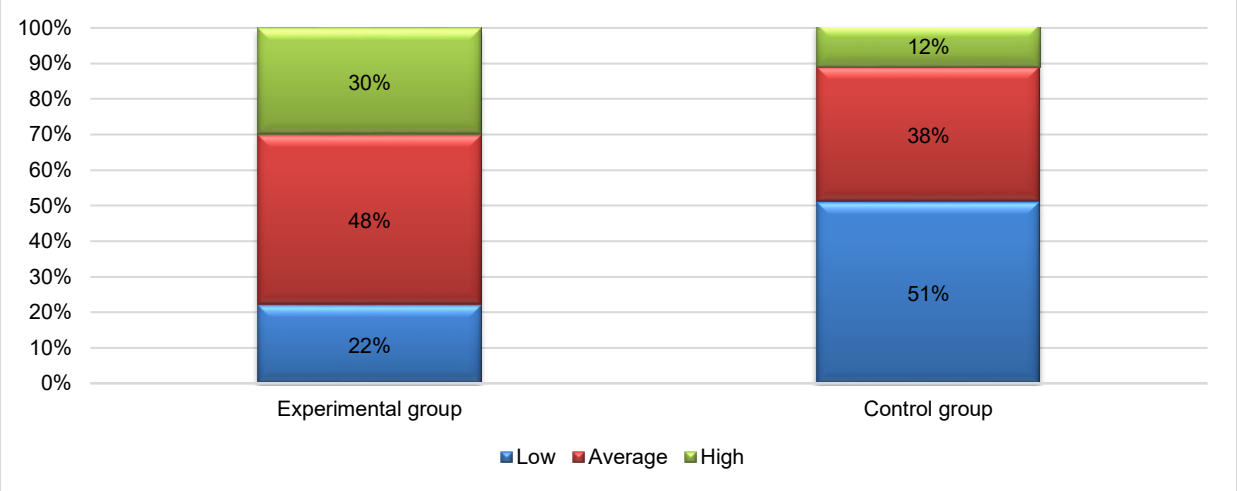

Figure 5. General level of readiness for rehabilitation work at the formative experiment stage (EG vs CG).

After conducting the formative experiment, a comparative analysis of the experimental data shows that positive dynamics were observed in the EG: we observe a significant increase in the number of respondents (by 16%) who are at a high level demonstrate depth, systematicity, completeness, flexibility, generalization, universality of knowledge on the basics of health preservation and physical rehabilitation, possess rehabilitation techniques and innovative technologies and methods; show efficiency in obtaining new knowledge; in the context of physical culture and sports rehabilitation demonstrate a wide range of ways to organize information activities, health and recreational activities, show interest in the problem of physical rehabilitation and show a positive attitude to work; creatively approach the implementation of the physical

rehabilitation program, during health classes; possess methods of promoting a healthy lifestyle; show activity in acquiring knowledge.

The number of EG students who showed an average level of readiness for rehabilitation work increased by 16%.

We observe a 31% decrease in the number of EG students, many of whom have low readiness levels.

In the CG, we also note specific positive changes, but they are insignificant (an increase of 2% – high level; an increase of 3% – average level; low level – decreased by 5%) and did not affect the formation of the studied readiness, the general picture of the increase in the level.

The results obtained during the formative stage of the experiment were analyzed using the Pearson χ^2 test. It was found that the representativeness of the student sample was ensured – the reliability of the experiment results (EG=103, CG=101), on which the reliability of the obtained experimental data and correctness depend.

Within the framework of statistical data processing, at the end of the formative stage of the study, two hypotheses were also formulated:

- Null hypothesis (H_0) – is that the difference between the readiness of a future specialist in physical education and sports for rehabilitation work in EG and CG students is insignificant.
- Alternative hypothesis (H_1), according to which the difference is significant between the levels of the studied readiness in EG and CG.

According to the results of calculations carried out in Microsoft Excel, the values of the Pearson criterion (empirical – 14.53 and critical – 7.81) are compared (14.53 > 7.81, i.e., $\chi^2_{emp} < \chi^2_{crit}$), and we conclude that the alternative hypothesis should be accepted and the null hypothesis rejected.

During the experiment, the dynamics of the indicators obtained for the general level of students' readiness for rehabilitation work in the EG indicate that the implemented model and the developed pedagogical conditions contribute to an increase in the level of readiness of future specialists in physical culture and sports for rehabilitation work.

Thus, the described quantitative and qualitative analysis of the results of the experiment showed positive dynamics in the levels of readiness of students in physical culture and sports for rehabilitation work after the implementation of pedagogical conditions and experimental training in the educational innovative environment of higher education in relation to the component specific structure of the studied readiness, their parameters of formation and criterion indicators, which occurred during the experimental testing of the developed model.

The analysis of the experiment's results confirmed the study's hypothesis: provided that a set of pedagogical conditions for the formation of the readiness of future specialists in physical culture and sports for rehabilitation work is implemented, positive dynamics can be achieved in the levels of the studied readiness.

The results of the chi-square analysis provide compelling evidence regarding the impact of the developed pedagogical conditions on the formation of readiness for rehabilitation work among future specialists in physical culture and sports. The interpretation of these findings gains deeper clarity when viewed through the lens of previous research and theoretical frameworks that have explored related constructs of professional readiness, competence development, and rehabilitation-oriented training.

The absence of statistically significant differences between the experimental (EG) and control (CG) groups at the ascertaining stage ($\chi^2 = 0.27$, $p = 0.874$; Cramer's $V = 0.036$) confirms that both groups started from

nearly identical initial conditions regarding their knowledge, motivation, and skills related to rehabilitation work. This equivalence is essential for validating the experiment's internal reliability. It supports the idea expressed by Pereira et al. (2021) that students commonly begin rehabilitation-related coursework with fragmented or underdeveloped conceptions of therapeutic physical activity. Similar findings are reported by González Rosabal & Castillo Limonta (2016), who demonstrated that even practicing teachers often lack systematic understanding of rehabilitation methodologies, which leads to inconsistent professional practice.

This homogeneity at baseline highlights a broader systemic issue: higher education programs in physical culture and sports traditionally underemphasize rehabilitation competencies, resulting in insufficient readiness among students. The present study's initial results confirm the patterns identified in the literature and emphasize the need for structural changes in curricula, which many scholars (e.g., Barotsis et al., 2024; Ceravolo et al., 2023) describe as urgent for aligning education with contemporary rehabilitation standards.

The statistically significant differences observed at the formative stage ($\chi^2 = 20.99$, $p < 0.001$; Cramer's V = 0.320) reflect a substantive shift in readiness levels in the EG compared to the CG. The medium-sized effect suggests that the pedagogical conditions implemented—updates to curricular content, an innovation-oriented special course, increased practical engagement, and use of interactive technologies—had a meaningful influence on students' readiness.

This aligns closely with the conclusions of Leochico et al. (2024), who argued that modern rehabilitation training must incorporate technology, multidimensional learning environments, and clinical simulations to produce measurable gains in competence. Similarly, Cordovi Naranjo et al. (2025) emphasize the efficacy of integrated physical culture and therapeutic approaches in strengthening students' understanding of rehabilitation mechanisms. The increase in high readiness levels among EG students indicates that the intervention not only improved knowledge acquisition but also enhanced motivational and operational components, echoing the competency-based transformations described by Steinmetz et al. (2024).

However, despite the substantial improvement, it is important to recognize that the intervention did not eliminate all deficits. For instance, while high readiness increased significantly, a notable share of EG students remained at the medium level, suggesting that **some components of readiness—such as independent decision-making in rehabilitation or advanced diagnostic judgment—may require longer-term or more intensive pedagogical strategies**. This echoes Janssen et al. (2022), who argue that rehabilitation competence arises from complex interaction between theoretical knowledge and supervised clinical practice and cannot be achieved solely through short-term curricular modifications.

From a critical standpoint, the results highlight several important issues:

The limits of traditional training models

The control group's lack of substantial improvement reinforces the critique of traditional physical education curricula as insufficiently responsive to the realities of modern rehabilitation contexts. This supports earlier findings by Morcillo-Valencia et al. (2025), who noted that educators often lack preparation for inclusive and rehabilitation-oriented environments, which limits students' ability to transfer theoretical knowledge into practice.

The pedagogical conditions appear to address multidimensional readiness

The medium effect size illustrates that readiness is not a singular construct. Instead, it requires coordinated development across motivational, cognitive, self-educational, and operational domains. This multidimensionality reflects theories advanced by Martínez et al. (2022) and León Reyes et al. (2025), who

argue that competence formation in rehabilitation requires both internal (motivation, self-awareness) and external (content, practice, environment) drivers.

Gaps remain in long-term sustainability of competence

While the study demonstrates short-term success, the literature warns that readiness tends to regress without continuous professional development (Bell Kindelán et al., 2025). Future research should therefore incorporate longitudinal tracking to assess the durability of the pedagogical effects.

Contextual factors must not be overlooked

Cultural, institutional, and infrastructural factors—such as access to rehabilitation facilities, equipment, and qualified instructors—may have amplified the intervention's effect. As identified by Zampolini et al. (2022), systemic support structures are essential for the effective formation of rehabilitation professionals. The present results should therefore be interpreted within the specific educational context in which the model was implemented.

Conclusions

The problem's relevance is demonstrated, and the main approaches to the professional training of future specialists in physical culture and sports for rehabilitation work (rehabilitation, humanistic, physical culture and health, competency-based) are clarified. The design of the educational and professional environment for the training of future specialists in physical culture and sports for rehabilitation work is considered. The orientation of future specialists in physical culture and sports toward rehabilitation work is shown.

The purpose of the experimental work: experimental verification of the effectiveness of pedagogical conditions for the formation of the readiness of future specialists in physical culture and sports for rehabilitation work in the process of professional training.

Working hypothesis of the experimental work: subject to the implementation of elaborated pedagogical conditions for the formation of the readiness of future specialists in physical culture and sports for rehabilitation work in professional training, positive dynamics in the levels of the studied readiness can be achieved.

Experimental work was carried out in three stages: preparatory, ascertaining, and formative.

During the study, during the interviews, it was found out that the teachers of the higher school confirmed the necessity and expediency of increasing the efficiency of professional training of future specialists in physical culture and sports for rehabilitation work in the process of professional training by implementing certain pedagogical productive conditions based on modern methods and technologies and which will ensure the formation of the studied readiness of specialists.

The results of the process of ascertaining the cross-section of students of the CG and EG indicate that they were generally characterized by a lack of clear ideas about rehabilitation work, its forms and possibilities, and an unformed, positive attitude towards it. A low level of readiness was observed among most students in this area of work.

The results of the diagnostic experiment showed that the initial level of preparation for physical rehabilitation among future specialists of EG and CG is similar across these groups and requires targeted activities to improve rehabilitation work.

The formative stage of the experiment involved the direct introduction of pedagogical conditions into the professional training of students to develop the readiness of future specialists in physical culture and sports for rehabilitation work when applying the structural-functional model in higher education.

After conducting the formative experiment, a comparative analysis of the experimental data shows that positive dynamics were observed in EG: we observe a significant increase in the number of respondents (by 16%) who are at a high level. The number of EG students who showed an average level of readiness for rehabilitation work increased by 16%.

We observe a 31% decrease in the number of EG students with low readiness levels.

In the CG, we also note specific positive changes, but they are insignificant (an increase of 2% – high level; an increase of 3% – average level; low level – decreased by 5%) and did not affect the formation of the studied readiness, the general picture of the level increase.

During the experiment, the dynamics of the indicators obtained for the general level of students' readiness for rehabilitation work in the EG indicate that the implemented model and the developed pedagogical conditions contribute to an increase in the level of readiness of future specialists in physical culture and sports for rehabilitation work.

The analysis of the experiment's results confirmed the study's hypothesis. We see the prospect of further scientific research into advanced foreign experience in the professional training of future specialists in physical culture and sports for rehabilitation work, and its implementation in higher education practice.

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Formation of aesthetic culture of future educators in preschool and primary educational institutions

Formación de la cultura estética de los futuros educadores en instituciones de educación preescolar y primaria

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Abstract

The purpose of the study is to analyze the characteristics that shape the aesthetic culture of future teachers in preschool and primary education institutions, and to examine the pedagogical conditions that will contribute to their effective development. The study was mixed in nature and consisted of three stages: ascertaining, formative, and concluding. The results show that Ukrainian students obtained better results in value orientation: attitude towards art, aesthetic interests, and attitudes (the role of art in students' lives and their participation in artistic events). Chinese students were better in knowledge and creative activity. The strongest predictors of the development of aesthetic culture were determined to be knowledge (β=0.38), creative activity (β=0.41). Self-esteem (β = 0.29) and participation in cultural events had a somewhat smaller impact. Comparison of the obtained results indicated a statistically significant increase

in all components of aesthetic culture, particularly in the greatest achievements in individual knowledge and creative activity. The study confirmed the effectiveness of targeted pedagogical interventions, in particular the integration of art into the educational process, the implementation of projects, and the participation of students in cultural events. The conclusions indicate a need to improve educational programs for the training of teachers in preschool and primary schools.

Keywords: Aesthetic culture, creative activity, pedagogical conditions, preschool and primary education, teacher training.

Resumen

El objetivo del estudio es analizar las principales características de la formación de la cultura estética en futuros docentes de educación preescolar y primaria, y estudiar las condiciones pedagógicas que contribuirán a su desarrollo efectivo. Metodológicamente, el estudio tuvo una naturaleza mixta y constó de tres etapas: constatación, formación y conclusión. Los resultados muestran que los estudiantes ucranianos obtuvieron mejores resultados en la orientación de valores: actitud hacia el arte, intereses y actitudes estéticas (el papel del arte en la vida de los estudiantes y su participación en eventos artísticos). Los estudiantes chinos obtuvieron mejores resultados en conocimiento y actividad creativa. Los predictores más sólidos del desarrollo de la cultura estética fueron el conocimiento (β = 0,38) y la actividad creativa (β = 0,41). La autoestima (β = 0,29) y la participación en eventos culturales tuvieron un impacto ligeramente menor. La comparación de los resultados obtenidos indicó un aumento estadísticamente significativo en todos los componentes de la cultura estética, en particular, con los mayores logros en conocimiento individual y actividad creativa. Las conclusiones confirmaron la eficacia de las intervenciones pedagógicas específicas, en particular la integración del arte en el proceso educativo, la implementación de proyectos creativos y la participación del alumnado en eventos culturales.

