# Eduweb

Revista de Tecnología de Información y Comunicación en Educación

Online ISSN: 2665-0223
Print ISSN: 1856-7576

Volumen 18, No. 1.
Enero-marzo 2024

Universidad de Carabobo
Facultad de Ciencias de la Educación


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**Depósito legal**: pp200702CA2520
**ISSN**: 1856-7576

**Código Revencyt:** RVE022
Registrada en el Catálogo Latindex con el número de folio 19424

**Dirección de la Revista:** Apartado de Correo 3812, Oficina de correos Trigal Sur, Valencia, Edo. Carabobo. Venezuela.
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La revista Eduweb es una publicación trimestral editada por la Universidad de Carabobo. Es una publicación de ámbito nacional e internacional indizada en el índice de Revistas Venezolanas de Ciencia y Tecnología REVENCYT, en el Catálogo LATINDEX, Actualidad Iberoamericana, Dialnet, Red Iberoamericana de Innovación y Conocimiento Científico REDIB, y en Emerging Sources Citation Index.



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Esta edición se produce bajo el auspicio del Consejo de Desarrollo Científico y Humanístico y la Dirección de Postgrado de la Facultad de Ciencias de la Educación de la Universidad de Carabobo.


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# Contenido

# 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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DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.0

Cómo citar:
Medina, E. (2024). Editorial. Revista Eduweb, 18(1), 7-8. https://doi.org/10.46502/issn.1856-7576/2024.18.01.0

# EDITORIAL

La Revista Eduweb afirma su compromiso de contribuir con la divulgación del conocimiento en el área de educación y tecnología. Iniciamos este año 2024 con gran entusiasmo para seguir recibiendo los diferentes trabajos de investigación en un contexto mundial pleno de desafíos académicos y tecnológicos. Atravesar distintos retos implica cultivar el conocimiento necesario para ofrecer y proponer alternativas que coadyuven el presente y el futuro de nuestra sociedad contemporánea. Y, esto es posible gracias a los aportes presentados en cada hallazgo tras el proceso investigativo. En este sentido, exhortamos a la comunidad nacional e internacional para que sigan profundizando e investigando el abanico de problemas que de la educación y la tecnología se derivan.

El trabajo de dibujar en palabras cómo enfrentamos los conflictos del presente serán vistos como transferencia de información y acumulación de conocimiento sistematizados por la comunicación de la ciencia. Sigamos adelante con la divulgación y publicación, esa es nuestra labor. Dicho por otros: "se trata de la conquista de la investigación".

Consecutivamente, les hacemos saber los trabajos que forman parte de este número. El primer artículo expone "Desarrollo de ecuaciones sustitutivas utilizando herramientas computacionales y su aplicación en la enseñanza del diseño de pavimentos" centrado en describir el procedimiento seguido para el desarrollo de las ecuaciones que sustituyen el nomograma. Seguido de "Procrastinación en universitarios colombianos – un estudio a través de la Escala de Procrastinación Irracional" Entendida la procrastinación como el conjunto de comportamientos que involucran la postergación deliberada de la ejecución de una acción planificada, muestra además como los dispositivos electrónicos y la red de internet contribuyen a este ya referido comportamiento. También ha sido estudiado el tema "Redes del conocimiento basadas en tecnologías de información y comunicación en los procesos de vinculación universitaria", esta indagación asumió un enfoque cuantitativo a través del cual destacaron el impacto de las TIC. Ha sido también abordado el trabajo titulado "Fortalecimiento de competencias matemáticas en niños entre 10 y 13 años usando secuencias didácticas mediadas por las TIC" que concluye en el diseño e implementación de secuencias didácticas mediadas por TIC fortaleciendo las competencias matemáticas. Podremos leer también, "El impacto del entorno de aprendizaje virtual en la competencia profesional de los futuros docentes en el aprendizaje permanente" Una conclusión relevante de esta propuesta es que sus resultados se pueden utilizar para ajustar el proceso educativo virtual de formación profesional de futuros docentes en el sistema de las IES de Ucrania. En la misma temática se expone: "Peculiaridades del uso de tecnologías innovadoras en la enseñanza del inglés en instituciones de educación superior", a través de la indagación muestran las ventajas del uso de tecnologías innovadoras en la enseñanza del inglés en instituciones de educación superior. Un grupo de investigadores se centran en "Enfoques de la educación superior en Ucrania: tendencias y perspectivas" en lo que concluyen que la innovación, planificación estratégica y apoyo específico son esenciales para una implementación exitosa. En este significativo recorrido disponen de otro trabajo titulado "La importancia de las tecnologías digitales para fomentar el desarrollo de la competencia comunicativa entre los futuros médicos", el mismo tuvo como objetivo determinar el papel de las tecnologías en la formación de la competencia comunicativa de los futuros médicos, en el que su objetivo fue alcanzado a través de la observación y el análisis. Como trabajo de cierre encontraremos "La eficacia

del método de proyectos para la formación de profesores de filología" esta investigación plantea perspectivas para investigaciones venideras en las que pueden comparar el uso del método de proyectos con otras prácticas pedagógicas. Apreciados lectores, esperamos realicen su recorrido cognitivo y encuentren su verdadero significado para la educación y así puedan establecer puentes con la información para su propia generación de conocimientos. Hasta el próximo número. Gracias por su amable lectura.

**Elsy Medina**
Universidad de Carabobo, Venezuela.

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DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.1

Cómo citar:
García Aladín, M.F., Pérez Ruíz, D.D., Serrano Guzmán, M.F., & Noguera Calvache, C.E. (2024). Desarrollo de ecuaciones sustitutivas utilizando herramientas computacionales y su aplicación en la enseñanza del diseño de pavimentos. *Revista Eduweb*, 18(1), 9-23. https://doi.org/10.46502/issn.1856-7576/2024.18.01.1

# Desarrollo de ecuaciones sustitutivas utilizando herramientas computacionales y su aplicación en la enseñanza del diseño de pavimentos

## Development of substitute equations using computational tools and its application in the teaching of pavement design

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Recibido: 31/05/23
Aceptado: 12/12/23

**Resumen**

Este trabajo se centra en el desarrollo de las ecuaciones sustitutivas para corregir el módulo efectivo de reacción de la subrasante, keff, basado en la erosión potencial del material de subbase, LS y su inclusión en una herramienta computacional que permita su uso en la enseñanza del diseño de pavimentos rígidos. Hasta el momento, el ajuste del módulo de reacción, keff, por pérdida potencial de soporte, se hace mediante el procesamiento del nomograma provisto por la guía AASHTO, 1993. Este estudio describe el procedimiento seguido para el desarrollo de las ecuaciones que sustituyen el nomograma, de tal manera que estas puedan ser introducidas en el procedimiento de cálculo y se facilite su sistematización y análisis de diferentes escenarios para el pavimento, sin necesidad de consultar el nomograma. Para ello se incluye la utilización de AutoCAD para digitalizar el nomograma presentado por AASHTO, 1993. Los valores numéricos obtenidos son utilizados para ajustar las ecuaciones sustitutivas, con la ayuda de Microsoft Excel. Se incluye también, un ejemplo en el cual se evalúan escenarios como estrategia didáctica para simular diferentes condiciones de diseño de pavimentos rígidos. Como base, se recurre a los datos de módulo de elasticidad del material que conforma la subbase, ESB y del módulo resiliente, MR, de la subrasante, que se obtienen en el laboratorio.

**Palabras clave:** Enseñanza, diseño, ingeniería civil, aplicación software educativo, pavimento rígido.

**Abstract**

This work focuses on the development of substitute equations to correct the effective reaction modulus of the subgrade, keff, based on the potential erosion of the subbase material, LS, and its inclusion in a

computational tool that allows its use in teaching of rigid pavement design. Until now, the adjustment of the reaction modulus, keff, due to the potential loss of support, is done by processing the nomogram provided by the AASHTO guide, 1993. This study describes the procedure followed to develop the equations that substitute the nomogram, so that these can be introduced in the calculation procedure and facilitate their systematization and analysis of different scenarios for pavement design, without the need to consult the nomogram. This includes the use of AutoCAD to digitize the nomogram presented by AASHTO, 1993. The numerical values obtained are used to fit the substitute equations, with the help of Microsoft Excel. An example is also included in which scenarios are evaluated as a didactic strategy to simulate different design conditions of rigid pavements. An example is also included in which scenarios are evaluated as a didactic strategy to simulate different design conditions of rigid pavements. As a basis, data on the modulus of elasticity of the material that makes up the subbase, ESB, and the resilient modulus, MR, of the subgrade, which are obtained in the laboratory, are used.

**Keywords:** Teaching, design, civil engineering, educational software application, rigid pavement.

## 1. Introducción

Una infraestructura vial deficiente afecta de manera adversa la competitividad de las regiones que deben vencer problemáticas asociadas con pobreza, inequidad, educación, salud, entre otros (Jacob, 2017). Esta realidad está en consonancia con las metas globales de la declaración del milenio (Serrano Guzmán et al., 2019), que han generado un incremento de la construcción de vivienda, la cual debe ir acompañada por el desarrollo de infraestructura de saneamiento básico, hospitales, puentes y vías (Khan et al., 2020); (Shen et al., 2021). El concreto, en lo particular, es uno de los materiales más utilizado en el desarrollo de obras civiles (Galán et al., 2019); (Wang et al., 2021), especialmente en la construcción de infraestructura vial, donde los pavimentos rígidos ofrecen una alternativa para proveer una capa de rodadura (Zhang et al., 2018); (Xu et al., 2021) que genere condiciones de circulación confortables, disminuyendo el ruido, mejorando la seguridad y reduciendo el daño de los vehículos (Xu et al., 2021); (Yu et al., 2019); (Zhang et al., 2021). Adicionalmente, el mantenimiento de este tipo de pavimentos es menos frecuente que el mantenimiento que requieren los pavimentos flexibles (Khan & Ali, 2018); (Gong et al., 2021).

El pavimento rígido, generalmente consiste en una losa de concreto construida sobre una base granular que podría ser estabilizada con cemento o asfalto y, ocasionalmente, una capa de subbase. Para garantizar la integridad y buen estado del pavimento se debe diseñar considerando las características físico-mecánicas de las diferentes capas realizando el control de calidad de los materiales seleccionados (Chen et al., 2021); (Li et al., 2021); (Yu et al., 2020), (Xu et al., 2022). En este estudio se utiliza el método de diseño para pavimentos rígidos propuesto por American Association of State Highway and Transportation Officials en 1993 (AASHTO, 1993) y se modifica el procedimiento para el ajuste del módulo de reacción efectivo de la subrasante, Keff, el cual se afecta por la pérdida potencial de soporte, LS, para obtener el k de diseño (AASHTO, 1986). Como alternativa al uso de los nomogramas se ofrecen una serie de ecuaciones sustitutivas que se han desarrollado con el apoyo de AutoCAD y MS Excel. El objetivo del este artículo es mostrar que con estas herramientas computacionales disponibles para variedad de usuarios pueden definirse ecuaciones sustitutivas aplicables para simulaciones en el diseño de pavimentos rígidos. Un procedimiento similar puede realizarse para otro tipo de diseños en ingeniería.

## 2. Marco teórico

Métodos de diseño de pavimentos

La práctica actual de diseño de pavimentos se basa en el uso de métodos que pueden ser: empíricos y aquellos fundamentados en criterios racionales, comúnmente llamados empírico-mecanicistas (Pradena et al., 2009). El método empírico, cuyo procedimiento de diseño más aceptado es el establecido por AASHTO

93, (Griffiths & Thom, 2007; Thom, 2014), ha sido cuestionado por cuanto sus ecuaciones fueron desarrolladas con base a estructuras de pavimento y subrasantes utilizadas en las pruebas de pista construidas por AASHTO, lo que limita su uso a las condiciones para las cuales el modelo fue desarrollado y calibrado (Pradena et al., 2009). En cuanto al método empírico-mecanicista racional, este se basa en el cálculo de la respuesta estructural (i.e. esfuerzo, deformación y deflexión) en función de las propiedades físico-mecánicas de los materiales, las condiciones climáticas y las condiciones de carga proyectadas (Hall et al., 2006; FDOT, 2018; AASHTO, 2008), (Rodríguez Calderón & Pallares Muñoz, 2005). Los resultados obtenidos con este método dependen grandemente de la caracterización adecuada de los materiales y condiciones de soporte. Como resultado, hay una dependencia de la calidad de la exploración geotécnica y programas de muestreo. Aunque el método empírico-mecanicista es más sofisticado y permite incluir un mayor número de variables en el diseño de pavimentos, su uso no se ha generalizado y en la actualidad, la gran mayoría de diseños de pavimentos en Colombia y Latinoamérica se hace utilizando la metodología de diseño propuesta por la American Association of Stage Highway and Transportation Officials en su versión de 1993 (AASHTO, 1993).

Variables de diseño de AASHTO

El objetivo del diseño estructural de pavimentos rígidos es determinar el número de capas, su composición y espesor requerido para responder adecuadamente a un régimen de carga derivado del tránsito. El método de diseño propuesto por AASHTO 93 (AASHTO, 1993) considera como variables: el desempeño deseado del pavimento, tránsito vehicular proyectado, las características de la subrasante, los materiales de construcción, las condiciones climáticas, las condiciones de drenaje, la confiabilidad, los costos y el diseño de las bermas. Con esta base, el método incluye el cálculo de: número de ejes equivalentes simples, W18 (Ecuación 1), la serviciabilidad inicial y final (Po, Pt, respectivamente), la confiabilidad (desviación normal, ZR y error normal, So), las propiedades mecánicas de la losa de concreto (espesor D, módulo de ruptura, S'c y módulo de elasticidad, Ec), el coeficiente de drenaje (Cd), la eficiencia en la transmisión de las cargas (coeficiente de transferencia de cargas, J) y el módulo de reacción de la subrasante (k) (AASHTO, 1986). Así mismo, en el proceso de diseño de estructuras de pavimento resulta necesario considerar distintos escenarios, de tal manera que sea posible seleccionar la estructura más apropiada.

$$Log_{10}(W_{18}) = Z_R * S_o + 7.35 * Log_{10}(D+1) - 0.06 + \frac{log_{10}\left[\frac{\Delta PSI}{4.5-1.5}\right]}{1+\frac{1.624*10^7}{(D+1)^{8.46}}} + (4.22 - 0.32P_t) * log_{10}\frac{S_c'*C_d(D^{0.75}-1.132)}{215.63*J*\left[D^{0.75}-\frac{18.42}{(E_C/k)^{0.25}}\right]} \quad (1)$$

Por su parte, el módulo de reacción, k, es usado para determinar el grado de soporte que la base, subbase y subrasante ofrecen a la losa de concreto. Sin embargo, la erosión y el asentamiento diferencial o desplazamiento vertical de la estructura de apoyo, generan una pérdida potencial de soporte que debe ser reflejada en el módulo de reacción efectivo, keff. De acuerdo con la guía AASHTO 93, el cálculo del k se realiza a partir de una serie de nomogramas y tablas que hacen difícil la sistematización del proceso de cálculo. Por otro lado, la pérdida se soporte, LS, se utiliza para ajustar el valor de k, en función de la erosión potencial del material de soporte. Para este propósito, la guía AASHTO 93 (AASHTO, 1993) incluye un nomograma en el que se correlaciona el módulo de reacción efectivo de la subrasante, k y la pérdida de soporte, LS, permitiendo el cálculo del módulo de reacción, k, ajustado con base en la pérdida potencial de soporte esperada. En su lugar, se propone el desarrollo de ecuaciones sustitutivas que simplifiquen el cálculo del módulo de reacción, k, y su sistematización para estimar el módulo compuesto de reacción de la subrasante (k∞), el ajuste del módulo de reacción por presencia de una capa rígida (krf), el factor de daño relativo para cada periodo (Uri) y el módulo de reacción efectivo (keff).