Palabras clave: Cultura estética, actividad creativa, condiciones pedagógicas, educación infantil y primaria, formación del profesorado.

Introduction

The current education system in Ukraine is undergoing active transformations aimed at developing and forming harmonious, spiritually evolved, and creative personalities. Aesthetic culture plays a crucial role in this system, determining a person's ability to perceive and create beauty, shaping value orientations and contributing to the development of emotional and imaginative thinking. The problem of forming aesthetic culture is particularly relevant in the professional training of future teachers of preschool and primary educational institutions, since they lay the first foundations for children's aesthetic perception of the world.

However, despite the growing attention to issues in artistic and aesthetic education, there are several contradictions in the training of teaching staff. In particular, there is a dilemma between society's need for teachers who can organise a culturally rich and aesthetically enriched environment and the actual level of their aesthetic training. In addition, there are discrepancies between modern educational standards and the insufficient number of methodological developments aimed at fostering aesthetic culture. As a result, graduates of pedagogical universities are not always ready to effectively implement aesthetic education in the practice of preschool and primary education (Yang et al., 2025). There are not many special studies on the peculiarities of the development of aesthetic culture in future teachers (Gómez García, 2021). Previous scientific work has mostly focused on the aesthetic education of children and the role of art in personality formation, but there is a lack of systematic, practice-oriented studies specifically aimed at future educators (Concha-Díaz et al., 2024). The real level of aesthetic culture among students of pedagogical specialities and the role of methods for integrating artistic disciplines into professional training remain insufficiently studied (Escalona Vázquez et al., 2025). Hence, despite the existing theoretical results in the field of art and aesthetic education, a key scientific problem remains unresolved - the lack of a systematic and empirically confirmed understanding of the level of aesthetic culture of future teachers and the pedagogical conditions that influence its formation (Diachenko et al., 2022). In particular, it has been proven that today

there are no agreed-upon approaches to assessing students' aesthetic culture, as well as no clearly defined criteria, methods, and educational practices that would effectively integrate artistic disciplines into the professional training of future educators and primary school teachers (Turabay et al., 2023).

Moreover, analysis of modern research has shown that scientific attention has been focused mainly on the aesthetic education of children and the influence of art on the development of personality, however, the issues of the formation of aesthetic culture of future teachers remain incompletely studied. Existing works have not proposed holistic models for assessing the aesthetic culture of students. There is also a lack of empirical data on its real level. Thus, the scientific gap lies in the lack of systematic, evidence-based and practice-oriented research on the formation of aesthetic culture of future educators and primary school teachers. Thus, the study will fill an important scientific and practical gap and offer new approaches to teacher training. The novelty of the study involves conducting an empirical analysis of the level of aesthetic culture among future educators and identifying the pedagogical conditions that contribute to its development.

Previous studies indicate significant attention to the artistic and aesthetic education of children, however, the level of formation of the aesthetic culture of future teachers, as well as the pedagogical conditions that determine its development, remain insufficiently studied. There are no agreed approaches to assessing the aesthetic culture of students, clear criteria and valid methods of its diagnosis, as well as practically oriented models of integrating artistic disciplines into the professional training of teachers. It is this uncertainty in the approaches and the lack of empirically substantiated data that form a key theoretical gap that requires systematic analysis.

The aim of this study is to identify the characteristics of aesthetic culture formation among future educators in preschool and primary educational institutions and to describe the main pedagogical conditions that contribute to its effective development.

Research objectives

In connection with the outlined contradictions, a key research question arises:

which components of the aesthetic culture of future teachers are the most important for its development and what pedagogical conditions ensure their effective formation?

An additional question is to identify differences in the formation of the aesthetic culture of students from different educational contexts (Ukraine - China) and the influence of pedagogical interventions on its dynamics.

This study focuses only on future teachers of preschool and primary education, however, the training of secondary and art school teachers is not considered. At the same time, the analysis covered aesthetic culture as an integral personal and professional component, which does not include detailed art historical characteristics of individual artistic disciplines. Therefore, the results obtained will be important for improving educational programmes for training future educators and primary school teachers.

Literature Review

Modern approaches to teacher training have identified aesthetic culture as an integral personal and professional component, which consists of a cognitive understanding of artistic phenomena, emotional and value sensitivity to beauty and the ability to apply aesthetic principles in pedagogical activity. Modern scientific works by Latin American authors also indicate that the aesthetic culture of a future teacher is an artistic competence and plays the role of an important core of pedagogical professionalism (Egana-delSol et al., 2019; Gonçalves, 2024). Other authors also indicate that it determines the ability to form a culturally enriched educational environment (Oliver-Barcelo et al., 2024).

Accordingly, according to other works, the features of the formation of aesthetic culture require a systematic combination of art history knowledge, personal artistic experience, and reflective practices (Egana-delSol, 2023). Others indicated that in teacher training, art-based methods that foster creativity, empathy, visual thinking, and the interpretation of cultural symbols are of great importance. A standard position unites all these theoretical approaches. In particular, the development of the aesthetic culture of future teachers is possible only under the conditions of a holistic educational model, which consists of the integration of artistic disciplines, the practice of immersion in the artistic environment, and pedagogical conditions that contribute to the formation of emotional and value sensitivity, creativity, and cultural competence. These provisions provided an essential theoretical basis for an empirical analysis aimed at determining students' level of aesthetic culture.

In recent years (2020–2025), there has been a noticeable increase in interest in the problems of aesthetic culture formation among future educators in scientific articles and monographs, especially when considering the contexts of preschool and primary education. Numerous publications by researchers from Latin America, Spain, and other countries highlight that aesthetic culture is not an auxiliary or optional element (Samaniego et al., 2024). It is clearly a key component of teachers' professional development. Aesthetic culture combines the development of artistic and creative abilities, sensitivity to the transformation of cultural codes, the ability to think critically, the ability to reflect on the artistic experiences of others, and the skillful integration of art into the educational process in educational institutions.

Contemporary publications have also demonstrated a range of distinct productive practices: the gradual integration of art and science, reflected in curricula (Hamilton et al., 2019; Berdichevsky et al., 2024). Researchers also highlight the importance of using workshops and art projects to prepare future teachers, emphasizing interdisciplinary approaches that combine artistic methods with aspects such as language learning, social sciences, or natural sciences (Barahona-Salgado & Torres, 2024). Positive results in research environments are associated with experiments with digital art and other multimedia tools, which became particularly relevant during the COVID-19 pandemic.

It is also important to highlight certain debatable aspects that can be traced in modern scientific publications. For example, there is no unity in terminology or specific conceptual approaches today: researchers use terms such as "aesthetic culture," "aesthetic competence," "art education," and "creative development" (Vera Noriega et al., 2024). These terms are considered interchangeable, which makes it difficult to compare results and develop unified standards.

Secondly, there is a noticeable gap between theory and practice. While students are usually introduced to the theoretical foundations of aesthetic education, the actual opportunities to use specific artistic methods in practice within the school environment are minimal. Researchers noted that mentors in schools and kindergartens often lack sufficient competence in this area themselves, which generally does not contribute to the effective acquisition of the necessary skills (Acosta Marroquín, 2020). There is certainly a problem of inequality in resource provision. The real financial limitations in many educational institutions in the Global South (Latin America, Ukraine, Asian countries) have led to a lack of material resources (workshops, tools, art supplies). Furthermore, artistic subjects are significantly inferior to disciplines that are focused on standard measurement of results.

Existing scientific research is largely based on primarily qualitative methods (interviews, observations, surveys) (García-Gómez, 2023). At the same time, some tools for measuring the level of aesthetic culture formation remain methodologically underdeveloped. Modern scientific research sometimes lacks large-scale and long-term studies that would allow us to determine how training will impact graduates' future professional work and individual child development outcomes (Muzyka et al., 2021). Individual political or administrative factors can primarily hinder the systemic implementation of aesthetic education. In many countries, state standards, the accreditation system, and external control prioritize academic results in mathematics and languages (the humanities component), while art and aesthetic practices are on the periphery of the learning process (Silva et al., 2018). Modern scholars also emphasized the importance of considering changes in cultural relevance. In a number of countries, models borrowed primarily from

Europe or North America are prevalent, which do not always take into account certain local cultural traditions and artistic practices. This allows for a discussion about the decolonial approach and the importance of integrating local art forms and cultural practices into future teacher training (Escala et al., 2024).

Finally, the digitalization of education has opened up new possibilities for further combining multimedia and digital art practices (Anzules-Falcones et al., 2025; Godinez-Flores et al., 2025). However, the question remains open as to how capable they are of shaping the aesthetic sensitivity of future educators and how these results can be adequately assessed.

Therefore, an analysis of current research has allowed us to conclude that the challenge of shaping the aesthetic culture of future educators has reached a high level of scientific relevance, but will require the development of a systematic terminology, the formation of comprehensive training programs, and the creation of validated tools for assessment and consideration of local cultural characteristics. Future research should also focus on the problem of finding effective models for integrating art into the professional training of educators, which would combine global trends with the cultural uniqueness of the region.

Methodology

Researh design

The article uses a mixed methodological approach. The design of the study was quasi-experimental and was based on the pretest–posttest model without a control group. At the first stage, an input measurement (pretest) was carried out, after which an eight-week formative program was implemented, and at the final stage, an output measurement (posttest). Randomization of participants was not carried out, and therefore the design belongs to quasi-experimental according to the Campbell & Stanley classification.

The comparison of the results of the Ukrainian and Chinese samples did not serve as a control group, but had an analytical, cross-cultural nature, aimed at identifying differences in educational contexts. Both groups underwent the same measurement procedure but were not considered experimental and control in the strict sense. For this purpose, a sequential explanatory design was chosen, in which quantitative data were obtained at the first stage, and qualitative data were used to interpret and deepen the quantitative results. Integration was carried out based on 2 components:

1. Methodological - the results of the qualitative analysis clarified the patterns that were identified statistically.
2. Analytical - comparison of the obtained thematic data.

Thus, the study had a mixed nature and consisted of ascertaining, formative, and concluding stages.

The ascertaining stage consisted of diagnosing the initial level of formation of the aesthetic culture of future educators.

The forming stage involved testing pedagogical conditions and methodological techniques aimed at developing the aesthetic culture of students.

The concluding stage consisted of a comparative analysis of the results and determining the effectiveness of the applied approaches.

An important point was that the study had a cross-cultural design. Thus, it was proposed to compare the levels and features of the formation of aesthetic culture in two different cultural and educational contexts - Ukrainian and Chinese.

Participations

The study involved 166 students of pedagogical specialties studying in higher education institutions in Ukraine and China. The sample was formed purposefully and taking into account the future professional activities of the participants in the field of preschool and primary education.

Thus, 135 students from Ukraine were selected, representing the specialties "Preschool Education" and "Primary Education". The sample included students of 2nd–4th years of pedagogical universities. The participants' age range was 18 to 22 years. At the time of the study, the students had theoretical training and initial experience of pedagogical practice in educational institutions.

31 students from China are future educators of preschool educational institutions. The participants' ages ranged from 18 to 23 years. The sample included students receiving professional training at a pedagogical university who are at the stage of developing basic pedagogical, cultural, and aesthetic competencies.

Despite the limited number of participants from China (N = 31), their inclusion in the study was methodologically justified and scientifically significant. It was the cross-cultural comparison that enabled identification of differences between educational systems. This made it possible not only to outline different emphases of aesthetic training and ensured the analyticality of the results. Thus, even a small Chinese sample enriched the study and confirmed its cross-cultural purpose. Hence, the total number of participants was 166 people.

The international composition of the sample made it possible to carry out analysis at such levels as: intra-national (analysis of the level of formation of aesthetic culture of students of pedagogical specialties in Ukraine) and intercultural (comparison with the experience of training).

The formative program lasted 8 weeks and included 16 training sessions. It consisted of the following modules: cognitive (short lecture blocks on aesthetics and art history), value (discussions, reflections, viewing works of art, analysis of emotions, values), activity (performing artistic and creative tasks, participating in cultural events, creating mini-projects). The implementation of the intervention was carried out by teachers and methodologists who were instructed in a single assessment algorithm.

Data collection process and instruments

Data collection was carried out in stages and in accordance with the characteristics of the sample and research objectives.

At the preparatory stage, research tools (questionnaires, questionnaires, test tasks, rating scales) were developed and adapted. Then, the questionnaires were translated and partially adapted into Ukrainian and English for participants from China, with subsequent verification of content compliance (translation and back-translation procedure). Then, the time, place and conditions of the study were agreed.

At the ascertaining stage, a questionnaire was administered to students to identify the level of aesthetic interests, attitudes towards art and cultural practices. Knowledge of art, aesthetic categories and cultural phenomena was also tested. In some cases, students' activities were observed during classes and creative tasks (participation in theatrical, musical or artistic events). At the same stage, self-assessment was carried out using a special scale (students determined their own level of aesthetic culture).

To ensure data quality, data were checked for omissions, anomalies, and logical consistency. Incomplete questionnaires (less than 70% of responses) were excluded from the final sample. Before combining the Ukrainian and Chinese samples, a translation equivalence test was performed using the back-translation procedure.

At the formative stage, pedagogical conditions aimed at the development of aesthetic culture were

introduced (integration of artistic elements into educational activities, creative tasks, participation in cultural events). A series of seminars and practical classes were also held, aimed at activating students' emotional and value-based attitude towards art.

At the final stage, repeated questionnaires and testing of students from both samples were carried out. Teachers and methodologists evaluated the results of pedagogical tasks.

Instruments

The questionnaire "Aesthetic Interests and Cultural Practices" was used to identify involvement in artistic activities and attitude to art as a value.

Test on aesthetics and art (max. = 20 points). It consists of 20 tasks of different types (multiple choice, matching, definition of concepts, examples from art).

The assessment was as follows:

0–6 points - low level (fragmentary ideas),
7–13 points - medium level (basic, but without depth),
14–17 points - sufficient level (formation of concepts),
18–20 points - high level (ability to apply knowledge).

The self-assessment scale of aesthetic culture (1–5 points) was also used. Students assessed their own attitude to art, the level of aesthetic skills and the ability to creative self-expression.

The pedagogical observation map provided for the involvement of expert assessment (from 0–5 points). Experts (teachers of artistic and pedagogical disciplines) recorded the following criteria:

cognitive activity (interest in art),
value-based attitude,
participation in creative tasks,
independent artistic initiative.

To compare the general level of aesthetic culture, an integral indicator was calculated (maximum = 20 points), which included weighted results:

Integral score was also expressed according to the scheme: Tknowledge+Sself-assessment+Pculture+Ccreativity
T–test scores (0–10, recalculated from 20),
S–self-assessment (0–5),
P–participation in cultural practices (0–3),
C–creative activity according to experts (0–5).

The validity and reliability of the instruments were verified. The validation of the instruments was implemented on the basis of the psychometric standards of AERA/APA. In particular, various types of validity were ensured. The substantive validity was ensured on the basis of expert assessment of the correspondence of the tasks to the research objectives. Thus, an expert group (5 teachers of pedagogical and artistic disciplines) checked the compliance of the content of the tasks with the objectives of the study, after which the instruments were adjusted. In addition, a preliminary factor analysis was conducted, which indicated the presence of three main components of aesthetic culture: cognitive, value and activity-creative. The linguistic validity was ensured using the translation-back translation procedure.

Construct validity involved a preliminary factor analysis. The reliability of the instruments was confirmed by

the following indicators: test: KR–20 = 0.79; self-assessment scale: Cronbach's α = 0.84; cultural practices questionnaire: α = 0.82; observation card: α = 0.86. All values exceed the recommended threshold of 0.70 This indicated consistency and validity.

Data Analysis

Descriptive statistics were used to analyze the data. In particular, at the initial stage, data processing was carried out using descriptive statistics methods: calculating the mean, median, standard deviation for the results of questionnaires, tests, observations and expert assessments. Participants were also classified according to the levels of aesthetic culture:

low - 0–6 points (according to the test),
average - 7–13 points,
sufficient - 14–17 points,
high - 18–20 points.

The average results of tests, self-assessment scales, questionnaires and expert assessments were compared.

The choice of statistical procedures was justified by the type of data and the research questions. The t-test for independent samples was used to compare the means in the two groups (Ukraine–China). This was chosen because the dependent variables are interval variables and the groups are independent.

Before applying the t-test, the assumptions of normality (Shapiro–Wilk, $p > .05$) and homogeneity of variances (Levene, $p > .05$) were tested.

Correlation analysis (Pearson r) was used for interval data; in the case of categorical or rank variables, Spearman ρ was used. For example, to identify relationships between different indicators of the level of aesthetic culture, the Pearson coefficient (r) was used for parametric data and the Spearman (ρ) for non-parametric data. The analysis was conducted using the following variables:

test results (knowledge of aesthetics and art);
self-assessment scale scores;
frequency of participation in cultural practices (according to questionnaires);
indicators of creative activity (according to observations);
expert assessments of teachers.

To determine the factors that most influence the level of aesthetic culture, multiple regression analysis was used.

Dependent variable: integral indicator of aesthetic culture (total result of the test, self-assessment, observations and expert assessments).

Independent variables (predictors):

level of knowledge (scores according to the test);
self-assessment of aesthetic culture (scale 1–5);
participation in cultural events (frequency, from 0 to 5 points);
creative activity (expert assessment 1–5 points).

Results and Discussion

The level of formation of aesthetic culture was assessed by 3 main components: cognitive (knowledge), value (attitudes, interests) and activity-creative (activity, skills). The results of the knowledge test, in which

the maximum score is 20, showed that most students are at an average level of knowledge, however, in some cases Chinese students demonstrated a slightly higher average score and a larger proportion of participants with a high level (See Figure 1).

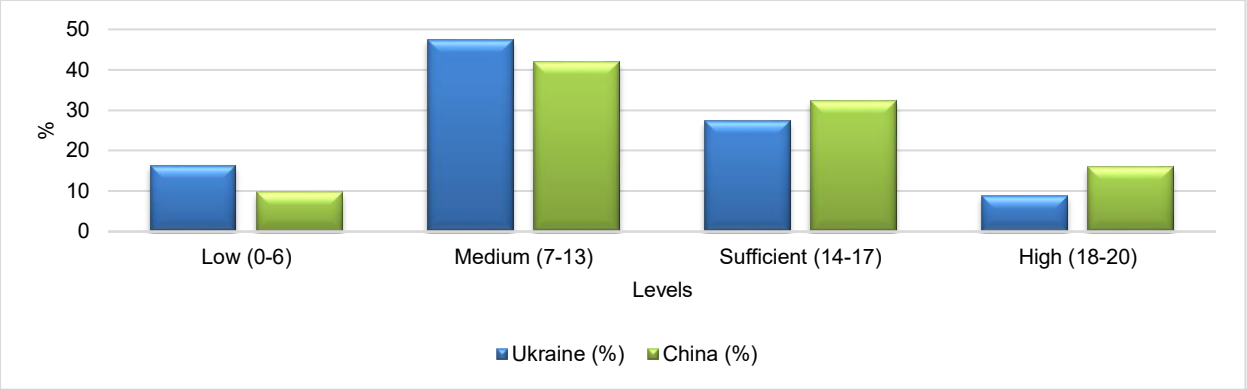

Figure 1. Distribution of students by knowledge levels (%)

At the same time, most students defined their level as average or sufficient. On average, the grades ranged from 3.2 to 3.5 points. Table 1 presents the results of students' self-assessment.

Table 1.
Distribution of students by self-assessment of the level of aesthetic culture

Country	N	1	2	3	4	5	Average score
Ukraine	135	8 (5,9%)	21 (15,6%)	56 (41,5%)	38 (28,1%)	12 (8,9%)	3,2
China	31	1 (3,2%)	3 (9,7%)	11 (35,5%)	12 (38,7%)	4 (12,9%)	3,5
Total	166	9 (5,4%)	24 (14,5%)	67 (40,4%)	50 (30,1%)	16 (9,6%)	3,3

The results of expert assessment (0–5 points for each criterion) showed that the highest indicators in both samples were demonstrated by students in the field of value attitude towards art (2.6 points in Ukraine and 2.8 points in China).

The lowest results were recorded in the category of creative activity (2.0 points in Ukraine and 2.4 points in China). This indicated insufficient implementation of the practical component of aesthetic culture.

According to the general integrated indicator, the groups scored from 9.1 to 10.2 points out of 20 possible. This is the average level.

The results of descriptive statistics indicated that Chinese students have higher results in knowledge of aesthetics and art (13.6 vs. 12.3), self-assessment of the level of aesthetic culture (3.5 vs. 3.2) and creative activity (2.4 vs. 2.0). This indicator was assessed by participation in creative tasks (0–5). At the same time, differences in the frequency of participation in cultural events are statistically insignificant (p=0.385). Thus, in the conditions of Chinese pedagogical education, more attention is paid to knowledge and practical activity, while in Ukraine, a value-based attitude dominates. (See Table 2).

Table 2.
Descriptive statistics of main variables

Variable	Ukraine (M ± SD)	China (M ± SD)	t-value	p-value
Knowledge test (0–20)	12.3 ± 3.1	13.6 ± 3.0	-2.05	0.042*
Self-assessment	3.2 ± 0.8	3.5 ± 0.7	-2.10	0.037*
Participation in cultural events	2.8 ± 1.1	3.0 ± 1.0	-0.87	0.385
Creative activity (expert)	2.0 ± 0.7	2.4 ± 0.6	-2.71	0.008**
Integral indicator (max 20)	9.1 ± 2.4	10.2 ± 2.2	-2.15	0.033*

* p<0.05, ** p<0.01

Correlations between indicators in a sample of students from Ukraine were established. The strongest relationship is observed between self-esteem and creative activity (r=0.62, p<0.01). Thus, the higher the level of awareness of one's own aesthetic culture is associated with more active inclusion in creative activity. In addition, significant relationships were found between participation in cultural events and expert assessments (r=0.39, p<0.05). Thus, for Ukrainian students, the leading factor is the value-motivational sphere, and not just knowledge (see Table 3).

Table 3.
Correlation matrix (Ukraine)

Variables	Knowledge	Self-assessment	Participation	Creative activity	Expert score
Knowledge	1	0,32	0,21	0,28	0,34
Self-assessment		1	0,41	0,62	0,47
Participation			1	0,44	0,39
Creative activity				1	0,58
Expert score					1

In the Chinese sample, a different situation is noticeable. In particular, the main connection is formed between knowledge and self-assessment of aesthetic culture (r=0.58, p<0.01). In addition, knowledge is strongly correlated with expert assessments of teachers (r=0.55). Thus, according to these regressions, knowledge and creativity are the leading predictors. For these students, it is the cognitive component that is key in the formation of aesthetic culture, while creative activity (r=0.61 with expert assessments) plays a supporting, but also significant role (See Table 4).

Table 4.
Correlation matrix (China)

Variables	Knowledge	Self-assessment	Participation	Creative activity	Expert score
Knowledge	1	0,58	0,33	0,41	0,55
Self-assessment		1	0,36	0,44	0,52
Participation			1	0,38	0,4
Creative activity				1	0,61
Expert score					1

Data from multiple regression indicated that the greatest influence on the integral level of aesthetic culture is exerted by knowledge (β=0.38, p<0.01) and creative activity (β=0.41, p<0.01). Thus, according to these regressions, knowledge and creativity are the leading predictors. Self-esteem is also a significant factor (β=0.29, p<0.05), while participation in cultural events shows only a tendency to influence (p=0.060). Thus, cognitive and creative-activity factors are leading in the formation of students' aesthetic culture.

After using and implementing a pedagogical program aimed at developing students' aesthetic culture (integration of art elements into the curriculum, creative master classes, cultural events, reflective practices), significant positive changes were observed in the experimental groups compared to the control groups.

Improvements were especially noticeable in the cognitive (knowledge) and activity-creative (creative activity) components, while the value component (attitude) also demonstrated stable positive dynamics (see Table 5). In particular, in Ukraine, the average score on the knowledge test increased from 12.3 to 14.0 (t=3.21; p<0.01), and on self-assessment – from 3.2 to 3.6 (t=2.89; p<0.01). An increase in the level of creative activity was also recorded from 2.0 to 2.5 points (t=3.11; p<0.01). The integral indicator increased from 9.1 to 11.2 (t=3.42; p<0.01). In the Chinese sample, the dynamics were similar: knowledge increased from 13.6 to 15.1 (t=2.68; p<0.05), self-esteem – from 3.5 to 3.9 (t=2.73; p<0.05), creative activity – from 2.4 to 2.9 (t=2.94; p<0.01), and the integral indicator – from 10.2 to 12.0 (t=3.02; p<0.01) (See Table 5).

Table 5.
Dynamics of students' aesthetic culture (N=166)

Variable	Ukraine Before	Ukraine After	t-value	p-value	China Before	China After	t-value	p-value
Knowledge test	12.3 ± 3.1	14.0 ± 2.9	3.21	0.002**	13.6 ± 3.0	15.1 ± 2.7	2.68	0.013*
Self-assessment	3.2 ± 0.8	3.6 ± 0.7	2.89	0.005**	3.5 ± 0.7	3.9 ± 0.6	2.73	0.010*
Participation	2.8 ± 1.1	3.2 ± 1.0	2.01	0.046*	3.0 ± 1.0	3.5 ± 0.8	2.12	0.042*
Creative activity	2.0 ± 0.7	2.5 ± 0.6	3.11	0.003**	2.4 ± 0.6	2.9 ± 0.5	2.94	0.007**
Integral indicator (max 20)	9.1 ± 2.4	11.2 ± 2.1	3.42	0.001**	10.2 ± 2.2	12.0 ± 1.9	3.02	0.005**

* p<0.05, ** p<0.01

The generalized results for the entire sample (N=166) indicated that after the implementation of the program, the average integral indicator of aesthetic culture increased from 9.3 to 11.4 points (p<0.01). Thus, this indicated the effectiveness of the development of special aesthetic-formative conditions regardless of the national sample. The greatest increase was recorded in the cognitive component (knowledge) and creative activity (See Figure 2).