Aplicaciones de AutoCAD y Microsoft Excel en ingeniería.

Las herramientas computacionales disponibles para el ejercicio de la ingeniería favorecen los procesos de diseño y están disponibles como software de apoyo que facilita la labor del calculista. AutoCAD y Microsoft Excel hacen parte del software de uso general, particularmente en ingeniería civil. Sin embargo, ambas herramientas son empleadas en varios entornos.

AutoCAD, es una herramienta de dibujo y modelación digital (Borges Alfonso, 2021) de fácil uso con reducidas exigencias de hardware (Gómez et al., 2012). Cabe resaltar que el concepto y uso del diseño computacional data de los años 60, surgiendo como una herramienta que potencializa la creatividad de los usuarios (Borges Alfonso, 2021) y dentro de la gran variedad de aplicaciones puede mencionarse la elaboración de planos arquitectónicos (Valdes Alonso et al., 2023), la preparación de modelos digitales de elevación (Castillo García et al., 2021), aunque también se ha utilizado en investigaciones relacionadas con la diagramación de áreas con formación de eflorescencias en mortero preparado con emulsiones asfálticas (Cañola et al., 2021) y en la enseñanza de la matemática y la geometría (Gómez et al., 2012).

En cuanto a Microsoft Excel, es una aplicación que posibilita trabajar con una cantidad significativa de datos numéricos y alfanuméricos haciendo uso de columnas y filas para conformar una hoja de cálculo que permite la presentación de resultados en formato de tabla (Almenar Llongo & Hernández Sancho, 2009). La versatilidad de esta herramienta permite su uso en diferentes entornos, como por ejemplo, para la determinación del tiempo de residencia de reactores continuos (Peña Abreu & Palanco, 2006), en la enseñanza de matemáticas (Amador-Montaño & Deulofeu-Piquet, 2021), para el procesamiento estadístico en diferentes disciplinas (López Fernández et al., 2009), para la estimación de variables químicas (Barrozo et al., 2020) y energéticas (Enriquez Garcia et al., 2022).

## 3. Metodología

Para facilitar la sistematización de la guía para el diseño estructuras de pavimento AASHTO (1993) (AASHTO, 1993) se propone el desarrollo de las ecuaciones sustitutivas que reemplazan el nomograma que el método incluye para definir el módulo de reacción, k, ajustado con base en la pérdida potencial de soporte, LS.

Uso de AutoCAD

AutoCAD se empleó para digitalizar el nomograma mostrado en la Figura 1, donde se presenta la reducción del módulo de reacción efectivo de la subbase, k, en función de la pérdida de soporte, LS (LS = 0, 1, 2 y 3). De esta manera, se registraron los puntos coordenados que conforman cada una de las rectas LS.

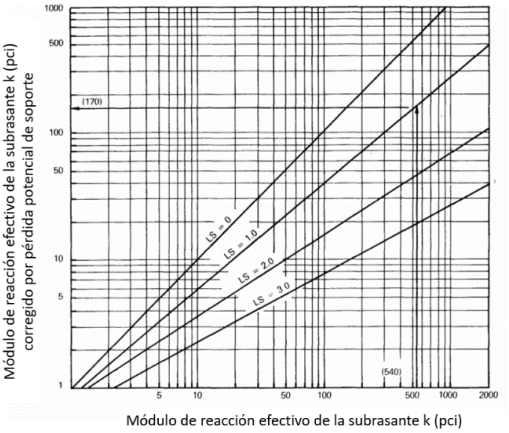


***Figura 1.*** Corrección del módulo de reacción efectivo de la subrasante por el potencial de pérdida de soporte. Fuente: (AASHTO, 1993)

Uso de MS Excel

Los valores digitalizados en AutoCAD fueron exportados como valores separados por comas (archivos CVS) y llevados a Microsoft Excel, donde fueron reorganizados en columnas de datos para cada uno de los valores de LS, como se muestra en la Tabla 1. Posteriormente se hizo el ajuste de las líneas de tendencia correspondiente a cada línea representando la pérdida de soporte LS, como se muestra en la Figura 2.

**Tabla 1.**
*Valores representativos de k efectivo y su corrección por LS.*

| Pérdida de soporte (LS)=1 | | | |
|---|---|---|---|
| keff (pci) | Log [keff (pci)] | keff ajustado (pci) | Log [keff ajustado (pci)] |
| 5 | 0.7 | 3.395 | 0.531 |
| 10 | 1.0 | 5.82 | 0.765 |
| 100 | 2.0 | 39.93 | 1.601 |
| 500 | 2.7 | 162.26 | 2.210 |
| 1000 | 3.0 | 274.425 | 2.438 |
| 2000 | 3.3 | 500 | 2.699 |
| Pérdida de soporte (LS)=2 | | | |
| keff (pci) | Log [keff (pci)] | keff ajustado (pci) | Log [keff ajustado (pci)] |
| 5 | 0.7 | 2.35 | 0.37 |
| 10 | 1.0 | 3.63 | 0.56 |
| 100 | 2.0 | 16.65 | 1.22 |
| 500 | 2.7 | 44.90 | 1.65 |
| 1000 | 3.0 | 68.68 | 1.84 |
| 2000 | 3.3 | 114.89 | 2.06 |
| Pérdida de soporte (LS)=3 | | | |
| keff (pci) | Log [keff (pci)] | keff ajustado (pci) | Log [keff ajustado (pci)] |
| 5 | 0.7 | 1.625 | 0.21 |
| 10 | 1.0 | 2.3065 | 0.36 |
| 100 | 2.0 | 7.772 | 0.89 |
| 500 | 2.7 | 19.115 | 1.28 |
| 1000 | 3.0 | 27.736 | 1.44 |
| 2000 | 3.3 | 39.95 | 1.60 |

Las ecuaciones resultantes del análisis de regresión permiten calcular directamente el valor del módulo de reacción efectivo ajustado, k, en función del valor del módulo de reacción efectivo inicial. El valor del coeficiente de determinación, R2, para los tres modelos (i.e., LS=1, LS=2 y LS=3), refleja la poca discrepancia observada entre los valores estimados y los valores obtenidos del nomograma.

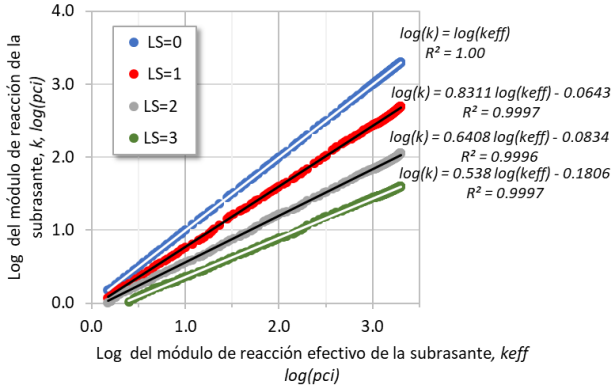


***Figura 2.*** Comportamiento de valores del módulo k efectivo ajustados con LS=0, LS=1, LS=2 y LS=3

## 4. Resultados y discusión

Las ecuaciones sustitutivas obtenidas en este trabajo (Ecuaciones 1 a 4), permiten calcular el módulo de reacción de la subrasante, k (i.e. k ajustado), para cada valor de pérdida de soporte LS igual a 0, 1, 2 o 3, según corresponda. Keff es el valor del módulo de reacción efectivo de la subrasante considerando las características de la losa de concreto (i.e. espesor de la losa, D y Módulo de elasticidad del concreto, Ec), serviciabilidad final, Pt y la influencia de la subbase y profundidad del estrato rígido.

$$\text{LS} = 0,\ k = k_{eff} \quad (1)$$
$$\text{LS} = 1,\ k = 10^{(0.8311 * \log(k_{eff}) - 0.0643)} \quad (2)$$
$$\text{LS} = 2,\ k = 10^{(0.6408 * \log(k_{eff})) - 0.0834)} \quad (3)$$
$$\text{LS} = 3,\ k = 10^{(0.538 * \log(k_{eff})) - 0.1806)} \quad (4)$$

Procedimiento para el cálculo de k

El módulo de reacción de la subrasante, k, se calcula siguiendo el procedimiento descrito en la Guía AASHTO 93 (AASHTO, 1993). El valor de k está relacionado con las condiciones climáticas de la zona del proyecto y depende del módulo resiliente, MR, el tipo de subbase, su espesor DSB y su módulo de elasticidad, ESB. Se requiere, además, identificar si existe un estrato muy rígido (lecho rocoso) a menos de 3 m del nivel de la subrasante y calcular del factor de pérdida de soporte, LS. Este último, está determinado por la erosión de la subbase, los asentamientos diferenciales o el movimiento vertical de la estructura.

Con relación al Módulo de elasticidad del material de subbase, ESB, resulta fundamental considerar el efecto de las condiciones climáticas propias de la región, definiendo los periodos lluviosos y secos que se presentan en el año con el fin de evaluar los cambios generados por los factores climáticos en el módulo resiliente, MR y el módulo de elasticidad de la subbase, ESB. El cálculo de k se hace siguiendo tres pasos:

Paso 1: se obtiene el módulo compuesto de reacción de la subrasante, k∞, el cual representa el sistema de fundación y subbase. Cuando no se emplee subbase, es decir DSB = 0, la relación entre el módulo resiliente, MR y el módulo de reacción de la subrasante, k, se determina con base en la Ecuación 5.

$$k\infty = \frac{M_R}{19.4} \quad (5)$$

Por lo contrario, cuando se emplea subbase, el valor de k∞ se calcula con base en las Ecuaciones 6 y 7.

$$ln(k\infty) = (-2.807 + 0.1253 * [ln(D_{SB})]^2 + 1.062 * ln(M_R) + 0.1282 * ln(D_{SB}) * ln(E_{SB}) - 0.4114 * ln(E_{SB}) - 0.0581 * ln(E_{SB}) - 0.1317 * ln(D_{SB}) * ln(M_R)) \quad (6)$$

$$k\infty = e^{(\ln(k\infty))} \quad (7)$$

Donde:

$k\infty$: Módulo compuesto de reacción de la subrasante con una fundación semi infinita (máximo 1500 psi /in.).

DSB: Espesor de la subbase (pulgadas).
ESB: Módulo de elasticidad de la subbase (psi).
MR: Módulo resiliente de la subrasante (psi).

Paso 2: En caso de existir lecho rocoso a una profundidad menor a 10 pies (3 m) del nivel de subrasante, se debe realizar el ajuste del módulo de reacción para el diseño del pavimento. Para ello se emplean los datos de MR, el módulo de reacción compuesto, k∞ y la profundidad del estrato rígido que subyace a la subrasante, DSG, según se describe en la Ecuación 8.

$$ln(k_{rf}) = (5.303 + 0.0710 * ln(D_{SG}) * ln(M_R) + 1.366 * ln(k_\infty) - 0.9187 * ln(D_{SG}) - 0.6837 * ln(M_R)) \quad (8)$$

Donde:

krf: Módulo compuesto de reacción de la subrasante considerando una capa rígida cerca de la superficie (psi / pulg).

k∞: Módulo compuesto de reacción de la subrasante considerando una fundación semi infinita (psi / pulg).
DSG: Profundidad desde la superficie a la capa rígida (pulgadas).

Paso 3: para cada periodo, es decir para cada una de las quincenas o meses del año, se estima el factor de daño relativo, $u_r$, que se puede calcular mediante la Ecuación 9.

$$U_{ri} = \left[ D^{0.75} - \frac{18.42}{\left(\frac{E_c}{k_i}\right)^{0.25}} \right]^{(4.22-0.32P_t)} \quad (9)$$

Donde:

D: Espesor de la losa (pulgadas).
Ec: Módulo de elasticidad del concreto (psi).
Pt: Índice de servicio final del pavimento.

El módulo efectivo de reacción, keff, se obtiene con el factor de daño promedio de todos los n periodos ($\overline{u_r} = (\sum_1^n U_{ri})/n$) y se calcula con la Ecuación 10:

$$k_{eff} = \frac{E_c}{\left[ \frac{18.42}{D^{0.75-(\overline{u_r})^{\left(\frac{1}{4.22-0.32P_t}\right)}}} \right]^4} \quad (10)$$

Paso 4: se debe realizar el ajuste o corrección por pérdida potencial de soporte de la subbase que busca reducir el módulo efectivo de reacción, k, bien sea por la erosión o por asentamientos diferenciales de la losa. En la se aprecia que la pérdida de soporte (LS) está directamente relacionada con el tipo de material de la subbase y es inversamente proporcional al módulo de elasticidad.

**Tabla 2.**
*Pérdida de soporte según el tipo material y módulo de elasticidad*

| Tipo de material de subbase | Módulo, E (ksi) | | Pérdida de soporte, LS | |
|---|---|---|---|---|
| | Mín. | Máx. | Mín. | Máx. |
| Base granular tratada con cemento | 1000 | 2000 | 0.0 | 1.0 |
| Mezcla de grava cemento | 500 | 1000 | 0.0 | 1.0 |
| Base tratada con asfalto | 350 | 1000 | 0.0 | 1.0 |
| Mezclas estabilizadas con asfalto | 40 | 300 | 0.0 | 1.0 |
| Estabilización con cal | 20 | 70 | 1.0 | 3.0 |
| Materiales granulares no tratados | 15 | 45 | 1.0 | 3.0 |
| Suelo fino o subrasante natural | 3 | 40 | 2.0 | 3.0 |

Fuente: AASHTO Guide for Design of Pavement Structures (1986) (AASHTO, 1986)

Ejemplo de aplicación

Al utilizar la metodología AASHTO se debe tener en cuenta que, para un tránsito determinado (i.e. espectro de carga), tanto W18 como k varían en función del espesor de la losa, D. Considerando lo anterior, los datos generales son los siguientes:

Confiabilidad 80%, Zr = -0.842.

Desviación estándar para pavimento nuevo, So = 0.35.
Serviciabilidad inicial, Po=4.5 y final, Pt=2.5.
Características del concreto, S'c = 600 psi, Ec = 5000000 psi.
Coeficiente de drenaje, Cd = 0.975.

Condiciones de juntas y apoyo lateral: sin pasadores y con apoyo lateral: J = 3.4.

Subbase granular: en condición de humedad óptima CBR = 79%, MR = 35000 psi (ensayo triaxial). Este valor cambia a lo largo del año debido al componente medioambiental.

Subrasante: en condición de humedad óptima CBR = 20%, MR = 17000 psi (ensayo triaxial). Este valor cambia a lo largo del año debido al componente medioambiental.

Escenario 1 (base)

Objetivo: Estimar el espesor de la losa de concreto (D), el módulo efectivo de reacción Keff y el factor de daño relativo promedio Ur en un pavimento.