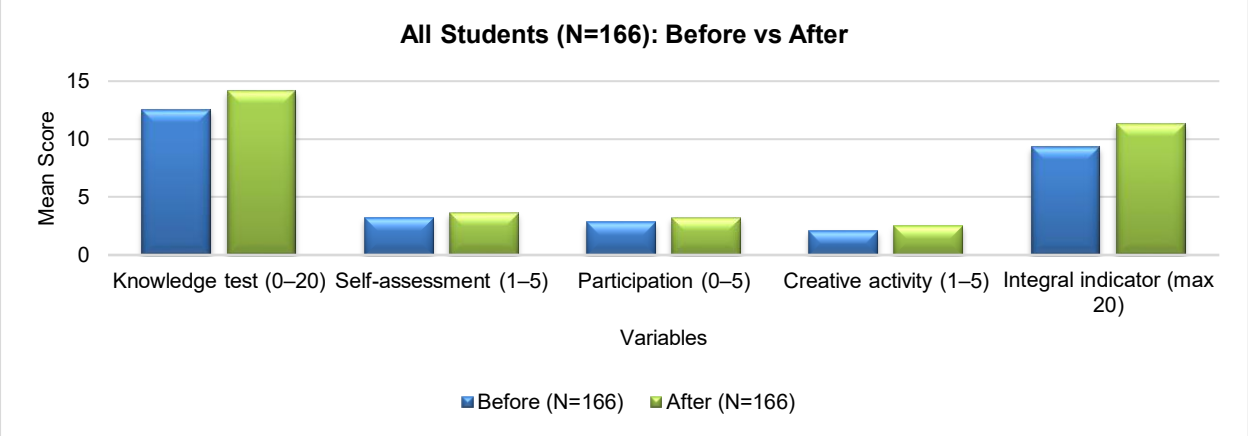

Figure 2. Cognitive component (knowledge) and creative activity.

Thus, after the implementation of the aesthetic culture development program, positive dynamics were recorded for all key indicators. The largest increases were in the cognitive component (knowledge) and the activity-creative component (creative activity); value attitudes also increased, but more moderately. Comparatively, the average values of knowledge, self-esteem, and creative activity were somewhat higher in students from China than in the Ukrainian subsample, and the overall integral indicator also increased in both groups.

The fact of higher knowledge and the associated effects in the Chinese group resonates well with works on the role of aesthetic experience and aesthetic education in the professional development of Chinese teachers. Other authors have indicated that aesthetic experiences and experiences were correlated with

professional growth and are supported by current state policies in the field of education in China (Sámuel et al., 2021; Casham et al., 2024).

The study proved the effectiveness of a structured framework for aesthetic education. The obtained before-and-after indicators of growth in knowledge, creativity, and communication skills are determined by recent empirical studies, which indicate an improvement in artistic perception, critical thinking, creativity, and educational communication of students (Heller, 2021; Aquino et al., 2021). This indirectly confirms that targeted curriculum interventions are effective.

In the Ukrainian education system, value-motivational spheres and innovations play an important role. This is also indicated in other works by European authors about the strong role of technology involvement (Aguirre-Canales et al., 2021). This study indicated a strong connection between self-esteem and creative activity in students from Ukraine. Such data are compared with the results of other authors who indicated the importance of creativity, aesthetic attitudes, and the introduction of innovative technologies in art education (Garcia-Lazo et al., 2024; González-Zamar & Abad-Segura, 2021). This is noticeable in the indicators of increased involvement, motivation for learning, development of skills, and artistic self-expression) (Rios-Atehortua et al., 2024). Value orientation and innovative methods are critical conditions for the development of aesthetic culture (Hollingsworth et al., 2025).

In the scientific literature, which highlights the pedagogical conditions for the development of aesthetic/artistic experience in future teachers, the value of purposeful organization of artistic activity (vocal/performative practices), integration of disciplines, and reflective forms of assessment is also indicated (Oliver-Barcelo et al., 2024; Penteado et al., 2025; Kurebay et al., 2023). All these factors were used in this research program. Thus, the results obtained are in good agreement with international works. In particular, it has been proven that structured, interdisciplinary, intercultural and reflective interventions consistently increase the indicators of aesthetic culture of future teachers (Medeiros & Ferreira, 2024; Seitenova et al., 2023). In a theoretical sense, the obtained results supported the model of aesthetic culture as an integral quality with three interconnected components (cognitive, value, activity-creative) and showed that strengthening one (knowledge) works best in conjunction with another (creative practice) (Muñoz-Salinas et al., 2025; Bacca Pachón et al., 2021).

However, the study has certain limitations. First, the sample was uneven and non-random: the Ukrainian group (N = 135) significantly outnumbered the Chinese group (N = 31). Such an imbalance could affect the generalized statistical indicators and the strength of intergroup comparisons.

Second, some of the indicators were based on self-assessment. This, in turn, may contain the effects of socially desirable responses. In addition, the recruitment took place on a target sample of future teachers, and not on a representative sample of general student youth. Therefore, the results cannot be fully extrapolated to the entire population of students in Ukraine and China.

At the same time, these limitations open up prospects for further scientific exploration. In particular, it is advisable to: apply experimental or quasi-experimental designs with control groups. In the future, it is proposed to expand the range of variables and include digital and multimedia aesthetic practices that are relevant in the context of digitalization of education. It is also worth conducting long-term studies to identify the sustainability of the effects obtained after pedagogical interventions.However, despite the results obtained, the study has certain limitations. First, these are unequal and non-random subsamples. The ratio of 135 (Ukraine) to 31 (China) may affect the overall estimates and the power of statistical tests between countries. It is also worth considering that some of the variables (self-esteem, participation in activities) are self-reported, so the answers may be overestimated or underestimated.

This opens up new avenues for further research. In particular, it is worth conducting an experimental or quasi-experimental design with control groups (or rotational implementation). It is also important to expand the variables, in particular to include digital/multimedia practices and their relationship to aesthetic culture.

Conclusions

Thus, most students were at an average or sufficient level of aesthetic culture formation. Ukrainian students showed higher results in value attitudes, while Chinese students showed higher results in knowledge and creative activity. This indicated the existence of different accents in educational systems: in Ukraine - humanistic and value orientation, in China - cognitive and activity.

The most significant predictors of the development of aesthetic culture were knowledge (β=0.38) and creative activity (β=0.41). Self-esteem (β=0.29) and participation in cultural events had a significant, but somewhat weaker influence (p≈0.06). Comparison of results before and after the program showed a statistically significant increase in all components of aesthetic culture. The greatest gains were recorded in knowledge and creative activity; value orientations also improved. This confirms that targeted pedagogical interventions (integration of art into the educational process, creative projects, cultural events) are effective for training future teachers. Ukrainian students demonstrated an advantage in their value attitude towards art, while Chinese students had higher indicators of knowledge and creative activity.

Future research directions include expanding the sample and involving more students from different universities and countries to increase the external validity of the results. It is also worth conducting long-term studies and: tracking changes in the dynamics of aesthetic culture after several months/years to determine the stability of the effects.

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Evaluating an ICT-Mediated active learning framework: A quasi-experimental study in ukrainian higher education

Evaluación de un marco de aprendizaje activo mediado por TIC: Un estudio cuasi-experimental en la educación superior ucraniana

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Abstract

This research fills a significant gap in empirical research on pedagogically driven digital transformation in Ukrainian higher education. It evaluates a structured ICT-mediated active learning model that integrates flipped classroom principles and collaborative digital tools through Moodle. A 16-week quasi-experimental study involving sociology students (N=92) compared this model to traditional lecture-based instruction. The results revealed that the experimental group achieved significantly higher academic performance ($p < .001$), digital competence ($p < .001$), and engagement, as measured by LMS analytics and surveys. The scientific novelty lies in conducting the first comprehensive quasi-experimental testing of an ICT-based active learning framework simultaneously assessing performance, digital competence, and engagement within Ukrainian universities. Practical recommendations include implementing structured faculty training

on active learning design, establishing centralized digital learning support units, and adopting phased pilot programs to ensure sustainable transformation. The research thus provides both empirical validation and an applied roadmap for integrating ICT into higher education reform in Ukraine.

Keywords: active learning, blended learning, flipped classroom, Higher Education, ICT, Online Learning, Ukraine.

Resumen

Esta investigación llena una brecha significativa en la investigación empírica sobre la transformación digital impulsada pedagógicamente en la educación superior ucraniana. Evalúa un modelo estructurado de aprendizaje activo mediado por TIC que integra el aula invertida y herramientas digitales colaborativas mediante Moodle. Un estudio cuasi-experimental de 16 semanas con estudiantes de sociología (N=92) comparó este modelo con la enseñanza tradicional. Los resultados mostraron que el grupo experimental alcanzó un rendimiento académico ($p < .001$), una competencia digital ($p < .001$) y un compromiso significativamente superior, medidos mediante analíticas del LMS y encuestas. La novedad científica consiste en ser la primera prueba cuasi-experimental integral de un marco de aprendizaje activo mediado por TIC que evalúa simultáneamente rendimiento, competencia digital y compromiso en universidades ucranianas. Las recomendaciones prácticas incluyen implementar formación docente estructurada sobre diseño de aprendizaje activo, establecer unidades centralizadas de apoyo digital y adoptar programas piloto por fases para una transformación sostenible. El estudio ofrece así una validación empírica y una hoja de ruta aplicada para integrar las TIC en la reforma educativa de Ucrania.

Palabras clave: aprendizaje activo, Aprendizaje semipresencial, aula invertida, Educación Superior, TIC, Aprendizaje en Línea, Ucrania.

Introduction

The digital revolution has had significant impacts on modern society in that it has created new structures of communication, work, and education (Bernasconi, 2025). In this new environment, higher learning institutions across the globe are forced to evolve in order to survive (Rehman, 2025). The implementation of the Information and Communication Technologies is one of the key components of the modernization of education (Cerdá Suárez et al., 2021). It is a change that goes beyond the incorporation of digital tools within the current structures. It requires a radical pedagogical restructuring to active and student-centered paradigms of learning which make the most of the opportunities of modern technologies (Useche et al., 2022). However, despite extensive international research on ICT integration, there remains a lack of theoretical clarity on how digital transformation aligns with pedagogical restructuring in transitional systems such as Ukraine's higher education sector. This unresolved relationship defines the core scientific problem addressed in this paper.

The need to digitally transform the educational system is critical and not trivial. NHES is in its phase of substantive change and Europeanisation, and the technology implementation is a key aspect of institutional competitiveness and resiliency (Szadkowski, 2025). The COVID-19 pandemic happened throughout the world, and it was a powerful, but disruptive factor that forced an abrupt transition to remote learning in institutions all over the world (Bracco et al., 2025). Within the framework of many Ukrainian universities, the experience indicated a severe mismatch between the surface aspect of digitisation of lectures and the deeper aspects of technology leveraging to create interactive and successful learning experiences. This situation exposes a methodological gap: most Ukrainian reforms rely on descriptive evaluations of digital practices rather than empirical testing of structured, ICT-mediated pedagogical models. The present study responds by applying an evidence-based framework to verify measurable learning effects. This transformation emphasizes pedagogical design over platform adoption, shifting from passive content delivery to active knowledge construction (Fernández-Batanero et al., 2024). Ukraine's current reality

demands transitioning from emergency remote teaching to strategic, evidence-based ICT education (Lezama et al., 2023).

Ukraine's digital transformation in higher education is crucial for post-war recovery and integration into the European Higher Education Area. Addressing challenges like infrastructure gaps, unequal technology access, and pedagogical innovation remains essential (Remesal & Villarroel, 2023). Strategic investment in this digitalization is vital for developing a resilient, modern workforce capable of sustaining national development (Zayachuk, 2025). Yet, the scientific challenge remains in determining how structured digital pedagogy can produce verifiable improvements in academic achievement and engagement under such constraints. This defines the analytical focus and novelty of the current research.

The paper meets the above need by going beyond the generic utterances on the importance of technology. The idea was to illustrate, using empirical evidence, the extent to which a certain, systematic method towards the incorporation of ICT can directly impact the primary educational indicators in Ukraine. The results have a practical implication, as they are an economical, scalable ICT-based active-learning paradigm, which can be integrated in the current Moodle systems to be enacted in Ukrainian institutions. The findings demonstrate a real improvement in academic achievement, digital skills, and student participation. Also, the research connects the global active-learning theory with the practical requirements of Ukrainian schools. Accordingly, this study bridges both theoretical and methodological voids by empirically testing how ICT-driven active learning translates into measurable educational outcomes in a post-crisis, reforming higher-education system.

The main aim of the research is to evaluate in an empirical way the possibility of a structured, ICT-mediated active learning framework impacting different aspects of student academic performance, digital competence, and engagement in a Ukrainian university. The above objective, in its turn, is operationalized by the following specific aims:

1. To compare academic performance between the ICT-mediated model and traditional lectures.
2. To assess the development of digital competence and self-efficacy.
3. To evaluate the impact on student engagement and collaborative learning.
4. To identify implementation challenges and enabling factors from the student perspective.

The current research will be designed based on the following research questions:

RQ1: Does academic performance differ significantly between students in an ICT -mediated model and those in a traditional setting?
RQ2: To what extent does the ICT-mediated model influence students' digital competence and self-efficacy?
RQ3: How does the model affect student engagement and collaborative learning?

The paper tests the hypothesis according to which within the comparison with students who participate in the traditional lecture format, students who study in an ICT-mediated active learning model, including flipped learning, online collaboration, and sustained interaction through a learning management system, will show Meaningfuldifferences in academic performance, digital competence, and self-efficacy.

Literature Review

Theoretical Framework

Digitization of education represents a significant structural change, which is not just the use of computing devices in educational facilities. As argued by Dewey (1986) and Vygotsky & Cole (1978), educational transformation requires active social and cognitive engagement, not mere technological substitution. This is carried out through a series of steps of incorporating digital tools aimed at reorganizing pedagogical, administrative, and learning activities (Bitar & Davidovich, 2024). The general objective here is to increase

the adaptability, inclusiveness, and responsiveness of the educational systems to the dynamic needs of a digitised society. Online learning is mainly delivered in the format of the internet thus providing the learners with the ability to study at any time of their day and at any geographical location (Miralrio et al., 2024). Piaget's (1952) constructivist perspective further emphasizes that such flexibility enhances autonomous knowledge construction. Analytically, this framework distinguishes three interrelated dimensions: (a) active learning as learner-centered knowledge construction, (b) digital competence as the operational capacity to navigate technology critically, and (c) engagement as sustained behavioral and cognitive participation in learning processes.