Recursos: Excel programado con la metodología AASHTO para la estimación de D, Keff y Ur y alimentado previamente con el espectro de carga y factor ambiental de la subrasante y la subbase, laboratorio de Geotecnia para desarrollo de ensayo triaxial o CBR según sea el caso.

Descripción de información requerida: Los módulos de subrasante y subbase provienen del ensayo triaxial: MR = 17000 psi y ESB = 35000 psi. Estos valores cambian mes a mes debido al factor climatológico (Tabla 3). Para este escenario se tiene espesor de la subbase DSB = 5.91 pulgadas (150 mm), la profundidad de la fundación rígida DSG = 196.85 pulgadas (5.0 m).

**Tabla 3.**
*Resultados de k∞, krf y daño relativo*

| Mes | Famb (SR*) | MR=17000 (psi) MRi* | Famb (SBG**) | ESB=35000 (psi) ESB i** | K∞ (pci) | Krf (pci) | Uri |
|---|---|---|---|---|---|---|---|
| Enero | 1.372 | 23324 | 1.438 | 50330 | 1121.0 | 1121.0 | 119.90 |
| Febrero | 1.319 | 22423 | 1.409 | 49315 | 1081.0 | 1081.0 | 121.98 |
| Marzo | 1.207 | 20519 | 1.346 | 47110 | 997.0 | 997.0 | 126.61 |
| Abril | 0.780 | 13260 | 0.994 | 34790 | 660.0 | 660.0 | 150.62 |
| Mayo | 0.666 | 11322 | 0.807 | 28245 | 559.0 | 559.0 | 160.38 |
| Junio | 0.579 | 9843 | 0.577 | 20195 | 470.0 | 470.0 | 170.59 |
| Julio | 0.578 | 9826 | 0.574 | 20090 | 469.0 | 469.0 | 170.72 |
| Agosto | 0.580 | 9860 | 0.579 | 20265 | 471.0 | 471.0 | 170.47 |
| Septiembre | 0.591 | 10047 | 0.616 | 21560 | 483.0 | 483.0 | 168.99 |
| Octubre | 0.666 | 11322 | 0.807 | 28245 | 559.0 | 559.0 | 160.38 |
| Noviembre | 0.666 | 11322 | 0.807 | 28245 | 559.0 | 559.0 | 160.38 |
| Diciembre | 1.087 | 18479 | 1.271 | 44485 | 905.0 | 905.0 | 132.20 |

* Factor ambiental subrasante (MR i = MRxFambi), **Factor ambiental subbase granular (ESBixESB *Fambi).

Desarrollo del escenario 1: La Ecuación 1 se resuelve utilizando la función Solver de Excel y entrega los siguientes resultados:

D = 11.65 pulgadas (296 mm ≈ 30 cm)

W18 = 17 747 326 ejes equivalentes
los cálculos de k∞, krf, Ur se realizan con las ecuaciones 6 a 9. Puede verse que debido a que DSG es mayor 10 pies (3.0 m) k∞ = krf

Se calcula Ur promedio = 151.11

Se calcula Keff = 655 pci (Ecuación 10).
LS = 1.67 (Interpolación en Tabla 2 para materiales granulares con ESB = 35000 psi)

Para reflexionar: Debe notarse que el valor del módulo de elasticidad es inversamente proporcional al valor de pérdida de soporte. Dado que LS = 1.67, los valores de pérdida de soporte fluctúan entre máximos y mínimos por lo cual k = 98 pci que se obtiene por interpolación lineal utilizando las ecuaciones 3 y 4 así:

Para LS = 1: $k = 10^{(0.8311*\log(k_{eff})-0.0643)}$ = 189 pci
Para LS = 2: $k = 10^{(0.6408*\log(k_{eff}))-0.0834)}$ = 53 pci

Escenarios 2 y 3

Objetivo: En estos escenarios se evalúa la influencia de la profundidad del estrato rocoso en el espesor del pavimento D.

Recursos: Excel y datos previos obtenidos en el escenario 1 (base).

Descripción de información requerida para el escenario 2: Para este propósito, se considera la profundidad de la fundación rígida DSG = 59.06 pulgadas (1.50 m). Esta información puede ser modificada por el docente responsable del desarrollo de la actividad.

Descripción de información requerida para el escenario 3: Se parte de una profundidad muy superficial del estrato rígido. Para propósito de este escenario se tomará como profundidad del estrato rígido, DSG = 19.69 pulgadas (0.50 m). Esta información puede ser modificada por el docente responsable del desarrollo de la actividad.

Desarrollo de escenarios: El cálculo de k∞, krf, Ur se realiza con las ecuaciones 6 a 9 (Tabla 4) y Keff con la Ecuación 10.

**Tabla 4.**
*Resultados de k∞, krf y daño relativo*

| | | | Influencia de la profundidad del estrato rígido (DSG) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Sub-rasante | Sub-base | Escenario 2 DSG = 1.50 m DSB = 0.15 m | | | Escenario 3 DSG = 0.50 m DSB = 0.15 m | | |
| Mes | Mr (psi) | Esb (psi) | K∞ (pci) | Krf (pci) | Uri | K∞ (pci) | Krf (pci) | Uri |
| Ene. | 23324 | 50330 | 1121.0 | 1319.0 | 108.72 | 1121.0 | 1651.0 | 93.60 |
| Feb. | 22423 | 49315 | 1081.0 | 1274.0 | 110.65 | 1081.0 | 1600.0 | 95.25 |
| Mar. | 20519 | 47110 | 997.0 | 1182.0 | 114.84 | 997.0 | 1494.0 | 98.90 |
| Abr. | 13260 | 34790 | 660.0 | 799.0 | 137.12 | 660.0 | 1045.0 | 118.40 |
| May. | 11322 | 28245 | 559.0 | 678.0 | 146.60 | 559.0 | 898.0 | 126.86 |
| Jun. | 9843 | 20195 | 470.0 | 565.0 | 157.19 | 470.0 | 757.0 | 136.50 |
| Jul. | 9826 | 20090 | 469.0 | 564.0 | 157.30 | 469.0 | 755.0 | 136.65 |
| Ago. | 9860 | 20265 | 471.0 | 566.0 | 157.09 | 471.0 | 758.0 | 136.42 |
| Sep. | 10047 | 21560 | 483.0 | 582.0 | 155.47 | 483.0 | 778.0 | 134.95 |
| Oct. | 11322 | 28245 | 559.0 | 678.0 | 146.60 | 559.0 | 898.0 | 126.86 |
| Nov. | 11322 | 28245 | 559.0 | 678.0 | 146.60 | 559.0 | 898.0 | 126.86 |
| Dic. | 18479 | 44485 | 905.0 | 1079.0 | 119.96 | 905.0 | 1376.0 | 103.32 |

Para reflexionar: Usando el complemento solver que ofrece Microsoft Excel se obtienen los siguientes resultados que se comparan con el escenario 1 (base):

Escenario 1
D = 11.65 (296 mm ≈ 30 cm)
W18 = 18 358 223 ejes equivalentes
Ur promedio = 151.11
Keff = 655 pci
k = 98 pci

Escenario 2
D = 11.60 (295 mm ≈ 30 cm)
W18 = 18 386 366 ejes equivalentes
Ur promedio = 138.18
Keff = 784 pci
k = 112 pci

Escenario 3
D = 11.52 (293 mm ≈ 30 cm)
W18 = 18 300 166 ejes equivalentes
Ur promedio = 119.55
Keff = 1024 pci
k = 137 pci

En los escenarios 1, 2 y 3 se evidencia que cuando la subrasante tiene alto MR el estrato rígido influye relativamente poco en el resultado del espesor de diseño de la losa D, de allí que en proyectos con este tipo de suelos se acostumbra a calcular estos datos considerando DSG = 59.06 pulgadas (1.50 m), pero en general este valor debe provenir del perfil estratigráfico.

Escenarios 4 y 5

Objetivo: Evaluar la influencia del espesor de la subbase granular y del tipo de subbase en el espesor final de la losa de concreto D considerando DSG = 59.06 pulgadas (1.50 m).

Recursos: Excel y datos previos obtenidos en el escenario 1 (base).

Descripción de información requerida para el escenario 4: Para este escenario se considera espesor de la subbase DSB = 11.81 pulgadas (300 mm). El valor de DSB puede ser modificado por el docente.

Descripción de información requerida para el escenario 5: El docente provee información relacionada con la subbase tratada con asfalto. A manera de ejemplo se considera una subbase tratada con asfalto ESB = 500000 psi con lo cual LS = 0.77 (Tabla 2). El espesor de la subbase DSB = 5.91 pulgadas (150 mm).

Desarrollo de escenarios: El cálculo de k∞, krf, Ur (Tabla 5) se realiza con las ecuaciones 6 a 9 y Keff se calcula con la Ecuación 10.

**Tabla 5.**
*Resultados de k∞, krf y daño relativo*

| | | | Influencia del espesor y tipo de subbase | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sub-rasante | Sub-base | Escenario 4<br>DSG = 1.50 m<br>DSB = 0.30 m granular | | | Sub-base | Escenario 5<br>DSG = 1.50 m<br>DSB = 0.15 m estabilizada | | |
| Mes | Mr (psi) | Esb (psi) | K∞ (pci) | Krf (pci) | Uri | Esb (psi) | K∞ (pci) | Krf (pci) | Uri |
| Ene. | 23324 | 50330 | 1273.0 | 1569.0 | 97.18 | 500000 | 1655.0 | 2245.0 | 53.79 |
| Feb. | 22423 | 49315 | 1230.0 | 1520.0 | 98.88 | | 1601.0 | 2179.0 | 54.95 |
| Mar. | 20519 | 47110 | 1139.0 | 1417.0 | 102.66 | | 1488.0 | 2042.0 | 57.48 |
| Abr. | 13260 | 34790 | 763.0 | 974.0 | 123.37 | | 1036.0 | 1479.0 | 70.62 |
| May. | 11322 | 28245 | 644.0 | 822.0 | 132.95 | | 909.0 | 1317.0 | 75.54 |
| Jun. | 9843 | 20195 | 533.0 | 671.0 | 144.52 | | 810.0 | 1188.0 | 79.99 |
| Jul. | 9826 | 20090 | 531.0 | 668.0 | 144.78 | | 809.0 | 1187.0 | 80.03 |
| Ago. | 9860 | 20265 | 534.0 | 672.0 | 144.43 | | 811.0 | 1190.0 | 79.92 |
| Sep. | 10047 | 21560 | 550.0 | 695.0 | 142.51 | | 824.0 | 1207.0 | 79.30 |
| Oct. | 11322 | 28245 | 644.0 | 822.0 | 132.95 | | 909.0 | 1317.0 | 75.54 |
| Nov. | 11322 | 28245 | 644.0 | 822.0 | 132.95 | | 909.0 | 1317.0 | 75.54 |
| Dic. | 18479 | 44485 | 1039.0 | 1303.0 | 107.23 | | 1364.0 | 1889.0 | 60.58 |

Para reflexionar: Usando el complemento solver que ofrece Microsoft Excel se obtienen los siguientes resultados que se comparan con el escenario 1 (base):

| Escenario 1 | Escenario 4 | Escenario 5 |
|---|---|---|
| D = 11.65 (296 mm ≈ 30 cm) | D = 11.55 (293 mm ≈ 30 cm) | D = 10.63 (270 mm ≈ 27 cm) |
| W18 = 18 358 223 ejes equivalentes | W18 = 18 311 410 ejes equivalentes | W18 = 17 804 074 ejes equivalentes |
| Ur promedio = 151.11 | Ur promedio = 125.37 | Ur promedio = 70.27 |
| Keff = 655 pci | Keff = 940 pci | Keff = 1491 pci |
| k = 98 pci | k = 129 pci | k = 631 pci |

En el escenario 4 se observa que el espesor de la subbase granular influye poco en el espesor del pavimento, esto se debe a la buena calidad de la subrasante en este caso. Así mismo, en el escenario 5 se puede ver una reducción de 3.0 cm en el espesor de la losa respecto al escenario 1. En ambos escenarios el espesor de la subbase es de 15 cm, lo cual sugiere que estabilizar esa capa podría ser económicamente conveniente para el proyecto. Este ejercicio permite resaltar la flexibilidad que la sistematización del proceso de diseño ofrece para el análisis de diferentes escenarios.

En los diseños de ingeniería suelen emplearse herramientas computacionales de alto costo (Enriquez Garcia et a., 2022). Sin embargo, herramientas como AutoCAD y Microsoft Excel están al alcance de la comunidad en general.

AutoCAD es una herramienta computacional de uso múltiple (Gómez et al., 2012) de innumerables ventajas en el diseño paramétrico en arquitectura (García Rodríguez et al., 2021) (Borges Alfonso, 2021), es accesible para los usuarios a un costo razonable y que puede considerarse una innovación para la enseñanza (Gómez et al., 2012). Tiene varias aplicaciones y permite hacer seguimiento a procesos constructivos de variedad de obras de infraestructura (Valdes Alonso et al., 2023) así como también la preparación de modelos digitales de elevación (Castillo García et al., 2021).

En cuanto a Microsoft Excel está al alcance estudiantes y profesionales (Barrozo et al., 2020) y del público en general que adquieran Office. La versatilidad y facilidad de uso de este software permite el desarrollo de cálculos con cierta complejidad matemática (Peña Abreu & Palanco, 2006) (Amador-Montaño & Deulofeu-Piquet, 2021), realizar análisis estadístico (López Fernández et al., 2009), aplicar matemáticas financieras (Almenar Llongo & Hernández Sancho, 2009), además que tiene amplia capacidad gráfica y permite el uso de Visual Basic para la automatización de procesos (Almenar Llongo & Hernández Sancho, 2009).

Mediante el proceso de dibujo en la herramienta AutoCAD y la digitación de puntos coordenados de diferentes valores del módulo de reacción efectivo keff en Microsoft Excel fue posible encontrar expresiones matemáticas confiables para estimar el valor del módulo de reacción efectivo k de diseño, para finalmente emplear esta información en el cálculo del espesor de la losa de pavimentación. Así mismo, se plantean escenarios para familiarizar al estudiante con el uso de estas ecuaciones sustitutivas para el diseño de pavimentos rígidos.

Ejercicios similares se pueden adelantar para transformar los nomogramas para el diseño de mezclas de concreto o de mortero en ecuaciones que permitan establecer variables claves en los cálculos de los materiales que intervienen en la dosificación de este tipo de mezclas.

## 5. Conclusiones

En la metodología AASHTO para diseño de pavimentos rígidos es necesario calcular el módulo de reacción (k) en función del espesor de la losa (D), tal como se evidencia en las ecuaciones propuestas en este estudio, por lo cual resulta conveniente tener ecuaciones que sustituyan el uso de nomogramas que permitan sistematizar el cálculo y faciliten de esta forma el análisis de distintos escenarios de diseño.

El uso de AutoCAD, como una herramienta de digitalización, permitió adquirir datos de los nomogramas. Por su parte, MS Excel, permitió organizar la información, crear gráficos y ajustar líneas de tendencia a los datos. De esta forma es posible seleccionar el modelo que mejor se ajuste a los datos obtenidos del nomograma original.