The integration of the face-to-face and online teaching approach into a planned and purposeful system is achieved in the pedagogy of blended learning. Following Garrison & Vaughan (2008), effective blended learning must integrate cognitive, social, and teaching presence. This kind of integration works when informed by premeditated, methodical integration of modalities and, therefore, produces an informative effect of learning. Here, active learning serves as the central analytical category linking digital delivery with participatory pedagogy, positioning the learner as an active agent rather than a passive recipient.

Digital competence as per good ICT models is self-assured, critical and responsible use of technology. According to Bandura's (1997) social cognitive theory, digital competence also depends on perceived self-efficacy, shaping one's confidence in using technology. This competence extends beyond knowledge of technical expertise to skills and attitude required to work successfully in a digital environment (Chiu, 2021).

Conceptually, it reflects both instrumental skills and metacognitive awareness, making it measurable through performance and self-efficacy indicators.

Emperical Analysis

The empirical studies that have been conducted in recent years have produced strong evidence that deals with the effect of digitally-enhanced education. Research on Latin America shows that properly designed blended learning models can significantly enhance academic outcomes and student satisfaction by providing students with more freedom and enabling more profound preparation with course content, unlike traditional instructional practices (Villa-Castaño & Duran Leon, 2022). Empirically, it is argued that project-based learning that includes application of information and communication technologies (ICTs) is an effective means to facilitate digital capabilities among students in comparison to the digital literacy courses that are not isolated (Govender, 2025).

One of the lessons learned in the literature is that pedagogy is more important than technology; ICTs are only the means of facilitating active learning, which leads to better student engagement and learning (Martín-Rodríguez & Madrigal-Cerezo, 2025). As Fernández-Batanero et al. (2024) discovered, intrinsic motivation and self-efficacy of students were positively influenced by the use of technology to arouse teamwork and problem-solving. The available Ukrainian literature on digitalization studies policy and infrastructure aspects, which are exemplified by the introduction of the "Diia" digital education program and general surveys on the convenience with which students of universities can use online resources (Kniazieva et al., 2023). Few laborious studies assess how structured ICT-based instruction affects performance, competence, or engagement. Local data are needed to show how technology use influences Ukrainian students. Okoye et al. (2023) noted the growth in the use of blended learning formats and at the same time highlighted the insufficient nature of experimentary trials and the absence of serious statistical confirmation. This research therefore aims at bridging the empirical gap by conducting a quasi-experimental study in tertiary institutions in Ukraine.

Research Gaps

This paper deals with the key gaps present in literature. Little research on the role of digitalisation is conducted in Ukraine, and the experimental design is used. Although the design is highly emphasized in

international scholarship, the assessment of a strictly designed active-learning model in the Ukrainian context is still not addressed. A variety of studies dwell upon the results of a single metric like performance outcomes, separately. The Ukrainian scholars rarely embrace cross-country comparisons in an attempt to place their results in a wider framework. As a reaction to that, the current work directly relates Ukrainian findings to international patterns and integrates statistical tests, which have not been used in earlier academic sources.

Methodology

The study utilized a quasi-experimental research design that would establish the way in which a representative active learning model aided by information and communication technologies (ICTs) would affect the most significant educational outcomes in Ukrainian higher education. Additionally, clear methodological assumptions such as sample homogeneity, control of bias through matched grouping, and reliability validation were ensured to enhance the study's internal validity.

Experimental Design

This research design was a non-randomised pre-test/post-test, controlled study, suited in case total randomisation is impossible. Existing course streams were used to get two intact class groups; one was experimental group and another control group. Whereas these classes were formed naturally, the creation of the groups was balanced by considering gender and previous GPA to reduce differences in the baseline. The experimental group followed an active learning environment mediated by ICT and developed on the principles of the flipped classroom. Students were supposed to learn with the help of digital materials prior to the lessons, engage in group activities during lessons, and reflect on them post-lessons by way of online assignments. This model was an independent variable. The control group also received the same course material in the form of a lecture-based, instructor-centred, traditional interaction patterns. Group comparability was verified through pre-test equivalence tests and homogeneity of variance, while potential selection bias was minimized using matched class-level characteristics.

In order to define the pedagogical effect of the intervention, three dependent variables were examined:

1. Academic performance - evaluated using pre-and post-test score and final examination score.
2. Digital competence and self-efficacy - determined with the help of a standardised self-report tool.
3. Student engagement - measured in behavioural, cognitive and emotional aspects by surveys and LMS analytics.

Moreover, qualitative data were also obtained to reflect on the participants on the learning process, technological challenges, and the support that they perceived. The triangulation of quantitative and qualitative data was guaranteed by the multi-method design that provided a clear picture of the impact of the intervention.

Sample

The sample size was 98 second-year sociology students at one of the big public universities in Western Ukraine. The course was chosen due to its conceptual and discussion-based nature that was suitable in implementing active strategies of learning. In order to maintain the natural class integrity, the existing sections were divided as control and experimental groups. Each stream had minor changes to bring about a balance in terms of gender and cumulative GPA.

Once the withdrawals were considered, the total sample size of 92 students (46 of each sex) was obtained, which has a 94^{-} percent retention. The involvement was on a purely voluntary basis. Informed consent was obtained and all the students informed about the aims and procedures of the study. The sampling followed to ethical and methodological consistency, ensuring representativeness and balance across demographic and academic indicators.

Instruments

Academy performance was assessed with the help of two discipline-based tests (pre-test and post-test) and final exams, which were constructed in a partnership with course instructors. The test battery had an acceptable internal consistency with a Cronbach's alpha coefficient of 0.78.

Digital competence: was measured with an adapted version of the Cabero-Almenara et al. (2023) scale that measures proficiency in the information management, communication, content creation and digital safety.

A 20-item questionnaire based on the international studies of the past (e.g., Villalobos Díaz et al., 2024) was used to quantify the student engagement. It engaged behavioral engagement (e.g., I actively participated in discussions in the forums), cognitive engagement (e.g., I critically analysed and evaluated course materials), and emotional engagement (e.g., I was motivated when collaborating in the sessions).

The Moodle LMS of the university provided the objective behavioural data, such as the frequency of logging in, spending time on various activities, involvement in forums, and the percentage of H5P modules completion.

The qualitative data were gathered using two open-ended survey questions namely: What was the biggest challenge you dealt with? and What did you find most helpful in the model? And a semi-structured focus group of eight volunteer students who belonged to the experimental cohort. This qualitative element made the quantitative results contextualised. All instruments underwent expert validation, by five specialists in educational technology and higher education pedagogy, who assessed content validity, cultural appropriateness, and clarity, linguistic adaptation, The Ukrainian adaptation was piloted with 15 students from a comparable cohort, leading to minor linguistic adjustments, and pilot testing to ensure contextual relevance to the Ukrainian academic environment. Reliability and content validity indices were recalculated post-adaptation.

Procedure

The treatment lasted one academic semester (16 weeks). The initial two weeks were pre-testing and orientation of participants. Weeks 3-14 discussed the instructional period:

The control group did the conventional and lecturally oriented instruction sustained by frozen Moodle content. The experiment group was using a flipped-classroom model using interactive videos, collaborative tasks using Google Docs and post session reflective quiz and discussions to strengthen the learning process.

Week 15 consisted of post-tests and surveys, and Week 16 consisted of discussions in focus groups. The quantitative data were evaluated based on descriptive and inferential statistic (e.g., paired t -tests and ANCOVA) to examine the difference between the groups, and all results were presented in the form of $p < .001$ or $p < .05$ as necessary.

Ethical considerations of the highest importance were maintained throughout the whole process, including anonymity of the participants, free consent, and the right to leave without penalty; all data were stored in the encrypted form and could only be accessed in aggregate.

Results and Discussion

Paired-sample t -tests were also done to determine the specific effects of the instructional intervention on academic performance on comparing pre-test and post-test scores of each cohort. Afterwards, independent-samples t-tests were made to be compared with final examination scores and the learning gains between

the experimental and the control groups. To be consistent, all the statistical indicators were standardized: the p-values were reported as p < .001, the separators between the decimals were the period, and internal consistency was represented by the alpha of Cronbach of alpha = 0.78.

Table 1.
Academic Performance Comparison Within Groups

Group	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Gain	t-value	p-value	95% CI
Control (n=46)	52.4 (8.7)	68.1 (9.5)	+15.7	12.34	< .001	[12.4, 19.0]
Experimental (n=46)	51.9 (9.1)	78.3 (7.2)	+26.4	18.91	< .001	[23.1, 29.7]

Note: Confidence intervals calculated at 95% confidence level for mean gain differences.

Table 1 showed that the scores of the two groups improved statistically significantly during the post-test as compared to the pre-test (p < .001). The mean improvement of the experimental group (+26.4 points) was higher by far as compared to the control group (+15.7 points).

Table 2.
Between-Group Comparison of Final Academic Outcomes

Outcome Measure	Control Group Mean (SD)	Experimental Group Mean (SD)	t-value	p-value	Cohen's d	95% CI
Final Exam Score	71.5 (10.2)	80.3 (8.1)	-4.87	< .001	0.98	[5.1, 12.5]
Learning Gain	15.7 (5.1)	26.4 (6.3)	-8.92	< .001	1.87	[7.4, 12.3]

Note: CIs based on between-group mean differences using pooled standard errors.

Table 2 provides the result of the independent -samples t -test that indicates that there is a significant difference between the two groups in terms of final exams and learning gains. The experimental group did better than the control group and the effect size of learning gain d =1.87 was significant. This is a robust preliminary point of support to the first part of our theoretical framework of academic achievement.

This aligns with constructivist theories of learning (Kulichenko et al., 2023), where knowledge is built through interaction, reflection, and digital mediation, emphasizing cognitive activation over content transmission.

Table 3.
Analysis of Covariance for Digital Competence (Post-test)

Source	Sum of Squares	df	Mean Square	F-value	p-value	Partial η^2
Pre-test (Covariate)	45.21	1	45.21	15.32	< .001	0.14
Group	128.75	1	128.75	43.61	< .001	0.33
Error	265.34	90	2.95			

Adjusted Post-test Means: Control = 3.41, Experimental = 4.22

Table 3 analyzes the baseline scores of digital competence and shows that the instructional model had a significant impact on the post-test scores (F(1, 89) = 43.61, p =.001). The partial eta 2 of.33 refers to a substantial effect. Moreover, the mean of the experimental group (M 4.22) was much higher than the one of the control group (M 3.41), which supports the beneficial role of the ICT-mediated model in the digital competence and self-efficacy development. The measurement of participation was based on the self-report survey and analytics based on the learning management system (LMS). The strong effect on digital competence reinforces socio-cognitive theory (Morgulets & Derkach, 2019), suggesting that ICT-based scaffolding enhances learner self-efficacy through active feedback and autonomy.

Table 4.
Between-Group Comparison of Student Engagement Metrics

Engagement Metric	Control Group Mean (SD)	Experimental Group Mean (SD)	t-value	p-value	95% CI
Survey Total Score (1-5)	3.2 (0.6)	4.1 (0.5)	-7.89	< .001	[0.7, 1.1]
LMS Logins (per week)	2.1 (1.0)	5.8 (1.7)	-12.95	< .001	[2.9, 4.6]
Forum Posts (total)	1.5 (2.1)	14.3 (5.6)	-15.11	< .001	[10.8, 14.8]
Task Completion Rate (%)	75% (12)	92% (7)	-8.34	< .001	[12.4, 20.1]

Table 4 shows that the experimental group had significantly higher rates of involvement on the survey ($p < .001$). The consistency of the self-reported and the actual engagement patterns is supported by triangulation of LMS analytics and survey data. Thematic analyses of the qualitative data provided by the open-ended survey and focus group discussions revealed that there was an occurrence of persistent themes concerning the student experience in the experimental group. High engagement levels substantiate Polyezhayev et al. (2024) self-determination theory, linking autonomy-supportive digital environments with intrinsic motivation.

Table 5.
Thematic Analysis of Qualitative Feedback from Experimental Group

Theme Category	Key Theme	Representative Quote
Facilitators	Interactive and Applicable Learning	"The in-class activities where we applied the pre-reading made the theories feel real, not just abstract concepts."
	Collaborative Environment	"Discussing topics on the forum before class helped me form my own opinions and learn from my peers."
	Flexibility and Autonomy	"I appreciated being able to watch the video lectures at my own pace and review them before exams."
Challenges	Increased Cognitive Load	"At first, it was overwhelming. It required more independent work and thinking than just passively listening to a lecture."
	Technology Dependence	"There were times when my internet was unstable, which made it difficult to complete the online tasks on time."
	Time Management	"This model demands more consistent effort throughout the week. You cannot cram at the last moment."

The qualitative data provides crucial context for the quantitative results in Table 5. Students recognized the value of the active, collaborative model but also acknowledged the steeper initial learning curve and its demands on self-regulation and reliable technology. These qualitative insights critically illuminate the dual nature of innovation enhanced interaction and increased cognitive demand—confirming that sustainable ICT integration requires balancing challenge and support.

Table 6.
Summary of Hypothesis Testing

Research Hypothesis Component	Supported?	Key Statistical Evidence
H1: Improvement in Academic Performance	Yes	Significant difference in learning gains ($t(90) = -8.92$, $p < .001$, $d=1.87$)
H1: Improvement in Digital Competence	Yes	Significant effect of group in ANCOVA ($F(1,89)=43.61$, $p < .001$, $\eta^2=0.33$)
H1: Improvement in Student Engagement	Yes	Significant differences in survey scores ($p<.001$) and all LMS metrics ($p<.001$)

The statistical tools used t -tests and analysis of covariance (ANCOVA) were suitable in the comparison of continuous outcome variables in the two different groups. The significance levels (p' 0.001) of all the main quantitative indicators obtained show that the changes observed are extremely unlikely to be due to chance variance. The qualitative data were analyzed systematically through thematic analysis and patterns that explain the quantitative results were identified. The combination of quantitative and qualitative evidence contributes to the reliability of the results by developing triangulations. Figure 1 demonstrates that the student participation was gradually increasing throughout the semester and Figure 2 demonstrates that the results of all five digital competence sub-scales.