## 6. Financiación

Este trabajo es derivado de la investigación adelantada sobre Estrategias pedagógicas para la enseñanza en ingeniería civil realizada en el Semillero Gestión de Obras y Grupo de Investigación DeCoR en la Pontificia Universidad Javeriana Cali.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.2

Cómo citar:
Rosero Bolaños, A.D., Chapid Muñoz, Q.S., Acosta Pasaje, A.E., & Portilla Ortiz, D. (2024). Procrastinación en universitarios colombianos – un estudio a través de la Escala de Procrastinación Irracional (IPS). *Revista Eduweb*, 18(1), 24-35. https://doi.org/10.46502/issn.1856-7576/2024.18.01.2

# Procrastinación en universitarios colombianos – un estudio a través de la Escala de Procrastinación Irracional (IPS)

## Procrastination in Colombian university students - a study using the Irrational Procrastination Scale (IPS)

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Recibido: 01/12/23
Aceptado: 29/02/24

**Resumen**

La procrastinación se entiende como el conjunto de comportamientos que involucran la postergación deliberada de la ejecución de una acción planificada, incluso cuando esto pueda generar dificultades tanto en el presente como en el futuro, impactando en múltiples facetas de la vida del individuo. En cuanto a los objetivos y el método del presente estudio, este contó con dos fases, para la primera orientada a la validación del instrumento "Escala de Procrastinación Irracional" (IPS) en población colombiana, seguido de una fase de carácter descriptivo y la generación de una baremación de los puntajes de la escala para facilitar la interpretación de los datos para futuras investigaciones. El instrumento IPS mostró adecuadas propiedades psicométricas: AFC: CMIN/gl2=2.1; CFI=0.94; TLI=0.92; RMR=0.05; RSMEA= 0.08; GFI= 0.82 Confiabilidad: α=0.86, por lo que se considera un instrumento válido para su aplicación en universitarios colombianos. Se identificó además que un 31.3%, mostró niveles moderados y un 38% niveles altos de procrastinación, por otra parte, se observa que las actividades relacionadas con el uso de aparatos electrónicos y de servicios de internet, así como también las de ocio y descanso se asocian con la presencia de procrastinación, por último, se describen los baremos para los puntajes obtenidos.

**Palabras clave:** Descriptivo, instrumento psicométrico, procrastinación, universitarios.

**Abstract**

Procrastination is understood as the set of behaviors that involve the deliberate postponement of the execution of a planned action. This behavior can generate difficulties both in the present and in the future, impacting multiple facets of an individual's life. The first phase of this study was focused on the validation of the 'Irrational Procrastination Scale' (IPS) in the Colombian population. This was followed by a descriptive phase and the generation of a scale score to facilitate data interpretation for future research. The IPS instrument exhibited satisfactory psychometric properties, with the values: AFC: CMIN/gl2=2.1; IFC=0.94; TLI=0.92; RMR=0.05; RSMEA= 0.08; GFI = 0.82 and a Cronbach's alpha (α)=0.86, making it a valid tool for use among Colombian university students. It was also observed that 31.3% of the participants showed moderate levels of procrastination, while 38% exhibited high levels of procrastination. Furthermore, activities related to the use of electronic devices and internet services, as well as leisure and rest, were found to be associated with the presence of procrastination. Finally, the scales for the scores obtained are described.

**Keywords:** Descriptive, psychometric instrument, procrastination, university students.

## 1. Introducción

La procrastinación se define como el conjunto de conductas que conllevan a retrasar voluntariamente el curso de una acción prevista a pesar de que esto genere dificultades inmediatas o a futuro, afectando así diversas esferas de la vida de la persona (Steel, 2007; Rozental & Carlbring, 2014). Este fenómeno que parece ser cada vez más frecuente, gannado especial interés actual por parte de disciplinas como la psicología y la economía conductual debido a los efectos negativos que puede tener en la vida de una persona y su entorno, como también, en la afectación que la procrastinación puede generar a nivel grupal y comunitario.

En cuanto a la prevalencia de la procrastinación, diversos estudios establecen que este fenómeno está presente en al menos el 20% de la población adulta, siendo la procrastinación crónica un elemento común entre los países de habla inglesa como por ejemplo Australia, Reino Unido y Estados Unidos (Ferrari, Díaz-Morales, O'Callaghan, Díaz, Argumedo, 2007; Hu, Ye & Zang, 2022), para el caso de Latinoamérica, se ha identificado que la incidencia de la procrastinación en adultos se presenta en alrededor del 15% de la población, evidenciándose un aumento en la incidencia con el paso de los años (Rodríguez et al., 2016), sin embargo, el panorama para la población juvenil parece ser más complejo, puesto que diversos estudios evidencian que los jóvenes tienden a procrastinar con mayor frecuencia que otros grupos etarios, alcanzando cifras de hasta el 70% de procrastinación crónica en diferentes muestras evaluadas (Garzón y Gil, 2017; Rodríguez et al., 2016; Casasola, 2022).

De acuerdo a lo anterior, es importante señalar que históricamente se han realizado diferentes avances en relación a la creación y validación de instrumentos para medir la procrastinación, destacándose el Cuestionario de Procrastinación Decisional (DPQ) (Mann, 1982), compuesto por 30 ítems; la Escala General de Procrastinación (GPS) (Lay, 1986), formado por 20 ítems; la Escala de Evaluación de la Procrastinación para Estudiantes (PASS) (Solomon & Rothblum, 1984), por mencionar algunos. Estos avances fueron un primer paso para poner las escalas de procrastinación a disposición de investigadores y profesionales de países de habla inglesa, sin embargo, los resultados de Steel (2010) sugieren que estos instrumentos no son los más adecuados debido a su estructura multifactorial, sosteniendo que una sola variable latente es suficiente para explicar la naturaleza de la procrastinación y que las medidas de autoinforme como las mencionadas que intentan diferenciar entre tipos de procrastinación no están justificadas de forma teórica o estadística (Svartdal et al., 2016).

En este escenario, la escala Irational Procrastination Scale (IPS) o en español, Escala de Procrastinación Irracional, es un test breve basado en un modelo teórico de único factor que ha mostrado adecuadas propiedades psicométricas en adaptaciones al finlandés, alemán, indonesio, italiano, noruego, polaco y sueco (Prayitano, Siaputra & Lasmono, 2013; Svartdal, 2017; Rozental et al., 2014). Para el caso de Latinoamérica y España, el instrumento mostró la misma robustez para medir este constructo, sin embargo, diversos países, entre ellos Colombia, no han realizado adaptaciones lingüísticas exitosas de este test, limitando la posibilidad de investigar y recolectar información a gran escala sobre el fenómeno de la procrastinación.

Con base en lo expuesto, el presente estudio desarrolló dos objetivos que fueron; la adaptación lingüística del instrumento psicométrico Irational Procastination Scale (IPS) para su aplicación en población colombiana y el desarrollo de un análisis descriptivo en una muestra de estudiantes universitarios del mismo país.

## 2. Revisión de literatura

La procrastinación se ha relacionado con un menor rendimiento académico y laboral. Según un estudio realizado por Steel (2007), la procrastinación es perjudicial para el rendimiento académico, especialmente cuando las tareas son importantes y el tiempo es limitado, afectando, además, la calidad del trabajo realizado, lo que puede tener consecuencias negativas en las funciones que desempeña una persona en el entorno académico. En el caso particular de los estudiantes universitarios, posponer o no cumplir responsablemente con la entrega de diferentes actividades, puede desencadenar una serie de consecuencias negativas y poner en riesgo la permanencia o conclusión de su formación profesional (Casasola, 2022).

Por otra parte, se ha identificado que además de los efectos en la productividad, la procrastinación también puede generar afectaciones en la salud mental y física de una persona, estudios indican que la presencia de la procrastinación se correlaciona con niveles altos de estrés y ansiedad, por ejemplo, un estudio realizado por Sirois & Pychyl (2013), concluyó que en la medida en la que la procrastinación se hace presente en más espacios de tiempo, los individuos tendieron a presentar mayor frecuencia e intensidad de signos y síntomas asociados de ansiedad, sumado a lo anterior, otros estudios indican que la procrastinación también se ha relacionado con un mayor riesgo de problemas de salud mental como la depresión y las adicciones tecnológicas (Cui, et al., 2021; Geng et al., 2021; Romash, 2020).

A pesar del aumento del reconocimiento e importancia que ha adquirido la procrastinación, hasta el momento no se ha logrado aclarar su naturaleza exacta y las interacciones y causalidad con otras variables relacionadas con la salud mental, razón por la cual, su medición y evaluación también es motivo de debate e interés (Steel, 2010). De acuerdo a lo anterior, Ferrari (1992) propuso inicialmente un modelo con el fin de diferenciar algunas características de la procrastinación, estableciendo una estructura compuesta por la procrastinación decisional (retrasos en la toma de decisiones), evitativa (retrasos relacionados con el miedo al fracaso o al éxito) y excitación (retrasos motivados por una experiencia emocionante), sin embargo, la evidencia actual no respalda este modelo tripartito, especialmente con respecto a la evitación y la excitación, sino que indica una nueva conceptualización de la procrastinación que postula que esta responde a hechos netamente irracionales (Padrós Blázquez & Elena-Guzmán, 2022), por esta razón, es prudente considerar que la procrastinación es un constructo de carácter unidimensional.

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procrastinación decisional (retrasos en la toma de decisiones), evitativa (retrasos relacionados con el miedo al fracaso o al éxito) y excitación (retrasos motivados por una experiencia emocionante), sin embargo, la evidencia actual no respalda este modelo tripartito, especialmente con respecto a la evitación y la excitación, sino que indica una nueva conceptualización de la procrastinación que postula que esta responde a hechos netamente irracionales (Padrós Blázquez & Elena-Guzmán, 2022), por esta razón, es prudente considerar que la procrastinación en desde esta perspectiva es un constructo de carácter unidimensional.

## 3. Metodología

### Participantes

En relación al proceso de identificación de las propiedades psicométricas del instrumento IPS, se contó con una muestra de tipo incidental, conformada por 112 estudiantes de pregrado de una universidad de la ciudad de San Juan de Pasto (Colombia), entre los 17 y 29 años de edad ($\overline{X}$=23.4; Ds =4.61). El 54% fueron mujeres, 46% hombres.

En cuanto a la fase de recolección de información para los resultados descriptivos de este estudio, se conformó una muestra de 460 estudiantes de pregrado de 5 universidades de la ciudad de San Juan de Pasto (Colombia), a través del mismo mecanismo de muestreo utilizado para el proceso de validación del instrumento IPS. La muestra contó con 33.9% hombres, 66.1% de mujeres; con edades entre los 17 y 37 años ($\overline{X}$=21.9; Ds =2.86).

### Procedimiento

El presente estudio es de tipo instrumental y descriptivo de corte transversal, conformado por un grupo y múltiples medidas (Montero & León, 2007). Para la adaptación lingüística de la prueba psicométrica se realizó un proceso de pilotaje a la estructura del test, con el fin de realizar ajustes en la redacción de los ítems que permitieran una adecuada comprensión y estilo, este proceso contó con la participación de 33 estudiantes universitarios. De dicho proceso es pertinente mencionar que los ítems 2, 5 y 6 presentaron observaciones y recomendaciones, por lo que estos reactivos fueron modificados lingüísticamente.

Una vez realizados los ajustes al instrumento, se llevó a cabo la aplicación de la versión experimental de la prueba Irrational Procrastination Scale (IPS) en su versión adaptada al español Guillera et al., (2018), con el fin de determinar las propiedades psicométricas del mismo, dicho proceso se desarrolló de manera electrónica a través de un formulario de Google Forms, todo lo anterior, previa firma de los consentimientos informados de los participantes.

Culminada la fase de adaptación del instrumento y confirmada la viabilidad del para su uso en población colombiana, se procedió a aplicar la versión adaptada del test IPS y del cuestionario socio económico con el fin de determinar algunas características relacionadas con la procrastinación en la muestra estudiada. La presente fase de este estudio se desarrolló también de manera virtual, con las mismas condiciones de la etapa descrita en el párrafo inmediatamente anterior.

### Elementos éticos y bioéticos

El estudio fundamenta sus principios éticos en los parámetros del código Deontológico y Bioético de Psicólogo en Colombia, consignados en la Ley 1090 de 2006. Adicionalmente se cumplieron con los parámetros de la Resolución 8430 de 1993 y la Declaración de Helsinky, por las cuales se establecen las normas científicas, técnicas y administrativas para una investigación en salud, referida a que el estudio debe realizarse con riesgo mínimo para los seres humanos. En todos los casos se explicó a los participantes

el objetivo del estudio y sus diferentes fases, resaltando además el carácter voluntario, anónimo y confidencial de su participación.

## Instrumentos

El instrumento que se sometió al proceso de adaptación lingüística fue el Irrational Procrastination Escale (IPS) o en español, Escala Irracional de Procrastinación, el cual fue traducido y validado al castellano por Guillera et al., (2018), donde se determinó que la versión para la población de habla hispana presentaba adecuadas propiedades psicométricas. En cuanto a la estructura de la prueba, esta cuenta con un único factor, compuesto por 9 ítems con una escala de calificación tipo Likert de 5 puntos, donde las categorías de respuesta van desde 1 = "no me describe en lo absoluto" a 5 = "me describe totalmente".

El segundo instrumento utilizado fue un cuestionario socio económico donde se recolectó información relacionada a la edad, el género, el estrato socio económico y la universidad en la cual los participantes se encuentran desarrollando sus estudios de pregrado. De forma adicional, el equipo investigador decidió añadir la pregunta: De los siguientes grupos de actividades, ¿Cuál cree usted que es la que más interfiere en la realización oportuna de sus deberes y que puede asociarse con la procrastinación?, para la cual se brindaron las siguientes opciones de respuesta: Actividades relacionadas al sueño o descanso (dormir, hacer la siesta, recostarse en la cama, "no hacer nada"; Actividades relacionadas al uso de aparatos tecnológicos (Navegar en internet, usar redes sociales, chatear, ver series); Actividades relacionadas al deporte (Ir al gimnasio, practicar algún deporte, trotar); Actividades de socialización (salir con amigos, asistir a fiestas o reuniones); Otras actividades.

## Análisis de datos

Inicialmente se procedió a aplicar la prueba piloto con 33 estudiantes universitarios, con el fin de evaluar la comprensión de los ítems del instrumento IPS en su versión española, así como también las instrucciones y la escala de respuesta. Para cada elemento del test se presentó la frase "¿Usted entiende esta afirmación?" con opciones de respuesta "sí" o "no", y un espacio para observaciones. La información recogida en este procedimiento se utilizó a conveniencia de los investigadores para generar los ajustes lingüísticos pertinentes a la versión inicial de la prueba.

Posteriormente, utilizando el software estadístico SPSS 23 - AMOS (IBM Corp, 2015), se ejecutó un análisis factorial confirmatorio (AFC) utilizado para observar la dependencia, influencia y relación de los componentes del cuestionario. El ajuste del modelo se analizó mediante el método de estimación máxima versosimilitud (ML). Para evaluar el ajuste del modelo se analizó los índices: chi-cuadrado de Satorra-Bentler $\chi^2$ S-B (Satorra y Bentler, 2010), CFI (≥ 0,90), TLI y NNFI (≥ 0,90), RMSEA (≤ 0,05 óptimo, ≤ 0,08 aceptable) (Hu y Bentler, 1999).
Mediante el coeficiente alfa de Cronbach (α) se analizó la consistencia interna para la prueba en general y cada sub escala, este último se obtuvo con el programa SPSS 23.