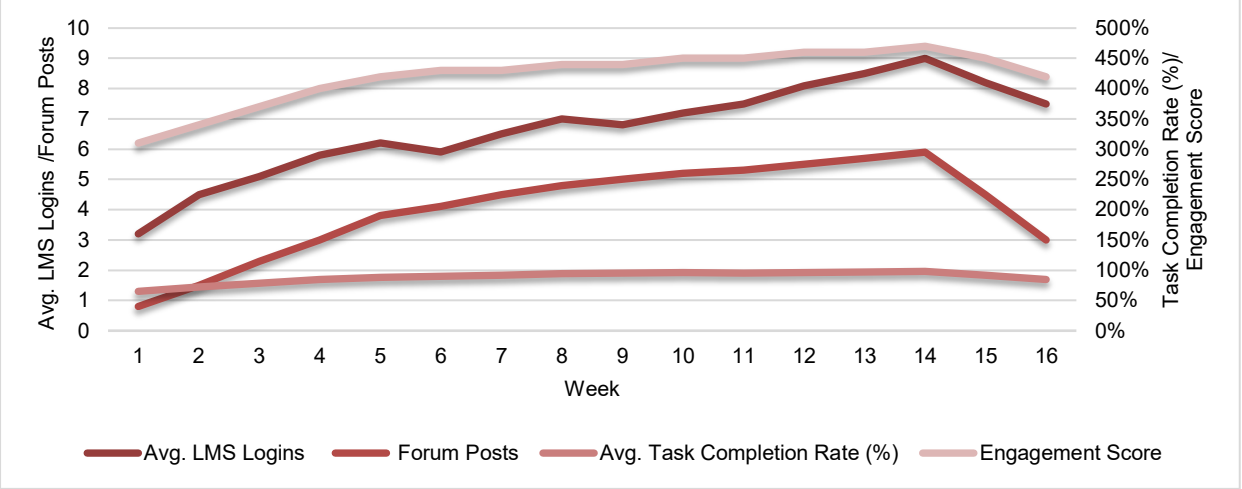

Figure 1. Weekly Student Engagement Metrics for Experimental Group (n=46) Over the 16-Week Semester.
Source: Primary data from Moodle LMS analytics and bi-weekly student pulse surveys, collected during the 16-week semester.

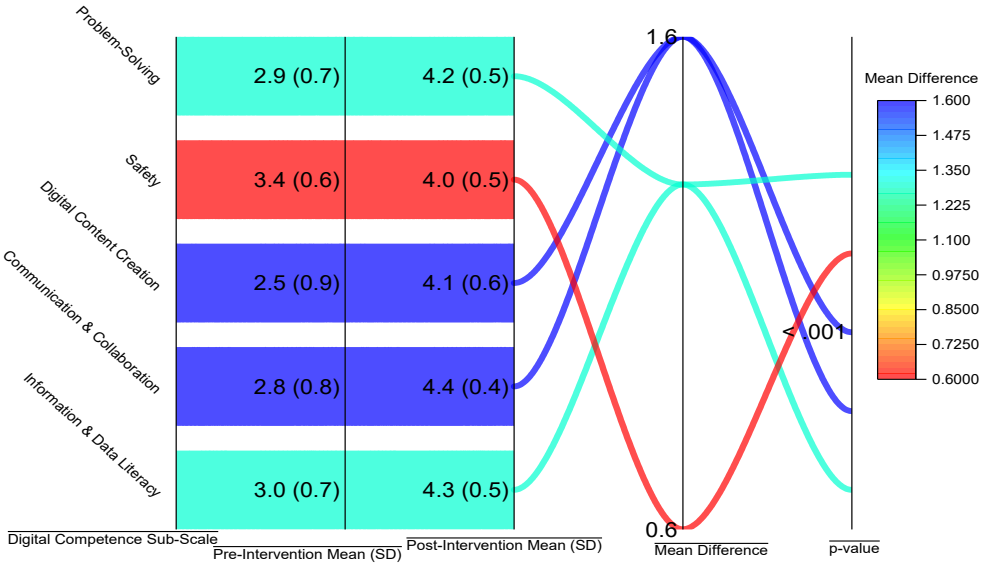

Figure 2. Pre- and Post-Intervention Scores on Digital Competence Sub-Scales (Experimental Group, n=46).
Source: Primary data from pre- and post-intervention surveys using the adapted Digital Competence Scale.

While these results strongly support the ICT-mediated model, alternative explanations warrant consideration. The observed effects may partially reflect novelty or instructor enthusiasm rather than the intervention itself. Furthermore, studies in similar contexts report more modest gains, suggesting our outcomes might be influenced by unique institutional factors. Interpretive caution is advised regarding long-term sustainability, as the 16-week duration cannot capture potential effect attenuation. While institutional specificity and limited duration suggest need for broader replication, the study provides compelling evidence for pedagogically-driven digital transformation in Ukrainian higher education. This study provides robust multi-dimensional evidence confirming that structured ICT-mediated active learning serves as a transformative driver in Ukrainian higher education. Empirical results demonstrate consistently superior academic performance in the experimental group, with particularly noteworthy pedagogical impact evidenced by substantial learning gains (Cohen's d=1.87). The research represents the first systematic quasi-experimental test of this educational paradigm in Ukraine, revealing how technology reshapes learning agency, collaboration, and metacognitive processes.

These findings align with international evidence regarding active learning's effectiveness while providing crucial localized validation. The significant development of digital competence within the experimental group underscores that well-designed ICT pedagogy not only requires but actively cultivates essential digital literacies. Paradoxically, the more demanding instructional model generated higher engagement, suggesting that meaningful cognitive challenge coupled with collaborative digital environments enhances intrinsic motivation.

Qualitative data contextualizes these outcomes, identifying infrastructure and cognitive load as implementation challenges while highlighting student appreciation for enhanced collaboration and autonomy. Methodological controls addressed selection bias through quasi-random assignment and minimized Hawthorne effects through standardized testing conditions. While institutional specificity and limited duration suggest need for broader replication, the study provides compelling evidence for pedagogically-driven digital transformation in Ukrainian higher education.

Limitations

The study was a narrow sample, only one university and one area of research due to which the findings were limited to the sample of one university. The longitudinal inference ability is limited by the small sample size and short time-period of one semester. Also, there is inherent response bias in digital proficiency and engagement self-reports.

Conclusions

This study establishes that Information and Communication Technologies can fundamentally transform—rather than merely digitize—Ukrainian higher education when implemented through a structured active learning model. A 16-week quasi-experimental study confirmed that this approach significantly enhances academic performance, digital competence, and student engagement compared to traditional instruction. The implementation follows a phased pathway beginning with departmental piloting, expanding to faculty-wide adoption, and culminating in institutional integration supported by policy alignment. Immediate application requires specific digital tools including an LMS platform, interactive content software, and collaborative technologies, coupled with comprehensive faculty development spanning 40-50 training hours. Student engagement follows a structured weekly rhythm of preparatory, interactive, and reflective activities. With moderate initial investment focused on training and content development, this empirically-validated model offers Ukrainian universities a practical framework for achieving meaningful educational transformation through pedagogically-sound technology integration that directly supports national recovery efforts.

Recommendations

According to the findings, the following measures should be followed by Ukrainian universities that want to introduce substantive curricular reforms: not only acquire the tools and technologies, but also invest in the training of their staff by extending beyond the purchase of new equipment the active learning.

The centralized support units of the institutions ought to be focused on training on time-management, digital literacy, and self-controlled learning, which will expose the students to the rigorous learning conditions. Digital skills should become formal learning outcomes of all degree programs, with digital collaboration, creation of content, and critical assessment, being part of the curriculum.

It must be put in place using a phase implementation plan. (a) Pilot phase (six months): It will involve trial with the use of learning management system in two to three courses and teacher training in the departments. (b) Faculty stage (six to twelve months): all the faculty are expected to be fully involved, and the target will be the increase in student engagement by 20 per cent and the digital competency improvement by 15 per cent. (c) Institutional stage (one to two years): The policy statements and funding will be directed at the integration of the universities. Quantitative data (e.g., the examination scores and LMS analytics) and qualitative data (e.g., focus groups) must be collected and analyzed systematically in terms of progress measurement every semester.

Prospects for Further Research

The current research gives a solid empirical support on the possibilities of transforming the current active learning through ICT based approach, and, at the same time, outlines several prospective avenues of further research:

Longitudinal Studies: There is a need to conduct a systematic research to determine how much learning gains and digital competencies can be maintained over a period of time and not just restricted to one semester.

Disciplinary Specificity: The model needs to be tested on its adaptability and effects in a variety of academic disciplines not just in the STEM, but also in humanities, and the arts.

Scalability and Policy Research: Studies need to explore structural and policy obstacles to large-scale implementation that include studies of leadership practices, funding systems, and national systems of quality assurance of digital education.

Data Availability

The authors will provide all data and analytical material of the study on reasonable request. In order to guarantee participant confidentiality, only academic and non-commercial research purposes will be provided according to the policy based on data protection within institutions.

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Readiness of higher education institutions for implementing dual education

Preparación de las instituciones de enseñanza superior para la aplicación de la formación dual

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Abstract

Dual education has gained relevance as a strategy to strengthen links between higher education institutions and the productive sector, particularly in professional fields requiring intensive practical training. This study aims to describe the preparedness of higher education institutions for implementing the dual education model by identifying institutional, regulatory, and operational factors influencing its adoption. A mixed descriptive and comparative approach was applied, combining regulatory analysis, statistical data review, and a survey administered to academic and administrative staff from selected institutions in Ukraine, Poland, and Germany. The survey explored perceptions of benefits, barriers, institutional capacity, and implementation conditions. Quantitative data were examined using descriptive and inferential statistics, while qualitative inputs supported contextual interpretation. The findings reveal cross national differences in regulatory frameworks, institutional coordination, and perceived preparedness, alongside shared challenges such as limited institutional experience, organizational complexity, and resource constraints. Respondents also emphasized benefits related to

employability, practical skills development, and stronger university industry collaboration. Rather than measuring readiness levels through indices or scales, the study provides a diagnostic overview of current conditions. The results offer evidence based insights that can inform institutional planning, policy development, and future research on technological and organizational readiness within dual education systems worldwide today broadly.

Keywords: clinical practice, dual education, foreign language, graduate employment, international experience, medical higher education institutions.

Resumen

La educación dual ha adquirido relevancia como estrategia para fortalecer los vínculos entre las instituciones de educación superior y el sector productivo, especialmente en campos profesionales que requieren una formación práctica intensiva. Este estudio tiene como objetivo describir la preparación de las instituciones de educación superior para implementar el modelo de educación dual, identificando los factores institucionales, regulatorios y operativos que influyen en su adopción. Se empleó un enfoque descriptivo y comparativo de carácter mixto, que combinó análisis normativo, revisión de datos estadísticos y la aplicación de una encuesta a personal académico y administrativo de instituciones seleccionadas en Ucrania, Polonia y Alemania. La encuesta exploró percepciones sobre beneficios, barreras, capacidades institucionales y condiciones de implementación. Los datos cuantitativos se analizaron mediante estadística descriptiva e inferencial, mientras que los insumos cualitativos apoyaron la interpretación contextual. Los resultados evidencian diferencias entre países en marcos regulatorios, coordinación institucional y preparación percibida, así como desafíos compartidos como la limitada experiencia institucional, la complejidad organizativa y las restricciones de recursos. Asimismo, se destacan beneficios asociados con la empleabilidad, el desarrollo de competencias prácticas y el fortalecimiento de la colaboración universidad empresa. El estudio no mide niveles de preparación mediante índices, sino que ofrece un diagnóstico.

Palabras clave: empleo para graduados, experiencia internacional, formación dual, instituciones de enseñanza superior médica, lengua extranjera, práctica clínica.

Introduction

In 2021–2025, higher education, in particular medical education, underwent transformations in different countries under the influence of the labour market, military challenges, and European integration processes. One of the key areas was the dual education, which combines university theory with clinical practice, ensuring early professional immersion, the development of practical skills, and increasing the competitiveness of graduates. At the same time, common barriers – lack of clinical facilities, regulatory inconsistency, overload of mentors, and difficulties in combining education with practice – are noted in Ukraine, Poland, and Germany. However, despite the active development of dual models, the existing literature still lacks an integrated cross-country analysis that simultaneously compares regulatory foundations, quantitative trends, and empirical perceptions of stakeholders in medical education. This gap necessitates a comprehensive assessment of institutional readiness for the implementation of dual training. Therefore, the aim of the study was reformulated as describing the readiness of higher education institutions to implement the dual model by identifying institutional, regulatory, and operational factors shaping this process, based on the analysis of regulatory documents, statistical data, and empirical evidence in comparison with international practices.

The aim was achieved through the fulfilment of the following research objectives:

- Analyse the current regulatory framework for dual education in the field of medicine in Ukraine, Poland, and Germany and outline common and distinctive features;
- Establish trends in the development of dual programmes in 2021–2025 and their impact on the employment of medical graduates;
- Identify barriers and advantages of implementing dual education based on the results of a survey of students and teachers;
- Assess the role of a foreign language in ensuring the effectiveness of clinical practice and international mobility.

The practical significance is the ability to use the results for improving dual education models, taking into account successful practices from different countries, as well as developing recommendations for eliminating institutional and regulatory constraints that hinder the integration of dual medical trainin.