El nivel de significatividad adoptado en todos los análisis fue de 0,05.

Para la fase descriptiva del estudio, se utilizó la prueba IPS adaptada y validada para la población colombiana, inicialmente se calculó la media ($\bar{X}$) y la desviación estándar (Ds), máximo, mínimo, curtosis y asimetría, para los puntajes finales de la prueba IPS, posteriormente se realizó un análisis de frecuencias a los ítems del test y a la afirmación adicional formulada por el equipo investigador que busca conocer que actividades se asocian a la procrastinación, por último, se calcularon los percentiles a partir de los puntajes totales de la prueba y se determinó la relación entre los niveles de procrastinación y las actividades que los participantes consideran que intervienen en la realización oportuna de deberes, para determinar dicha

relación, se utilizó la prueba T Student con un nivel de confianza del 95% y una significancia menor de 0.05.

## 4. Resultados y Discusión

### Resultados

Una vez realizados los ajustes lingüísticos al instrumento Irational Procastination Scale (IPS), se desarrolló un proceso de análisis factorial confirmatorio (AFC) al modelo unifactorial de la prueba IPS propuesto por los autores Guillera et al., (2018), del cual se obtuvieron diversos índices (Tabla 1).

En el contexto de este análisis factorial confirmatorio (AFC), se han evaluado diversas métricas de ajuste del modelo con el propósito de determinar la adecuación de un modelo estadístico. El estadístico Chi-cuadrado normalizado por grados de libertad (CMIN/gl) reveló un valor de 2.1, lo que se traduce en un Chi-cuadrado de aproximadamente 27.9 con 2.1 grados de libertad, esto indica que el modelo exhibe un ajuste significativo a los datos, aunque se observa cierta discrepancia. Los índices de ajuste incremental, el Comparative Fit Index (CFI) y el Tucker-Lewis Index (TLI), alcanzaron valores de 0.94 y 0.92, respectivamente, señalando un buen ajuste relativo al modelo nulo. Además, el Root Mean Square Residual (RMR) y el Root Mean Square Error of Approximation (RMSEA) se situaron en 0.05 y 0.08, respectivamente, indicando niveles aceptables de error de aproximación y ajuste del modelo en términos de complejidad. El Goodness of Fit Index (GFI), que proporciona una evaluación global del ajuste, registró un valor de 0.82, lo que sugiere un ajuste satisfactorio, aunque no óptimo.

**Tabla 1.**
*Resumen de índices de análisis factorial confirmatorio (AFC) de la prueba IPS*

| Índices | Chi Cuadrado | CMIN/gl[2] | CFI | TLI | RMR | RSMEA | GFI |
|---|---|---|---|---|---|---|---|
| Resultado obtenido | 58.7 | 2.1 | 0.94 | 0.92 | 0.05 | 0.08 | 0.82 |

Fuente: Elaboración propia

Es importante mencionar que todos los ítems superaron una carga factorial mayor o igual a 0.60, a excepción del ítem 1; con respecto a esto, se desarrolló nuevamente el AFC eliminando este reactivo, sin embargo, no se mostraron diferencias significativas con esta acción, por lo que se decidió conservar la estructura de los ítems tal como lo proponen los autores que realizaron la traducción y adaptación en población española.

Por otra parte, se calculó el estadístico alfa de Cronbach (α) es una medida de confiabilidad o consistencia interna de un conjunto de ítems del cuestionario. En este caso, el valor obtenido de α = 0.86, este valor se considera sólido y sugiere una alta consistencia interna en las respuestas a las preguntas o ítems incluidos en el conjunto. Esto significa que las preguntas o ítems utilizados en tu estudio están relacionados de manera consistente y que miden una característica común o constructo de manera confiable.

En conjunto, los resultados descritos evidencian un ajuste razonable del modelo a los datos obtenidos por el test y permite inferir que la adaptación lingüística a la población colombiana del instrumento IPS se dio de manera satisfactoria.

En relación a los estadísticos de tendencia central y dispersión calculados a partir de los puntajes totales de la escala IPS, se han obtenido estadísticas descriptivas que ofrecen una visión detallada de la distribución y la variabilidad de dichos puntajes (Tabla 2). En este orden de ideas, el valor mínimo registrado para IPS es 11, lo que indica la presencia de observaciones en el extremo inferior del espectro. Por otro lado, el

valor máximo alcanzado es 44, denotando la existencia de valores en el extremo superior de la escala de medición. La media de los puntajes totales de la prueba IPS se sitúan en aproximadamente 28.59.

La desviación estándar (Tabla 2) sugiere que los datos tienden a dispersarse alrededor de la media, el valor obtenido relativamente bajo indica una concentración razonable de observaciones cerca de la media, lo que podría respaldar la estabilidad de la variable en estudio. La asimetría, y la curtosis muestran cierta desviación de la normalidad en la forma de la distribución, sin embargo, estos hallazgos no parecen ser significativos y pueden considerarse dentro de los límites de una distribución normal.

**Tabla 2.**
*Resumen de estadísticos de tendencia central y dispersión – Prueba IPS*

| Estadístico | Mínimo | Máximo | Media | Desviación estándar | Asimetría | | Curtosis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Estadístico | Error estándar | Estadístico | Error estándar |
| Resultado | 11 | 44 | 28,59 | 6,65 | -0,007 | 0,114 | -0,09 | 0,227 |

Fuente: Elaboración propia

El análisis de frecuencias por ítems, ha constatado que, en relación al primer ítem: *"Pospongo tanto las cosas que mi bienestar o eficiencia se ven afectados innecesariamente",* la respuesta que predomina es "A veces sí, a veces no", la cual se presenta con una frecuencia del 49.8%, esto denota que la mayoría de los encuestados experimenta una ambivalencia en relación a la afirmación, en la medida en que no se sienten completamente descritos por ellas, aunque tampoco pueden rechazarlas por completo. En contraste, la opción "Me describe totalmente" exhibe una frecuencia marginal del 8%, sugiriendo que un porcentaje reducido de los participantes se identifica plenamente con dicho ítem.

El ítem 2: *"Si hay algo que debo hacer, lo realizo antes de hacer otras tareas menos importantes"* revela que la categoría de respuesta predominante es "A veces sí, a veces no", con un 40.4%. Esto implica que una proporción considerable de los encuestados reconoce que esta afirmación se ajusta a su experiencia en determinadas circunstancias, aunque no de manera consistente. En contrapartida, la categoría "No me describe en absoluto" exhibe una frecuencia de tan solo el 6.5%, constituyendo así la respuesta menos común, lo que indica que un porcentaje relativamente bajo de los participantes considera que dicha afirmación no guarda relación alguna con su comportamiento en torno a la procrastinación.

El ítem "Ítem 3": *"Si algunas cosas las hubiera hecho antes, mi vida sería mejor"* Indica que la categoría de respuesta más frecuente es nuevamente "A veces sí, a veces no", con un 25%. Este hallazgo indica que una cuarta parte de los encuestados experimenta una variabilidad en su concordancia con la afirmación, la cual no se manifiesta de forma constante. Por otro lado, la categoría "Es usual en mí" presenta una frecuencia del 22.4%, configurando la segunda categoría más predominante, lo que sugiere que una porción significativa de los participantes se siente identificada con la afirmación en cuestión.

Los Ítems 4 al 9 exhiben pautas similares en cuanto a la distribución de respuestas, de manera general, la categoría de respuesta "Es usual en mí" ostenta la frecuencia más elevada en la mayoría de los ítems, indicando que una proporción sustancial de los encuestados se identifica con estas afirmaciones. Contra puntualmente, la categoría "No me describe en absoluto" tiende a manifestar la frecuencia más baja en estas instancias, lo cual podría denotar cierto nivel de procrastinación en la muestra encuestada.

**Tabla 3.**
*Distribución de frecuencias por ítem – Prueba IPS*

| Respuesta | Ítem 1 % | Ítem 2 % | Ítem 3 % | Ítem 4 % | Ítem 5 % | Ítem 6 % | Ítem 7 % | Ítem 8 % | Ítem 9 % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2,8 | 6,5 | 7,4 | 2 | 4,6 | 3,3 | 4,1 | 3,3 | 10,4 |
| 2 | 22,6 | 36,3 | 18 | 13,7 | 13 | 21,3 | 20,4 | 20,9 | 40,9 |
| 3 | 49,8 | 40,4 | 25 | 28,7 | 21,5 | 38,9 | 33 | 35 | 36,1 |
| 4 | 16,7 | 14,6 | 22,4 | 37,6 | 33 | 29,8 | 33,5 | 28,3 | 9,6 |
| 5 | 8 | 2,2 | 27,2 | 18 | 27,8 | 6,7 | 8,9 | 12,6 | 3 |

Nota: *Puntajes: 1= No me describe en absoluto / 2= No es usual en mí / 3= A veces sí, a veces no / 4= Es usual en mí / 5= Me describe totalmente*
Fuente: Elaboración propia

En relación a la pregunta: *"De los siguientes grupos de actividades, ¿Cuál cree usted que es el que más interfiere en la realización oportuna de sus deberes y que puede asociarse con la procrastinación?",* se observa que más de la mitad de los participantes respondieron a la opción *"Actividades relacionadas al uso de aparatos tecnológicos"* (Tabla 4), lo cual indica que el uso inadecuado de las TIC puede asociarse en gran medida a niveles altos de procrastinación debido al tiempo que las ocupan en estas actividades. Por otra parte, sobresalen las actividades relacionadas al sueño o descanso, como por ejemplo dormir o hacer la siesta, alcanzando un 24.8% de participantes que consideran estos espacios como elementos que interfieren en las diferentes obligaciones que de su diario vivir.

En cuanto a actividades como el deporte, un 9.1% considera que disponer de tiempo para el desarrollo del ejercicio físico puede interferir en cierta medida con la ejecución eficaz de deberes diarios o específicos, sin embargo, pone en consideración el hecho de que estas actividades pueden percibirse como obligatorias o que hacen parte de una rutina establecida, situación que implicaría una ambivalencia en la medida en la que estas mismas pueden interferir con otras obligaciones.

El porcentaje más bajo está relacionado con actividades de socialización como por ejemplo salir con amigos o asistir a fiestas o reuniones, alcanzando un 6.1%, situación que podría explicarse por la baja preferencia de los contextos físicos o "cara a cara", para la socialización frente a las posibilidades que brindan los entornos virtuales.

**Tabla 4.**
*Actividades asociadas a la procrastinación*

| Actividad | N | % |
|---|---|---|
| Actividades de socialización (salir con amigos, asistir a fiestas o reuniones) | 28 | 6,1 |
| Actividades relacionadas al deporte (Ir al gimnasio, practicar algún deporte, trotar) | 42 | 9,1 |
| Actividades relacionadas al sueño o descanso (dormir, hacer la siesta, recostarse en la cama, "no hacer nada") | 114 | 24,8 |
| Actividades relacionadas al uso de aparatos tecnológicos (Navegar en internet, usar redes sociales, chatear, ver series) | 243 | 52,8 |
| Otras actividades | 33 | 7,2 |

Fuente: Elaboración propia

Adicional a lo anterior, se ejecutó la prueba T Student para determinar la relación entre los puntajes finales de la prueba IPS y las actividades asociadas a la procrastinación, este análisis mostró que las dos variables mencionadas muestran un grado estadísticamente significativo de interacción (Prueba $T=4$; $gl=68$; $p < 0.05$).

Finalmente se establecieron los baremos de la presente escala, las cuales se exhiben en cuartiles, además del porcentaje de participantes según la interpretación de sus puntajes totales tal como se detalla en la Tabla 5. Las divergencias entre individuos de género masculino y femenino muestran una variación mínima.

**Tabla 5.**
*Distribución en cuartiles e interpretación – Puntajes totales de la prueba IPS*

| Percentil | Puntajes – mujeres | Puntajes – hombres | Interpretación | % Mujeres | % Hombres |
|---|---|---|---|---|---|
| 1-25 | 11-21 | 11-20 | Muy bajo | 10,22 | 5,0 |
| 26 – 50 | 22-25 | 21-25 | Bajo | 10,22 | 5,2 |
| 51 - 75 | 26-30 | 26-31 | Moderado | 19,13 | 12,2 |
| 77-99 | 31-44 | 32-44 | Alto | 26,30 | 11,7 |

*Nota: El porcentaje obtenido no se discrimina por género y se obtiene según el tamaño total de la muestra; N= 460*
Fuente: Elaboración propia

## 5. Discusión

Lla procrastinación es una conducta que conduce a la toma de decisiones erróneas en la vida cotidiana, generando conflictos emocionales que acarrean problemas en las áreas académicas, sociales y personales (Zanabria-Contreras, 2020; Domínguez-Lara, 2017; Fernie et al., 2016).

En cuanto al proceso de adaptación lingüística de la prueba IPS, el respectivo pilotaje permitió los ajustes pertinentes a algunos ítems con el fin de mejorar su comprensión para la población colombiana, donde el AFC a través de sus diferentes índices y la prueba de confiabilidad de alfa de Cronbach (α), indican que la versión adaptada de la prueba IPS en el presente estudio cumple con los estándares y puntos de cortes propuestos para dichos indicadores estadísticos. Con respecto a esto, la prueba IPS ha arrojado propiedades psicométricas similares en adaptaciones realizadas en otros países e idiomas, destacándose los estudios instrumentales de Rocha, Almeida & Díaz (2021), Padrós Blázquez & Elena-Guzmán (2022) y Corrales-Reyes et al., (2022), lo cual indica una importante estabilidad de la prueba en relación a la validez de constructo, contenido y fiabilidad.

En cuanto a los resultados descriptivos de este estudio, se tiene que el promedio de los puntajes totales obtenidos a través de la prueba IPS se ubicaron en un nivel moderado ($\overline{X}$= 28.59), donde el análisis de frecuencias mostró que 31.3% de la muestra se encuentra en dicho nivel, siendo superado por un 38% de estudiantes universitarios que puntuaron para un nivel alto de procrastinación, adicional a ello, los análisis de frecuencias por ítems indicaron que la muestra tiende a generar conductas de procrastinación de manera ocasional y usual. Los datos mencionados tienden a ser similares a los encontrados por investigadores del tema de la procrastinación en Latinoamérica, como por ejemplo Araoz & Uchasara (2020) quienes en un estudio sobre el tema, en estudiantes universitarios de Perú identificaron que el 48% de la muestra evaluada mostró puntajes altos, seguidos de un 23.2% que obtuvo niveles moderados, encontrándose una situación similar en la investigación realizada por Altamirano Chérrez & Rodriguez-Pérez (2021) quienes identificaron en una muestra de universitarios ecuatorianos que el 70% de la muestra evaluada presentaba altos y moderados niveles de procrastinación académica.

Los resultados presentados en el párrafo anterior sugieren que la procrastinación es un problema significativo entre la población universitaria en la región, esto plantea preocupaciones importantes en el contexto académico, ya que la procrastinación puede tener efectos perjudiciales en el rendimiento académico, la calidad del trabajo estudiantil y, en última instancia, en el éxito educativo (Casasola, 2022). Los altos porcentajes de estudiantes que muestran niveles moderados y altos de procrastinación indican

que este comportamiento es común y merece una atención seria por parte de las instituciones educativas y los profesionales de la salud mental.

A diferencia de investigaciones previas relacionadas con la adaptación o uso del instrumento IPS al español a excepción del estudio realizado por (Zanabria-Contreras, 2020) en el contexto peruano, el presente estudio ha promovido la inclusión de baremos basados en normas percentiles y su respectivo análisis, esta elección reviste una gran importancia para los estudios posteriores en población universitaria colombiana, puesto que se convierten en un recurso esencial para quienes se encuentren interesados en investigar el fenómeno de la procrastinación y en contar con un marco de referencia para el contraste de sus resultados.

## 6. Conclusiones

El proceso de adaptación lingüística, acompañado del análisis de las propiedades psicométricas de la prueba de medición de la procrastinación IPS en una muestra de estudiantes universitarios colombianos, permite concluir que dicha prueba es válida y confiable en esta población, sumándose a una larga lista de países que han validado esta escala de medida que se utiliza con fines investigativos y de intervención.

El presente estudio identificó que más de la mitad de la muestra encuestada mostró puntajes moderados o altos de procrastinación, ocurriendo una situación similar en análisis por ítems, donde hubo mayor prevalencia a puntuar las conductas de procrastinación de manera usual o recurrente. Estos análisis se unen a la tendencia encontrada en otras investigaciones realizadas en Latinoamérica.

Las actividades relacionadas con el uso de aparatos electrónicos y el consumo de servicios de internet son percibidas como un elemento que propicia o genera procrastinación, seguido de las actividades de ocio y descanso.

El presente estudio genera un sistema de baremos para la prueba IPS con el fin de facilitar su interpretación y uso en futuras investigaciones.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.3

Cómo citar:
Jiménez, F.E., & Medina Reyes, A. (2024). Redes del conocimiento basadas en tecnologías de información y comunicación en los procesos de vinculación universitaria. *Revista Eduweb*, 18(1), 36-47. https://doi.org/10.46502/issn.1856-7576/2024.18.01.3

# Redes del conocimiento basadas en tecnologías de información y comunicación en los procesos de vinculación universitaria

## Knowledge networks based on information and communication technologies in university linkage processes

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Recibido: 20/07/23
Aceptado: 12/01/24

**Resumen**

El objetivo de la investigación es determinar la relación entre las redes del conocimiento basadas en tecnologías de información y comunicación en los procesos de vinculación universitaria buscando plantear la relación humana organizacional en el logro de objetivos comunes mediatizados por el intercambio de información en los procesos de conocimientos entre expertos, investigadores y empresas para una comunicación fluida y heterogénea que propicien la cooperación, potenciación y generación de conocimientos basados en la experiencia. Con un enfoque cuantitativo, y un nivel de investigación descriptivo correlacional; asimismo se estructuró un cuestionario en escala de Likert, con una confiabilidad de 0.916 de 21 elementos. Los participantes integran la comunidad universitaria como motor de progreso para enfrentar los cambios conectados de evolución en las generaciones del conocimiento. La creación de Redes del Conocimiento tiene como base la utilización de herramientas tecnológicas, estas permiten el acercamiento de personas para el intercambio y actualización de información inmediata, para procesarla y convertirla en nuevos conocimientos; también los procesos de vinculación institucional brindan como resultado la creación de más redes que facilitan la generación de conocimientos.

**Palabras Clave:** Redes del conocimiento, vinculación, tic herramientas colaborativas, generación de conocimiento, transferencia de conocimiento.

**Abstract**

The research objective is to determine the relationship between knowledge networks based on information and communication technologies in university linkage processes, aiming to establish the organizational human relationship in achieving common goals mediated by the exchange of information in the knowledge processes among experts, researchers, and companies for fluid and heterogeneous communication that fosters cooperation, enhancement, and generation of knowledge based on experience. With a quantitative

approach, and a descriptive correlational research level; a Likert scale questionnaire was also structured, with a reliability of 0.916 from 21 items. Participants integrate the university community as a driving force for progress to face the connected changes of evolution in the generations of knowledge. The creation of Knowledge Networks is based on the use of technological tools, which allow the approach of people for the exchange and immediate update of information, to process it and turn it into new knowledge; also, the processes of institutional linkage result in the creation of more networks that facilitate the generation of knowledge.

**Keywords:** Knowledge networks, linkage, ict collaborative tools, knowledge generation, knowledge transfer.

## 1. Introducción

Las redes de conocimiento basadas en tecnologías de información y comunicación se constituyen como la oportunidad de intercambiar información partiendo de la necesidad de unir dos orillas de interacción social entre las herramientas digitales y los procesos de vinculación universitaria. Esta investigación busca determinar la influencia entre ambos temas partiendo de experiencias previas que en el contexto de la Educación Superior en América Latina y el Caribe (2017), es importante destacar que los intercambios que se generan entre las organizaciones académicas e industriales son escasas y usualmente no implican la transferencia de innovación para la producción de nuevos conocimientos, las redes; son una vía que facilita la configuración y reconfiguración en el intercambio de valores y conocimientos (Severiche et al., 2016).

En este sentido es importante analizar los elementos que intervienen y hacen referencia al surgimiento de las redes de conocimiento y su relaciona con procesos de vinculación universitaria; si bien la función primordial de las entidades de educación superior es la creación y transferencia del conocimiento proyectando sus hallazgos a un universo de nodos globalizados para el aprovechamiento de la misma y todos los que puedan acceder a su repositorio combinando los conocimiento individuales y colectivos de las organizaciones como un fenómeno dinámico en que se comparte desarrolla y generan nuevo conocimiento.

De la revisión de la literatura, se observa que el tema de la construcción de redes de conocimiento y el tema de los grupos académicos está cobrando cada vez mayor relevancia en el ámbito internacional. Aunado a la capacidad de las herramientas de Tecnología de Información y Comunicación (TIC), que permiten acercar de manera exponencial a personas y entidades sin importar la zona geográfica para colaborar de manera inmediata mediante el envío y recepción en tiempo real de información. Lo anterior en un flujo emergente de investigación sobre modelos híbridos identificando los desafíos de las partes interesadas. De acuerdo a McAdam et al., (2017) las complejidades de la participación de las universidades, la industria y los usuarios finales son reflejados como verdaderos desafíos con la alineación de los procesos organizacionales y mecanismos en los cuales estas dinámicas logran interactuar.

La creación de Redes del Conocimiento hoy en día no está limitada al contacto de manera física con las personas, en la actualidad se aprovecha la capacidad de las herramientas de Tecnología de Información y Comunicación (TIC). Para Sanchez (2014), las redes implican desarrollos complejos de acción recíproca que se retroalimentan y, a su vez, las redes representan ser un medio para obtener recursos sustantivos para las organizaciones. Estas representan las relaciones de actores sociales que participan en el proceso de creación e intercambio de conocimiento a través de un grupo de personas y sus vínculos de conocimiento que interactúan e intercambian información sobresaliente como parte de sus relaciones formales o informales.

Según Martinez (2009), las organizaciones que trabajan con el conocimiento, entre ellas las redes, tienen en su proceso de interacción con la sociedad un triple imperativo; intervenir en espacios de orden territorial,

establecer incidencia en el escenario nacional e interactuar con dimensión global. La interacción entre actores para generar innovaciones son procesos dinámicos que no están encerrados en fronteras locales, regionales o nacionales, sino que las interacciones se dan en diferentes niveles espaciales que van desde lo local hasta lo global en un constante flujo de conocimiento.

Por otro lado, la vinculación es la actividad de enlace sumativa en la cual dos o más entidades que pueden ser de diferentes sectores se unen para buscar un fin común y crear a partir de esto, nuevos conocimientos que se ponen a disposición de los involucrados o de cualquiera que pueda obtener un beneficio, logrando no solo un objetivo conjunto, sino también la transferencia de nuevos conocimientos a una nueva escala. Morales et al. (2013) establece que la investigación universitaria dentro de las sociedad es un productor natural de conocimiento científico y tencologico para ayudar a las empresas a tarves de aportes de destrezas a solucionar problemas, se espera que la generación de nuevos conocimientos impulsen el desarrollo de un sistema de innovación correlaciona al cotexto global.

Algunos actores denotan que estas Redes no están limitadas a la academia universitaria en específico, si no que pueden formarse a partir de intereses mutuos de varios sectores de la sociedad en una aplicación versátil entre las organizaciones en su uso de herramientas de socialización para convertirlo en un recuso académico y accesible a toda una comunidad universitaria. (Casas, 2001).

Para lograr la cohesión de las redes de conocimiento en la vinculación es necesario que personas e instituciones, interesados en la resolución de un fin común, con el objeto de compartir conocimientos y potenciar los recursos y beneficios, a través de la cooperación, colaboración y solidaridad constructiva, hagan uso de las tecnologías de la información y comunicación y focalicen sus objeticos con el propósito de balancear la gestión interinstitucional (Morett, 2018).

Ante la necesidad de encontrar puntos convergentes entre redes del conocimiento basadas en tecnologías de información y comunicación en los procesos de vinculación universitaria se plantea la hipótesis que sugiera hacer un buen uso de las redes de conocimiento para el aprovechamiento de oportunidades en la vinculación universitaria. Es ese sentido se espera que la capacidad de crear redes, conexiones y transmitir conocimiento, sea a través de la innovación, utilización de herramientas tecnológicas de comunicación y colaboración, junto a la conexión de la tríada empresa, gobierno y universidad. La investigación busca evaluar cómo estos elementos pueden influir con el fin de contribuir a la mejora de los procesos.

## 2. Marco teórico

Las redes del conocimiento basadas en tecnologías de información y comunicación (TIC) han transformado la forma en que las universidades se relacionan con la industria y la sociedad. Las redes del conocimiento proporcionan un entorno favorable para la creación y el intercambio de conocimiento entre los actores involucrados, incluyendo universidades, empresas y otras instituciones. Estas redes se basan en el uso estratégico de las TIC, como plataformas en línea, redes sociales y sistemas de gestión de conocimiento, que facilitan la comunicación y la colaboración a través de barreras geográficas y organizacionales. (Parker Rossell, 2007).

Las tecnologías de la información y la comunicación (TIC) representan una pieza en el impulso, transparencia y gestión de conocimientos para fortalecer los actores de cooperación descentralizada en el desarrollo local. Como señala Blanco (2018), En el marco de la cooperación descentralizada para se puede abarcar desde las nociones de red como forma de trabajo, las redes como organismo coordinador de entidades públicas, privadas y de la sociedad civil hasta el concepto de red vinculado a las TIC comprendiendo la red como una forma de trabajo, un organismo coordinador que conecta a los diversos actores y promueve la participación activa y la sinergia.

Este fenómeno actúa como catalizador del cambio en la cooperación impulsando la creación de redes sólidas y eficientes que promueven la transparencia y la innovación para la accesibilidad y democratización del conocimiento en el ecosistema universitario empresarial.

Las tecnologías de la información y comunicación permiten una mayor micro segmentación de los mensajes dirigidos a grupos con afinidades específicas, ya sean idiomáticas, geográficas, de intereses comunes o culturales, facilitando de esta forma la conformación de una doble realidad: la física que se desarrolla en la sociedad de acogida y la virtual en la de origen, permitiendo participar en ambas. Este nuevo escenario ilustra un fenómeno de nominado como "diáspora virtual" que proporciona la capacidad para generar vínculos interpersonales por los procesos de vinculación universitaria. (Vaquerizo, 2019).

Establecer una red del conocimiento permite encontrar el acceso a información de diferentes individuos y organizaciones; es, básicamente, integrar las aportaciones individuales de conocimiento, a través de la sistematización del mismo, siendo capaz de generar información útil de acuerdo con objetivos y metas prestablecidas Bedoya et al. (2018). Por ello una red del conocimiento puede ayudar a organizar oportunamente la información, a encontrar información relevante y trascendente para los fines de la organización; puede ser un canal que permita la comunicación y la discusión o debate de una problemática común capaz de generar una retroalimentación que, a la larga, se traduce en nuevo conocimiento; además, puede ayudar a la solución de problemas, a la toma acertada y oportuna de decisiones estratégicas o a la gestión adecuada de un proyecto común (Parker Rossell, 2007).

La existencia de las necesidades de los estudiantes de interactuar con los docentes y autoridades de manera sincrónica o asincrónica a las tecnologías de la información y comunicación contribuyen efectivamente entre las partes interesadas en el proceso de enseñanza aprendizaje (Garcia & Sanchez, 2022)

Los recursos de las tic en el proceso de aprendizaje ayudan y favorecen cuando sean empoderados docentes y estudiantes en ellas igualmente las autoridades se beneficia de incorporar las tecnologías de la información y comunicación en las actividades administrativas interactuando en tiempo y espacio (Gonzalez el al., 2022).

Las universidades en la aplicación de los nuevos conocimientos generados por sus investigaciones propias o de otras instituciones modifican continuamente sus prácticas anteriores por lo que la innovación adaptadas a nuevos contextos para responder a un nuevo acelerando convenios de colaboración mutua buscando la vinculación entre universidades y con empresas de manufactura de productos para poder transmitir conocimientos nuevos como estrategias de transiciones de información hacia la industria también las publicaciones en revistas científicas alguna universidades llegan a tener emprendimientos o viveros de empresas o en la iniciativa de los estudiantes de la misma universidades Rangel et al. (2021).

Las redes de conocimiento está muy presente su aplicación en la transmisión de la investigación científica que es de mucha utilidad por la estructura tecnológica digitales en la comunicación donde confluyen los organizaciones privadas y públicas un factor de relevante con esto es el comienzo el definir los objetivos claros donde se evidencia los beneficios para las distintas entes académicos, industriales o gubernamentales estableciendo los canales de comunicación la Red de metas conjuntas por medio de transversales en los distintos dimensiones de la Red (Blanco, 2018).

Al establecer una red del conocimiento, las organizaciones pueden superar las limitaciones individuales y aprovechar el potencial colectivo de las personas y las instituciones involucradas. La diversidad de perspectivas, experiencias y conocimientos enriquece el proceso de creación y aplicación del conocimiento, generando resultados más sólidos y efectivos así mismo la gestión del conocimiento se convierte en un pilar para los centros de información y el avance científico-tecnológico, impulsado por el uso de las tecnologías de información y comunicación (TIC).

Estas instituciones se posicionan como catalizadores del progreso al promover actividades que fomentan la investigación, el acceso a la información científica y el intercambio de conocimientos. Fomentando las mejores prácticas a través de redes que sustentan el desarrollo de estrategias para fortalecer las oportunidades educativas. Este enfoque se traduce en innovaciones en métodos de enseñanza, tecnologías educativas, servicios académicos, investigaciones y asesoramiento, generando así un impacto significativo en el ámbito educativo y científico (Correa-Díaz et al., 2019).

La necesidad de establecer redes de conocimiento para organizar y compartir información, lo que contribuye al desarrollo de estrategias educativas y científicas efectivas. Estas redes, impulsadas por las TIC, facilitan el acceso a la información, promueven la investigación y mejoran los servicios académicos, generando así un impacto positivo en la educación y la ciencia en el contexto de estudio.