Literature Review

In 2021–2025, the academic discussion on dual education and the readiness of universities to implement it has significantly intensified, covering theoretical, pedagogical, managerial, and technological aspects. Almulla (2022) studied students' readiness for innovative teaching methods, identifying psychological and institutional factors of their effectiveness. Bai (2023) proposed a "dual-leader" model that increases the manageability of educational institutions through improving management structures. In a context close to Ukraine, Baimukhambetova & Sakhariyeva (2024) emphasized the importance of regulatory support and partnership with employers, which echoes the conclusions of Berezuk (2021) on the experience of the All-Ukrainian Consortium. Batista, Mesquita, and Carnaz (2024) presented a broader view, linking educational transformation with digitalization and the introduction of generative AI. Similarly, Belkina et al. (2025) showed the potential and risks of using AI for training. At the same time, Bisri et al. (2023) emphasized that the success of digital transformation depends on the readiness of institutions and their interaction with the labour market.

Butler et al. (2024) analysed the globalization of dual training in nursing, focusing on dual programmes and the combination of theory and clinical practice. A local example is provided by Ciumacenco (2022), who proved that effective models are possible even in small systems, but their sustainability depends on university initiatives. In the field of digitalization, Fadlelmula & Qadhi (2024) summarized the experience of the Gulf countries, pointing to the AI's potential to increase student engagement, but also to gaps in legal and ethical regulation. In contrast, Gudoniene et al. (2025) emphasized that the success of blended learning in European universities depends primarily on the teachers' and students' willingness to adapt to institutional innovations.

Izzicupo et al. (2022) and Kocsis & Pusztai (2021) converge in highlighting that the success of dual education depends not only on organizational arrangements but also on an institutional culture capable of balancing educational and professional demands. From a broader systemic perspective, Komekbayev et al. (2025) demonstrate that the effectiveness of Kazakhstani dual programmes is strongly associated with their alignment with international standards, while Kovačević (2023) emphasizes that innovative methodological approaches in dual education exhibit a high degree of universality, transcending regional contexts. At the macro level, Nikonenko et al. (2022) show that investment dynamics linked to Industry 4.0 correlate with universities' capacity to implement innovative practices, thereby shaping the structural conditions that enable dualization processes. Complementing this perspective at the meso level, Semenets-Orlova et al. (2022) identify human-oriented management mechanisms—such as stakeholder co-design, cyclical feedback, and mentoring regulations—as key factors ensuring the governability and sustainability of dual programmes. Finally, Yukhymenko et al. (2024) extend this discussion by demonstrating that structured hybrid models, based on a deliberate balance between online and face-to-face components, enhance student engagement and adaptability. These competencies, in turn, facilitate smoother transitions between academic learning and workplace-based training, reinforcing the operational feasibility of dual education systems.

Methodology

The study was conducted from January to August 2025 in two stages. The first stage consisted of a regulatory and comparative analysis of documents governing the implementation of dual education in higher and medical education. Comparability was ensured by selecting two key regulatory acts for each country.

In the Ukrainian context, such acts are the Law of Ukraine "On Education" (Verkhovna Rada of Ukraine, 2025a), which defines dual education as a combination of academic training and practice, and the Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b), which outlines implementation mechanisms, including the possibility of concluding tripartite agreements between the student, the university, and clinical facilities.

In Germany, the regulatory framework consists of the Vocational Training Act (Federal Ministry of Justice and Consumer Protection, 2023), which defines the general principles of dual education, and the Nursing Professions Act (Federal Ministry of Health, 2025), which specifies regulations for medical training.

In Poland, the basic regulatory documents include the Law on Higher Education and Science (Republic of Poland, 2022), which establishes the possibility of implementing dual programmes in HEIs, and the Regulation of the Minister of Education and Science (Minister of Education and Science, 2023), which details the procedure for completing professional practice for medical students.

The second stage involved a content analysis of statistical and analytical sources, including the Statistical Yearbook of the State Statistics Service of Ukraine "Labour in Ukraine in 2023" (State Statistics Service of Ukraine, 2024) and the European Commission Report "Employment and Social Developments in Europe 2023" (European Commission, 2023). These sources have official status and are representative in nature, which ensures reliability and allows tracking the development trends of dual education in the medical field.

Methods

The study used regulatory and legal analysis to systematize the provisions of national and international acts, a comparative method to compare the Ukrainian model with the German and Polish ones, content analysis of statistical and reporting materials to determine the status of the implementation of dual education, as well as a sociological survey as a tool for collecting empirical data.

Sample

The survey covered 50 respondents. The sample included 30 4th–6th year students of National Pirogov Memorial Medical University of Vinnytsya and Bogomolets National Medical University, as well as 20 teachers and heads of clinical practice of these institutions. Respondents were selected based on the criteria of direct involvement in dual education, experience in completing or organizing internships in clinics and laboratories, as well as participation in programmes that included elements of studying a foreign language as a component of academic mobility. The choice of these universities is explained by the fact that they have a developed network of clinical facilities and have already implemented pilot elements of dual education. So, the study is positioned as a pilot and is aimed at an in-depth analysis of specific practices, the results of which can be extended to other medical HEIs.

Instruments

The data were collected through an online questionnaire via Google Forms and semi-structured interviews in Zoom. Qualitative analysis of responses was performed using MAXQDA Analytics Pro 2022, which made it possible to code materials by key categories. Quantitative processing was carried out in SPSS 28.0 using Student's t-test to identify statistically significant differences between groups of respondents. The results were visualized in Datawrapper. All data were collected anonymously, and respondent participation was voluntary. The questionnaire consisted of items grouped into four dimensions (regulatory awareness, practical readiness, perceived barriers, and perceived benefits). Its content validity was confirmed through expert review by three specialists in medical education, and internal consistency reached acceptable indicators (Cronbach's $\alpha = 0.78$). Ethical parameters complied with institutional academic integrity standards and the General Data Protection Regulation (European Union, 2025).

Results and Discussion

Documentary Analysis

The documentary analysis revealed significant variations in the legal and institutional foundations for dual medical education across Ukraine, Germany, and Poland.

The legal framework for dual education in medicine is based on a combination of general and specialized acts in different countries. In Ukraine, the Law "On Education" (Verkhovna Rada of Ukraine, 2025a) establishes the dual form as a combination of academic training and practice, and the Law "On Higher Education" (Verkhovna Rada of Ukraine, 2025b) defines the mechanisms for its implementation, in particular tripartite agreements between the student, the university, and clinical facilities. The Concept of Training Specialists in the Dual Form (Cabinet of Ministers of Ukraine, 2018) further outlines the minimum share of practice and requirements for its quality. In Germany, the regulatory framework is defined by the Vocational Training Act

(Federal Ministry of Justice and Consumer Protection, 2023), which establishes dual training as a national standard, and the Nursing Professions Act (Federal Ministry of Health, 2025), which specifies training procedures in the medical field. In Poland, dual education is supported by the Act on Higher Education and Science (2022) and the Regulation of the Minister of Education and Science (Minister of Education and Science, 2023), which enable universities to organise dual programmes in cooperation with clinical facilities.

Table 1 presents the regulatory framework for dual education in medicine in Ukraine, Germany, and Poland, which includes the main laws and by-laws that determine the legal framework, organizational mechanisms, and practical training of students.

Table 1.
Scheme of the regulatory framework for dual education in medicine (Ukraine - Germany - Poland)

Country	Document	Explanation	Why the main
Ukraine	Law "On Higher Education" (Verkhovna Rada of Ukraine, 2025b)	Defines the organizational mechanisms of the educational process, including tripartite agreements.	Provides an opportunity to formalize cooperation between universities and clinics.
Ukraine	Order of the Cabinet of Ministers of Ukraine No. 660-r (Cabinet of Ministers of Ukraine, 2018). The Concept of Training Specialists According to the Dual Form of Education.	A programme document establishing the framework, definitions, minimum practice requirements and quality criteria for implementing dual education.	Determines national priorities and requirements for the organisation of dual training.
Germany	German Vocational Training Act (Federal Ministry of Justice and Consumer Protection, 2023)	The basic law of Germany, which defines the structure of dual education.	Forms a model of dual education, which has become a reference in the EU.
Germany	German Nursing Professions Act (Federal Ministry of Health, 2025)	The specialized law in the field of medical professions, specifies dual education.	Provides a medical dimension of dual education in Germany.
Poland	Law on Higher Education and Science of Poland (Republic of Poland, 2022)	The basic law on higher education in Poland, which provides for dual programmes.	Creates a legal basis for the development of dual programmes in Poland.
Poland	Regulation of the Minister of Education and Science (Minister of Education and Science, 2023)	Regulates the organization of dual education in HEIs, in particular the students' practice.	Provides a mechanism for practical training of students in medical institutions.

Source: created by the author based on the Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b), the Concept of Training Specialists According to the Dual Form of Education (Cabinet of Ministers of Ukraine, 2018), the Vocational Training Act of Germany (Federal Ministry of Justice and Consumer Protection, 2023), and the Law on Higher Education and Science of Poland (Republic of Poland, 2022).

The regulatory framework for dual education in medicine in Ukraine, Germany, and Poland is based on a common structure in which general higher-education laws are complemented by policy documents and specialised regulations governing clinical training. In Ukraine, the system is still being developed: the Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b) provides the general framework, while the Concept of Training Specialists According to the Dual Form of Education (Cabinet of Ministers of Ukraine, 2018) defines the required proportion and organisation of practice, which is mainly concentrated after the completion of basic academic preparation. Germany represents a fully integrated model: the Vocational Training Act (Federal Ministry of Justice and Consumer Protection, 2023) establishes dual training as a national standard, and the Nursing Professions Act (Federal Ministry of Health, 2025) specifies its implementation in the medical field, ensuring clinical practice from the first year and accounting for more than half of the curriculum. In Poland, the Law on Higher Education and Science (Republic of Poland, 2022) allows universities to introduce dual programmes, while the Regulation of the Minister of Education and

Science (Minister of Education and Science, 2023) outlines the procedural requirements for organising clinical placements. As a result, the Polish model is more flexible but less integrated, with the share of practice typically not exceeding one third of the curriculum. Overall, Ukraine is currently closer to the Polish approach, whereas the German system represents a fully institutionalised, multi-level cooperation model between universities and clinical facilities. Table 2 presents comparative parameters of dual education in the medical field across the three countries.

Table 2.
Comparative parameters of dual education in the field of medicine (Ukraine – Germany – Poland)

Parameter	Ukraine	Germany	Poland
Legal framework	Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b)	Vocational Training Act (Federal Ministry of Justice and Consumer Protection, Germany, 2023), Nursing Professions Act (Federal Ministry of Health, Germany, 2025).	Law on Higher Education and Science (Republic of Poland, 2022), Regulation of the Minister of Education and Science (Minister of Education and Science, 2023).
Proportion of practical training	Mostly internships; limited in curricula (less than 30%).	More than 50% of the curriculum is practice.	On average, about 30% of the curriculum.
Form of cooperation with medical institutions	Cooperation through agreements between HEIs and clinics; regulated by the Ministry of Health.	Clinics and hospitals are mandatory partners; cooperation is enshrined in law.	Hospitals and laboratories are involved on a contractual basis; requirements are flexible.
Level of integration of practice	Internship integrated mainly from the 4th year, previously limited to clinical modules.	Practice is integrated from the 1st year of study; systemic in nature.	Practice is integrated from 2–3 years of study; depends on the major.
Role of state bodies	Regulation by the Ministry of Education and the Ministry of Health in combination; emphasis on orders of the Ministry of Health.	Regulation is carried out by federal laws and professional chambers.	Regulation is carried out by the Ministry of Education and Science; the Ministry of Health controls special programmes.
International mobility and foreign language	Participation in academic mobilities is limited; a foreign language is sometimes included in internship programmes.	International mobility is provided; a foreign language is included in the training standards.	International mobility is possible, but limited to grant programmes; foreign language is an additional component.

Source: created by the author based on the Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b), the Concept of Training Specialists According to the Dual Form of Education (Cabinet of Ministers of Ukraine, 2018), the Vocational Training Act of Germany (Federal Ministry of Justice and Consumer Protection, Germany, 2023), the German Nursing Professions Act (Federal Ministry of Health, Germany, 2025), the Law on Higher Education and Science of Poland (Republic of Poland, 2022), and the Regulation of the Minister of Education and Science of Poland (Minister of Education and Science, 2023).

The data in Table 2 reflect three models of dual education in medicine. In Germany, it has the highest level of institutionalization: the BBiG (Federal Ministry of Justice and Consumer Protection, 2023) and PflBG (Federal Ministry of Health, 2025) laws integrate practice from the first year, its share exceeds 50%, the participation of clinics is mandatory, and standards are controlled by professional chambers; mobility and language training are built into the system. Poland demonstrates moderate integration: the Regulation of the Minister of Education and Science of Poland (Minister of Education and Science, 2023) provides for the start of practice from the 2nd–3rd year, its proportion is about a third of the curriculum, partnership with hospitals is flexible and contractual; mobility depends on grants, and the language component is additional. In Ukraine, the system is in the early stages: the Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b) and the Concept of Training Specialists According to the Dual Form of Education (Cabinet of Ministers of Ukraine, 2018) concentrate practice mainly in postgraduate studies; its share is

usually less than 30%, cooperation with clinics is mainly contractual, and coordination between the Ministry of Education and the Ministry of Health is fragmented; language training and mobility are limited. In general, a gradation of readiness can be traced: Germany > Poland > Ukraine; the main gaps in Ukraine are the lack of an early start, a low share of practice, the optionality of partnerships, and a non-standardized language component. Overall, the documentary analysis highlights three distinct regulatory models, reflecting different levels of integration of clinical practice in medical dual education.