## Método

El estudio se basó en una metodología mixta para examinar a profundidad las redes de los conocimientos basados en tecnologías de información y comunicación en procesos de vinculación con el objetivo de obtener teoría científica. En cuanto al nivel de investigación, se adoptó una categoría la cuantitativa para examinar a profundidad las competencias laborales en la toma de decisiones financieras, con el objetivo de obtener teoría científica, tal y como indican Hernández & Mendoza (2018) En cuanto al nivel de investigación, se adoptó una categoría exploratoria-correlacional, que permitió describir y analizar las características de una población en particular y determinar si existía una correlación entre las variables de interés, de acuerdo con (Tamayo, 2009).

Asimismo, se utilizó el diseño como no experimental, debido a que este realiza estudios sin la manipulación deliberada de variables y en los que solo se observan los fenómenos en su ambiente natural para analizarlos. El estudio es de tipo transeccional o transversal, dado que la recolección de datos se realizó en un periodo específico de cuatro meses, desde septiembre de 2022 hasta diciembre de 2022. El proceso de investigación se llevó a cabo de manera secuencial y organizada, partiendo de una idea delimitada y generando objetivos y preguntas de investigación, para luego revisar la literatura y construir un marco teórico riguroso.

Se considera que todo hecho se puede apreciar y estudiar desde diferentes puntos de vista, esto depende de lo que se quiere analizar, sin interferir en lo posible, para encontrar las causas que lo rigen, el investigador tiene que observar la mejor metodología a seguir para obtener los resultados veraces esperados que respondan las interrogantes formuladas en forma de hipótesis.

En el estudio se consideró una población conformada por las autoridades académicas, administrativas y los docentes de cinco universidades de la ciudad de San Pedro Sula, Honduras. Se alcanzaron 1,522 elementos de estudio, de los cuales 82 son autoridades académicas y administrativas y 1,440 son docentes. La población con perfiles de puesto jerárquico para determinar la relación entre las categorías investigadas son: capacidad para crear redes, conexiones y transmitir conocimiento, innovación, utilización de herramientas Tecnológicas de Comunicación y colaboración, conexión empresa, Gobierno, Educación, Sociedad. La técnica utilizada en este proceso fue el censo tiene como objetivo recolectar información de todos los individuos o elementos de una población en estudio, tomando en cuenta ciertas características de dicha población (Hernández & Mendoza, 2018).

El enfoque permitió abordarlo de la parte cuantitativa, la recopilación de datos para realizar estadísticos de correlaciones entre cada una de las categorías para establecer patrones de comportamiento. Señala Kerlinger (2002) que para verificar hipótesis de investigación y obtener resultados generalizables sobre una población. Este enfoque se enfoca en la medición precisa de variables y busca establecer relaciones causales y patrones de comportamiento cuantificables. Se utilizó la fórmula estadística para poblaciones

finitas (cuando se conoce el total de unidades de observación que la integran) con un nivel de confianza de 95% por la homogeneidad de la población estudiada, obteniendo un resultado de sesenta participantes en la muestra. La información obtenida fue analizada en el software estadístico SPSS, siendo clasificados los datos en aspectos descripticos a través de frecuencias y correlaciones, por medio de sus factores de análisis. Este método responde a los objetivos de la investigación.

Se construyó el instrumento de investigación utilizando la Escala de Likert, la cual fue evaluada por expertos en el tema, concluyendo que el instrumento posee un alto nivel de validez, con lenguaje comprensible y gramaticalmente correcto. Además, se llevaron a cabo 21 mediciones para evaluar la confiabilidad del instrumento, indicando que se realizó una prueba piloto adecuada en términos del tamaño del censo.

El análisis de la confiabilidad del instrumento se realizó mediante el cálculo del coeficiente Alfa de Cronbach, que mide la consistencia interna del instrumento. Para ello, se utilizó una muestra de participantes que completaron el instrumento en dos momentos diferentes, y se obtuvo un valor de Alfa de Cronbach de 0.916, lo que indica un nivel aceptable de confiabilidad.

El instrumento en su totalidad constó de 27 interrogantes agrupadas comprendiendo cada una de las variables y subvariables (TIC, Redes del Conocimiento y Vinculación), a la escala de Likert para determinar de manera estadística las relaciones y comprobaciones de la información recopilada; la cual fue enviada de manera virtual como formulario en línea utilizando la plataforma Microsoft Forms y enviada mediante un correo electrónico con el enlace a los encuestados; sin hacer ninguna interferencia del investigador al momento de contestar las preguntas.

En esta investigación se realizaron entrevistas semiestructuradas elaborando previamente una guía de preguntas que responden a las preguntas de esta investigación; así mismo el entrevistador pudo cambiar y adicionar preguntas que ayuden a complementar la información, con miembros como Vicerrector de Vinculación Nacional a Internacional, Director de Doctorados y Vinculación Académica dando total libertad de repuesta a el entrevistado haciendo uso del enfoque cualitativo como parte del proceso reflexivo e inductivo que se centra en la comprensión de los fenómenos desde la perspectiva de los participantes (Creswell, 2014).

La metodología propuesta permitirá obtener una comprensión detallada sobre las Redes del conocimiento basadas en Tecnologías de Información y Comunicación y los procesos de vinculación universitaria. Para el análisis de información se manejan técnicas estadísticas con el Software SPSS el objetivo de obtener teoría científica que explique la relación entre las variables y sub variables de interés regresión lineal para determinar el coeficiente de determinación en cada categoría de la línea de investigación. Estos resultados pueden utilizarse para la tomar decisiones que construyan a mejorar los procesos entre las partes interesadas.

## 3. Resultados y discusión

Los resultados de esta investigación están presentados en una manera lógica basados en el método científico, presentando datos descriptivos, correlacionales, observaciones y entrevistas avalados mediante la utilización del Software estadístico SPSS. Como se muestra en el gráfico 1 se determina que la participación de cada una de las categorías principales (Redes del Conocimiento, TIC y Vinculación) aplicadas en el cuestionario tienen representatividad y se manifiesta en la línea de investigación, ver figura 1.

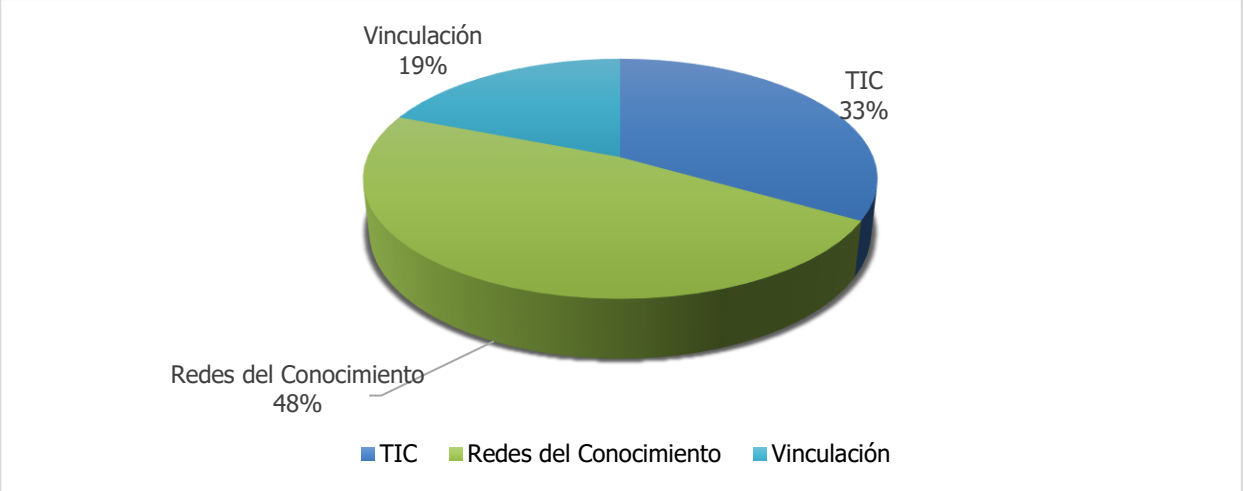


***Figura 1.*** Participación según categoría.
***Nota:*** Elaboración propia mediante el programa SPSS, versión 22.

En el gráfico anterior se proporciona datos en donde el (48%) representa la participación de las redes de conocimiento son mecanismos dinamizadores de interacciones entre los actores las cuales permiten promover la difusión de conocimiento, por otro lado; las TIC con una representación del 33% que significa aproximadamente un tercio del censo están relacionados de alguna manera con las TIC y tiene alguna conexión con ambientes académicos universitarios y con el sector empresarial, finalmente la vinculación con una participación del 19% induce a buscar una atmosfera de apoyo para el aprovechamiento de las innovación y las tecnologías de la comunicación.

Los resultados enfatizan la trascendencia de las redes colaborativas como facilitadoras de interacciones y difusión de conocimiento, así como el impacto sustancial de las TIC en la interacción y el aprovechamiento de la innovación. Estos hallazgos destacan la relevancia de promover la colaboración entre actores y el papel fundamental de las tecnologías en el fomento de la innovación el contexto analizado.

Posteriormente la figura 2, se muestra la utilización de herramientas para el intercambio de información.

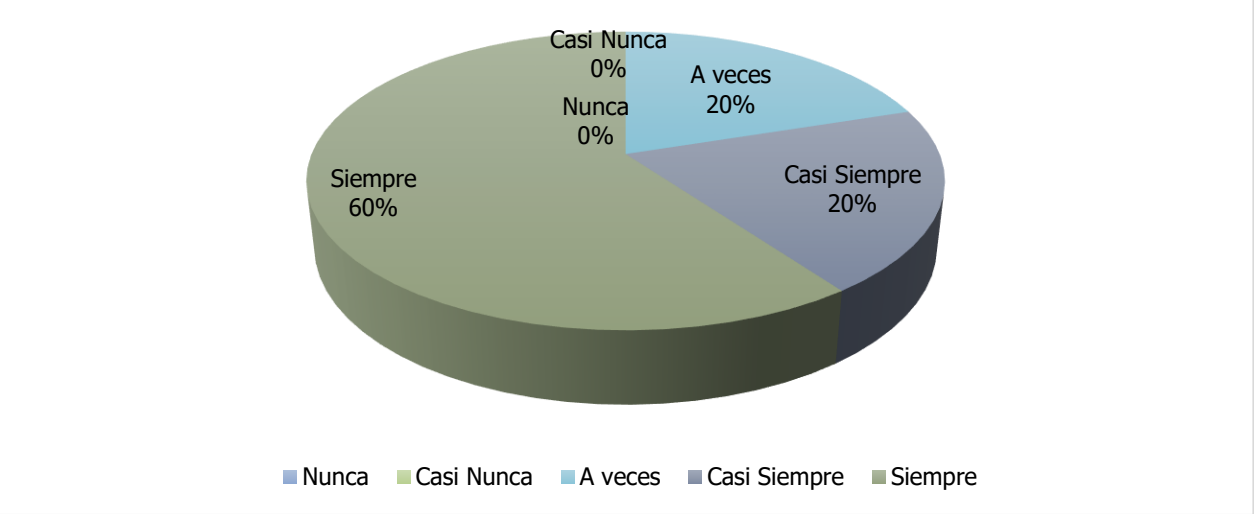


***Figura 2.*** Utilización de Herramientas de Intercambio de Información.
***Nota:*** Elaboración propia mediante el programa SPSS, versión 22.

Cada uno de los participantes a los que se les consultó, mostraron que siempre o casi siempre (80%) utilizan herramientas tecnológicas de colaboración como ser Google Drive o OneDrive, las cuales presentan una facilidad en la utilización al momento de almacenar, editar y compartir información por medio de enlaces proporcionados. A pesar de la facilidad del envío y recepción de manera inmediata de la información utilizando herramientas tecnológicas de colaboración, un porcentaje de los encuestados presentan algún tipo de desactualización en la información recibida (20%).

Antes los cuestionamientos sobre la transferencia del conocimiento la opinión es dispersa en la creación de proyectos de inversión dado estos solo están disponibles para algunos puestos estratégicos, y que, por el contrario, al tener un puesto generalmente asociado a las redes, esto no da acceso al control de inversión monetaria. La movilidad de investigadores es uno de los aspectos con mayor discusión en las opiniones, dado que con la utilización de Tic se permite el intercambio de la información sin la necesidad de movilización de personas.

Al realizar el análisis de correlación de la categoría Redes del Conocimiento con cada pregunta de las subcategorías (Información, Innovación y Transferencia del Conocimiento) se han obtenido los siguientes resultados:

La información que se maneja en las redes del conocimiento hay una congruencia de relevancia significativa en el cual se plantea que, para la generación de redes del conocimiento, toda información generada o compartida debe estar actualizada. En el apartado de Innovación en la creación de Conocimiento, se puede observar que existe una intervención media alta en cada una de las interrogantes, denotando que todos los elementos tienen una importancia alta en el proceso de innovación.

La transferencia del conocimiento se basa en los diferentes puntos que enriquecen o facilitan el traspaso de información, encontrando que acorde al momento en el que se realizó la investigación, se habían detenido a aminorado los procesos de acercamiento, esto conlleva que haya poca movilidad de personas y que los programas de pares se hayan detenido. Por el contrario, los grupos formados con programas en ejecución se mantuvieron en camino debido al alcance de las herramientas tecnológicas de información y colaboración que se poseían, las cuales facilitaron la comunicación a distancia.

En el estudio se realizó un análisis de la transferencia del conocimiento con interrogantes orientadas a los mecanismos utilizados en el servicio especializado que conlleva con cada uno de los ítems seleccionados para identificar los procedimientos que se ejecutan, el cual se personifica en la figura 3.

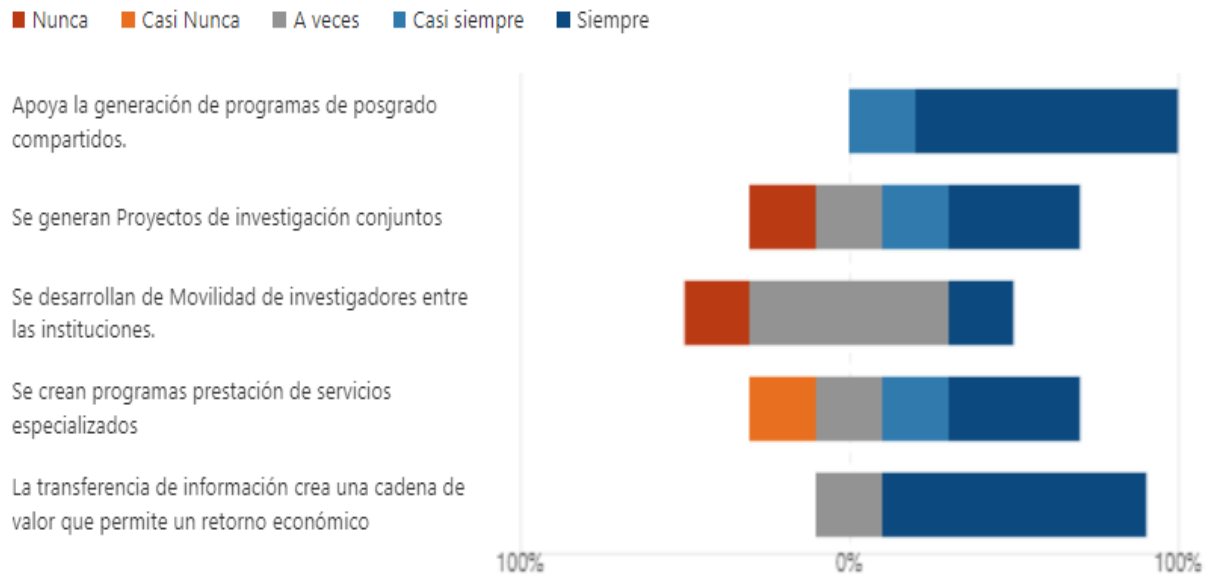


***Figura 3.*** Transferencia del conocimiento.
***Nota:*** Elaboración propia mediante el programa SPSS, versión 22.

La relación de vinculación institucional con respecto al sector social para el grupo estudio es uno de las áreas menos utilizadas, denotando un ponto de mejora sustancial; en la vinculación en el sector público se manifiesta un dispersión fuerte como aporte a la generación de conocimiento; para el apartado de vinculación en sector privado se encontró una alta participación, algo que se demuestra en la gran cantidad de acuerdos y convenios que se realizan y que constantemente está en crecimiento; mismo aporte se puede encontrar al observar el sector educativo, dada el enfoque de la institución, las áreas educativas y privada son las más fuertes en los procesos de vinculación.