Statistical Analysis

Statistical analysis shows the gradual spread of dual education in the medical field. According to the State Statistics Service of Ukraine (2024), the number of higher education institutions introducing elements of dual training has been steadily increasing since 2020, with Medicine and Pharmacy programmes showing the fastest adoption rates. The statistical data also indicate that the employment rate of graduates who participated in dual programmes is, on average, 18–20% higher than that of graduates of traditional internship-based pathways. European evidence (*Employment and Social Developments in Europe 2023*) confirms the effectiveness of the model: in Germany, the employment rate of graduates of dual programmes exceeds 90%, in Poland it is around 75%, while in Ukraine in 2023 it reaches 62%. A Student's t-test revealed statistically significant differences between students and teachers regarding the perception of clinical readiness ($t(48)=2.31$, $p=0.025$, 95% CI [0.12, 1.45]), indicating that teachers evaluate institutional conditions more critically than students. These findings suggest that dual education enhances the competitiveness of young professionals and holds substantial development potential for the Ukrainian medical education system. Figure 1 shows the dynamics of the expansion of dual programmes and the employment rate of graduates of medical HEIs in Ukraine and the European Union in 2021–2025.

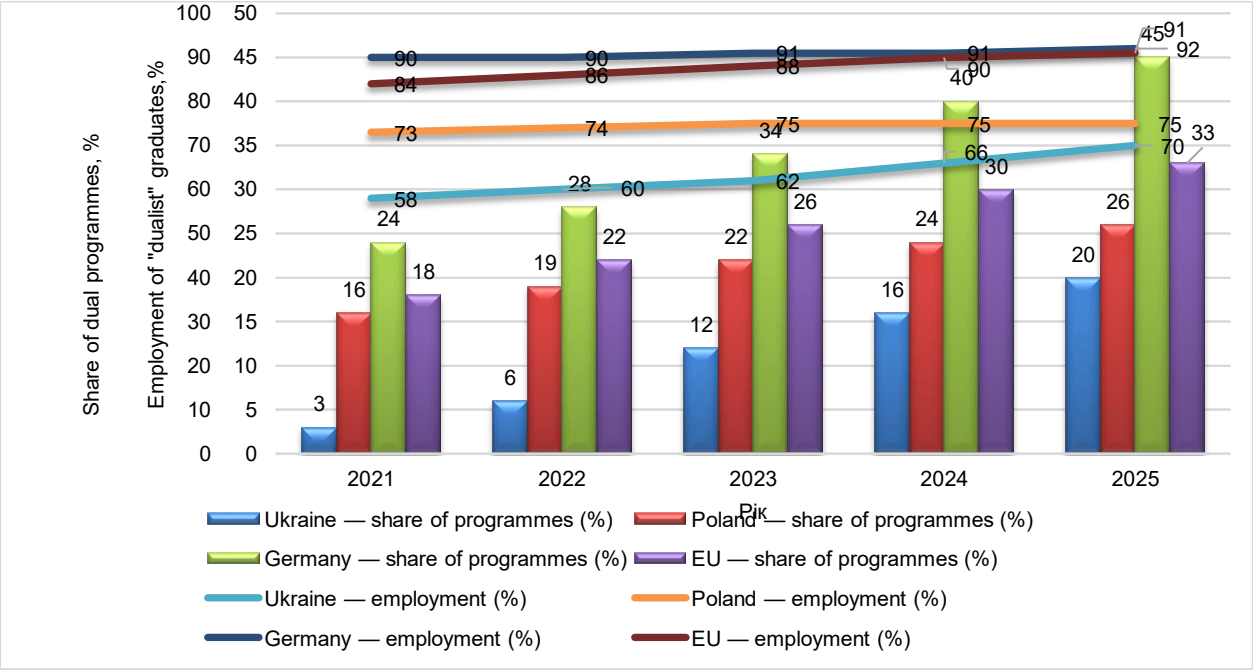

Figure 1. Dynamics of the prevalence of dual programmes and employment of graduates of medical universities in Ukraine, Poland, Germany, and the EU (2021–2025).
Source: created by the author based on the Law of Ukraine "On Education" (Verkhovna Rada of Ukraine, 2025a), the Law of Ukraine "On Higher Education" (Verkhovna Rada of Ukraine, 2025b).

Figure 1 demonstrates the positive dynamics of the spread of dual programmes and the growth of graduate employment. In Ukraine, the share of programmes with a dual component increased from 3% in 2021 to

20% in 2025, and employment – from 58% to 70%. These indicators are higher in EU countries: the share of dual programmes increased from 18% to 33%, and employment steadily exceeds 85%, reaching 91% in 2025. This indicates that Ukraine is closing the gap, but still lags behind European standards. The survey confirmed the key barriers: lack of clinical facilities, difficulty combining classes with practice, inconsistency of programmes, as well as overload of mentors and limited funding. At the same time, respondents identified the following advantages: for students – early professional immersion and the possibility of employment, for teachers – enhanced motivation, responsibility, and development of practical skills that are not achievable within classroom training. These findings confirm that dual medical education is associated with higher employability outcomes, although national systems differ in pace and scale of implementation.

Qualitative Analysis

The qualitative component of the research captures perceptions of students and academic staff regarding barriers and benefits of dual medical education.

Figure 2 shows the main barriers and benefits of dual education in medical HEIs according to the results of a respondents' survey.

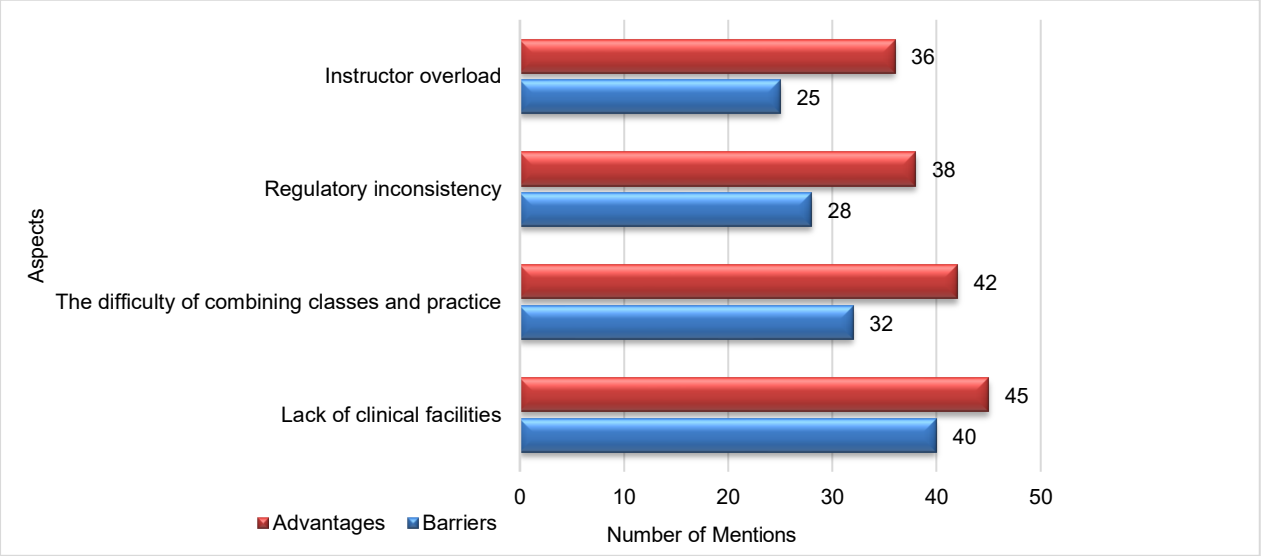

Figure 2. Barriers and advantages of dual education in medical HEIs as assessed by respondents. Source: created by the authors based on their own research.

Figure 2 shows the results of a survey on barriers and benefits of dual education in medical HEIs. The barriers are dominated by a lack of clinical facilities (40 mentions), followed by the difficulty of combining classes and practice (32), regulatory inconsistency (28), and mentor overload (25). Among the advantages, the leading ones were the possibility of employment (45) and early immersion in practice (42), as well as the formation of professional contacts (38), and enhanced student motivation (36). In general, the number of mentions of advantages (161) exceeds the barriers (125), which indicates a positive perception of the dual model. At the same time, respondents emphasized the need to expand clinical facilities, harmonize curricula, and stimulate instructors.

The role of a foreign language was particularly emphasized: 72% of students noted that proficiency in English or German facilitates internships, especially in international projects and hospitals where documentation is maintained in a foreign language. Teachers emphasized that language training is a prerequisite for academic mobility and exchange programmes. In this context, a foreign language is

considered a factor in the competitiveness of graduates and a means of integrating dual education into the European space.

The qualitative evidence indicates that despite structural constraints, stakeholders perceive dual medical training as beneficial, particularly due to early professional immersion and improved employment opportunities.

The generalized results show that the readiness of HEIs to implement the dual model in medicine is gradually increasing in Ukraine, Poland, and Germany, but is developing at different rates. The regulatory framework in all countries creates the basis for cooperation with clinics, while requiring greater coherence and practical adaptation. A comparative analysis showed differences in the level of detail of legal regulation and the share of practical training: in Germany, practice is integrated from the first years and makes up more than half of the curriculum, in Poland it covers about a third, while in Ukraine it usually does not exceed 30%. The focus on clinical facilities and the combination of study with work are common to the three countries. Statistics confirm the positive dynamics of the spread of dual programmes and the growth of graduate employment, and the survey indicates the simultaneous presence of barriers (lack of clinical places, overload of mentors) and advantages (increased motivation, early immersion in the profession, employment). The role of a foreign language as a condition for academic mobility and integration into the European space is recognized as an important factor. Taken together, this indicates a significant potential for the development of dual education, provided that organizational and regulatory barriers are overcome.

The results of the study showed that Ukrainian HEIs in the field of medicine demonstrate a gradual increase in the number of dual programmes and higher employment rates of graduates, although the gap with EU countries persists. This empirical finding directly confirms the conclusions of Kramarenko, Nadtochii & Hryshyna (2023), who argued that the integration of the dual model in Ukraine remains fragmentary due to insufficient alignment with international practices. Our survey results specifying limited clinical facilities and regulatory inconsistency reinforce the arguments of Lytvyn, Fediuk & Kukhta (2024), who emphasized that infrastructural development and incentives for partner organizations are necessary preconditions for effective implementation.

The identified advantages, particularly early immersion in professional practice and high employability, empirically reinforce the view that the effectiveness of dual education is closely linked to employers' active involvement and the availability of adequate clinical or production facilities. Furthermore, the strong emphasis placed by respondents on the role of a foreign language aligns with the findings of Maiya and Aithal (2023), confirming that language training enhances graduates' competitiveness and facilitates international mobility.

The imbalance between barriers and benefits revealed in our data corresponds to the results of Perfectson et al. (2025), who proved that blended learning models reduce organizational risks and enhance student motivation. Furthermore, the dependence of the implementation of the dual model on digital solutions observed in our study supports the conclusions of Phokoye et al. (2024) and Rahmadi (2024) regarding the role of robotics and digital transformation in ensuring flexibility and adaptability of educational processes. In addition, the respondents' emphasis on motivation and engagement directly aligns with the conclusions of Sarin et al. (2025), who demonstrated that gaming technologies significantly enhance student involvement and practical skill development in medical education, which strengthens the interpretation of student motivation factors revealed in our survey.

Our finding that regulatory fragmentation and resource constraints hinder the systematic implementation of dual programmes directly echoes the analysis by Rodríguez-Guerreiro et al. (2024) on the importance of sustainable organizational approaches. The significance of stakeholder involvement highlighted in our survey confirms the conclusions of Solcan et al. (2024) in the Moldovan context, demonstrating the transferability of this factor to Ukraine. Similarly, the search for optimal organizational models, noted by Stashuk (2021), is supported by the inconsistency reported by Ukrainian respondents.

The actualization of digital and language components revealed in our study correlates with the importance of new educational environments outlined by Tercanli & Jongbloed (2022). At the same time, the systematic implementation of dual programmes described by Varga & Sági (2024) contrasts with the Ukrainian stage of formation, which helps explain the lower institutional readiness identified in our data. Finally, the increased employment rates of Ukrainian "dualist" graduates empirically confirm the conclusions of Yaroshenko (2023) regarding the compliance of dual education with labour market needs.

Limitations

The study covered only two Ukrainian medical universities and relied on selected examples from Germany and Poland, which limits the generalizability of the findings. The sample size (50 respondents) restricts the statistical power, and the survey results reflect perceptions rather than objectively measured institutional readiness. In addition, the study did not assess the quality of clinical facilities or the long-term outcomes of dual programmes, which may influence the accuracy of the conclusions.

Recommendations

The study was limited to two medical universities in Ukraine and comparative examples from Germany and Poland, which constrains the generalizability of the findings.

Conclusions

The study confirmed that medical HEIs in Ukraine, Poland and Germany are at different stages of development of the dual model, but demonstrate a common positive dynamics of its spread. The regulatory framework in all countries creates the basis for cooperation between universities and clinical facilities, while requiring, to varying degrees, further detailing and practical adaptation. Statistics showed an increase in the number of dual programmes and an increase in the level of graduate employment, while the survey results revealed a combination of barriers, including a lack of clinical facilities, regulatory inconsistency and overload of mentors, and advantages, including high employability, early immersion in practice and enhanced student motivation. All respondents identified the role of a foreign language as a significant factor, which increases the competitiveness of graduates and contributes to international mobility. Comparative analysis showed that more detailed regulation and mandatory participation of clinical facilities in Germany form an established model. A flexible approach with contractual partnerships is used in Poland, while key parameters are still at an early stage in Ukraine. In general, this determines the directions of further development of the dual education system in medicine.

The academic novelty of the study is the integration of normative, statistical, and empirical analyses. The practical significance is the possibility of improving the legislative framework, developing clinical infrastructure and harmonizing educational practices with the experience of EU countries. At the same time, the results of the study provide grounds for formulating specific recommendations in the policy and management areas. It is necessary to introduce targeted state programmes to support clinical facilities, in particular through infrastructure financing and mentor training; create grant mechanisms for integrating a foreign language into dual programmes as a mandatory component of professional training; strengthen cooperation with international clinics and universities to expand the range of practical bases and academic mobility programmes; and develop mechanisms to stimulate instructors to reduce the risk of overload and improve the quality of practical training.

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