Finalmente se revela el nivel de vinculación institucional del grupo de estudio en diferentes sectores, resaltando áreas con oportunidades de mejora y mostrando sectores con una alta participación y colaboración. Estos datos son relevantes para entender la dinámica de vinculación de la institución y pueden ser de utilidad para identificar áreas de enfoque y potencial crecimiento en sus relaciones con diferentes sectores.

## 4. Discusión

Las Tecnologías de Información y Comunicación (TIC's) tienen una alta incidencia en la creación de redes del conocimiento, donde los encuestados expresan facilidad en la utilización de herramientas de comunicación, no solo en la parte de hardware y elementos tangibles que poseen la capacidad de conexión a Internet; sino también en herramientas intangible denominado software o aplicaciones de videoconferencias y/o mensajes que permiten la comunicación en tiempo real o inmediato en ambas direcciones. Esto establece relaciones entre las personas y la información como recursos reconocidos por su gran valor al combinar de manera eficaz su utilización para generar nuevos conocimientos (Parker Rossell, 2007). Los hallazgos del estudio evidencian la relación de las personas en el uso de las herramientas tecnológicas.

En relación a la aceptación en el uso de programas que facilitan la colaboración institucional para compartir información digital, como encuestas, archivos, imágenes, entre otros, dentro de los destacados pudiendo mencionar Google Drive y el correo electrónico, estos permitiendo no solo el almacenamiento de grandes

cantidades información digital, sino también la edición en tiempo real de los datos compartidos, alcanzando una gran eficiencia y rápida captación de información para el procesamiento y salida de resultados con el fin de gestionar agrupaciones heterogéneas determinadas (Arias et al., 2014). Lo anterior demostrando que el intercambio de información digital mediante herramientas de tecnología, apoya a la institución en la generación de conocimiento promoviendo a la vez la toma de decisiones de la empresa apoyando la generación de beneficios sociales.

En ese sentido se generan beneficios económicos que permiten la autosostenibilidad de la institución mediante la implementación de los programas; sin embargo, el cambio constante en la tecnología obliga a la institución a buscar métodos para que el personal que utiliza los medios tecnológicos mencionados esté constantemente en preparación o capacitación, no solo en el uso de herramientas si no también como elementos de cambio que faciliten la transferencia de conocimiento. La vinculación en la academia es un proceso que no puede estar separado de la administración dados los 4 sectores que implica, social, público, privado y educativo, de los que se encontró una fuerte relación entra cada uno de ellos; tomando en consideración todas las herramientas tecnológicas mencionadas anteriormente que permitan la comunicación entre los sectores.

Mediante las entrevistas a involucrados en los procesos de Creación de Conocimiento y Vinculación Institucional, se denota la importancia de la utilización de TIC's en ambos procesos, pasando desde utilizar una comunicación directa por medio de mensajería como ser WhatsApp a herramientas colaborativas y que los involucrados puedan fácilmente adaptarse a las nuevas herramientas que aparecen en el mercado y que permiten el intercambio de información, hasta utilizar programas o aplicaciones como ser ZOOM, MS Teams, Google Meets, entre otros. Para Morales et al. (2013), establece que la investigación universitaria ha sido parte fundamental en el desarrollo de los procesos de innovación dentro de la sociedad, la cual debe ser considerada como un destinatario natural del conocimiento científico-tecnológico generado en las universidades.

## 5. Conclusiones

Las redes de conocimiento basadas en tecnologías de la información y comunicación (TIC) muestran una trascendencia significativa como dinamizadoras de interacciones y promotoras efectivas de la difusión de conocimiento. Se destaca el impacto relevante de las Tic en la facilitación de la interacción y el aprovechamiento de la innovación en el contexto a través de hallazgos que enfatizan la importancia crítica de fomentar la colaboración entre actores mediante el uso de redes dada su función fundamental en la estimulación y óptima difusión de conocimiento. Se sugiere promover proactivamente la adopción y colaboración en redes de conocimiento basadas en Tic tanto en el ámbito académico como empresarial, ya que esta convergencia estratégica puede catalizar el crecimiento y la eficiencia en la generación y aplicación del conocimiento, generando beneficios sustanciales para las instituciones involucradas contribuyendo al avance social y tecnológico en la sociedad. En cuanto a los procesos de vinculación si bien se muestra una relación se figuran distanciadas en el objetivo primordial de cada una por lo que se insta a fortalecer sus lazos.

La implementación de Tecnologías de la Información y Comunicación (TIC) en la colaboración y transferencia de conocimiento ha demostrado beneficios significativos, incluyendo una mayor eficiencia en la innovación y continuidad de los procesos. Los resultados resaltan la relevancia de mantener la información actualizada en las redes del conocimiento, lo que fortalece su impacto en la generación de conocimiento. Sin embargo, se identifican áreas de mejora en el uso estratégico y fortalecimiento de las de las herramientas que superen los obstáculos para la optimización y colaboración y el intercambio de información cuyos beneficios para quienes las utilizan permiten de manera fácil el almacenamiento y actualización de información inmediata, a través de los cuales se realiza la creación y/o transferencia de

conocimiento. En relación con esto, los resultados de la encuesta han demostrado que la utilización de TIC favorece no solo a la Vinculación, sino también a la creación de Redes del Conocimiento.

La vinculación institucional entre los grupos de estudio en diversos sectores, revelan áreas con oportunidades de mejora, especialmente en el sector social. Estas áreas de mejora ofrecen un espacio propicio para la innovación, permitiendo el desarrollo de nuevas estrategias y enfoques para fortalecer las relaciones, lo que propicia una base sólida para potenciar la generación de acuerdos y convenios que contribuyan al crecimiento y desarrollo interinstitucional. Como resultado la creación de Redes del Conocimiento utilizando los procesos de Vinculación incorporando herramientas tecnológicas que permiten el acercamiento de pares que buscan un beneficio mutuo, es preciso construir redes para poder formular, implementar y consolidar los cambios que requieren siendo una oportunidad que aporte valor a los procesos de cada parte interesada.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.4

Cómo citar:
Muñoz-Potosi, A.F., Castro-García, M.E., Valdivieso-González, L.G., Rodríguez-Montero, P., & Tepichín-Rodríguez, E. (2024). Fortalecimiento de competencias matemáticas en niños entre 10 y 13 años usando secuencias didácticas mediadas por las TIC. *Revista Eduweb*, 18(1), 48-65. https://doi.org/10.46502/issn.1856-7576/2024.18.01.4

# Fortalecimiento de competencias matemáticas en niños entre 10 y 13 años usando secuencias didácticas mediadas por las TIC

## Mathematical skills Strengthening in children between 10 and 13 years using didactic sequences mediated by ICT

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Recibido: 09/08/23
Aceptado: 12/01/24

**Resumen**

El objetivo del artículo es fortalecer las competencias matemáticas en estudiantes de séptimo grado de la Institución Educativa Santa María Goretti de Bucaramanga, Colombia a través de secuencias didácticas mediadas por las Tecnologías de la Información y Comunicación (TIC) y de la modelación de situaciones problema.
La metodología empleada en este trabajo consiste en un estudio cuantitativo, descriptivo donde participaron 98 estudiantes. Inicialmente, se realizó una prueba diagnóstica construida con preguntas de la prueba Evaluar para Avanzar, los resultados evidenciaron un bajo desempeño en saberes relacionados con Introducción a la geometría. Para fortalecer las temáticas, se diseñaron e implementaron dos secuencias didácticas mediadas por TIC. Finalmente, se realizó una valoración del impacto de la propuesta.
Los resultados obtenidos demostraron el impacto positivo de la propuesta porque los estudiantes pasaron de un nivel de desempeño Básico a un nivel Superior.

**Palabras clave:** educación básica, enseñanza centrada en el rendimiento, enseñanza de las matemáticas, tecnologías de la información y la comunicación, innovación pedagógica.

**Abstract**

The objective of this work is to strengthen mathematical skills in seventh grade students of the Santa María Goretti Educational Institution in Bucaramanga, Colombia. The above through didactic sequences mediated by Information and Communication Technologies (ICTs) and the modeling of problem situations.
The methodology used in this work consists of a quantitative, descriptive study where 98 students participated. By first, a diagnostic test to evaluate the conceptual knowledge of mathematics addressed in the previous year, built with questions from "Evaluar para avanzar" test, was carried out. The analysis of the results showed a low performance in topics related to Introduction to geometry. In order to strengthen this, we designed and implemented two didactic sequences mediated by ICTs. Finally, an impact assessment of the proposal, was carried out.
The results obtained showed the positive impact of the proposal given that the students went from a Basic level of performance to a Superior level.

**Keywords:** basic education, performance-based education, teaching mathematics, Information and Communications Technologies, pedagogical innovation.

## 1. Introducción

La Institución Educativa (IE) Santa María Goretti es una entidad oficial, fundada el 14 de enero de 1960. Esta Institución se encuentra ubicada en la zona urbana de Bucaramanga y ofrece servicios educativos en los niveles de preescolar (transición), básica primaria, básica secundaria y media académica.

Como en toda IE, existen parámetros que buscan medir de forma gradual el desempeño de los estudiantes y evaluar los conocimientos y habilidades adquiridos en la educación obligatoria. En el caso de Colombia, quien define los lineamientos asociados al desarrollo de las competencias educativas en los estudiantes es el Ministerio de Educación Nacional (MEN). Al respecto del área de matemáticas, los estudiantes de secundaria deben desarrollar competencias de comunicación, representación y modelación, planteamiento y resolución de problemas, así como de razonamiento y argumentación. (Fernández-Cézar et al., 2018).

De acuerdo con la Cartilla Nueve, los aprendizajes en matemáticas para sexto y séptimo grado propuesta por el MEN (Ministerio de Educación Nacional de Colombia, 2016) asociados con los Estándares Básicos de Competencias (EBC) relacionan; al pensamiento numérico con los sistemas numéricos, el pensamiento espacial con los sistemas geométricos, el pensamiento métrico con los sistemas de medida, el pensamiento aleatorio con los sistemas de datos y finalmente, al pensamiento variacional con los sistemas algebraicos y analíticos (Ministerio de Educación Nacional de Colombia, 1998).

Existen pruebas estandarizadas que permiten hacer comparaciones a nivel local, nacional e internacional del desempeño de los estudiantes. Para los niveles local y nacional, en Colombia se realizan las pruebas Saber, aplicadas por el Instituto Colombiano para la Evaluación de la Educación (ICFES). Estas pruebas evalúan las competencias básicas de los estudiantes definidos por el MEN, que se aplican en tercero, quinto y noveno grado (Rodríguez Rosero et al., 2021).

Recientemente, se ha implementado el programa Evaluar para Avanzar, que busca reducir las brechas educativas en Colombia, ofreciendo una gran variedad de herramientas para que los docentes apoyen, acompañen, den seguimiento y fortalezcan el desarrollo de los procesos de enseñanza a estudiantes desde 3° hasta 11° grado (Icfes, 2022).

A nivel internacional, existe el Programa de Evaluación Internacional de Estudiantes (PISA) de la Organización para la Cooperación y el Desarrollo Económico (OCDE), el cual "evalúa el desarrollo de las

habilidades y conocimientos de los estudiantes de 15 años en pruebas de lectura, matemáticas y ciencias" (Sanabria James et al., 2020).

De acuerdo con el ICFES en los resultados de las pruebas Saber 5 y 9, la IE presentó resultados comparables con la media nacional en el área de las matemáticas. Sin embargo, al comparar los niveles de desempeño con los colegios privados del área metropolitana, su calificación fue baja. Adicionalmente, en el año 2018 los estudiantes colombianos en el área de matemáticas tuvieron un desempeño mucho menor en el examen PISA que el promedio de la calificación obtenida por los países pertenecientes a la OCDE (Echazarra & Schwabe, 2019).

Los resultados anteriores evidencian la necesidad de desarrollar estrategias pedagógicas que, desde la innovación en los procesos de enseñanza-aprendizaje, permitan a los estudiantes fortalecer sus saberes y a los docentes, contar con herramientas que los apoyen en sus procesos de enseñanza.

## 2. Revisión de literatura

En la literatura se proponen diferentes estrategias pedagógicas que buscan mejorar el desarrollo de competencias digitales, investigativas y pensamiento complejo en estudiantes de diferentes grados de escolaridad (Sánchez-Otero et al, 2019; Amaya et al., 2020; Barrera et al, 2020; Linárez Ríos, 2020; Oseda Gago et al., 2020; Ríos-Cuesta, 2021; Sánchez et al, 2021; Acosta-Guarnizo et al., 2023).

En el área de las matemáticas, la teoría constructivista, juega un papel fundamental en el aprendizaje de los estudiantes, puesto que les permite llevar a cabo procesos de razonamiento y comprensión de conceptos abstractos, que les potencializa el planteamiento y la resolución de problemas (Mello & Hernández, 2019; Pinto Ladino et al., 2019; Bolaño Muñoz, 2020; Celi Rojas et al., 2021). Dicha teoría favorece el uso de actividades lúdicas innovadoras como los videojuegos, software educativo y desarrollo de actividades didácticas secuenciales y organizadas, que se articulan a los ejes temáticos y las estructuras metodológicas, permitiendo que los estudiantes desarrollen sus competencias a través de aprendizajes integrales que les faciliten la articulación de sus saberes conceptuales, actitudinales y procedimentales (González-González, 2019; Buriticá, 2019).

Al respecto de la importancia del desarrollo de las competencias matemáticas, autores como Duval (2016), Rondero & Font (2015) resaltan la importancia del aprendizaje de las matemáticas, puesto que desarrollan las capacidades de razonamiento, análisis y visualización de los estudiantes, por lo que impacta en los procesos cognitivos relacionados con su diario vivir (Pérez et al., 2020).

Es importante reconocer que en cualquier proceso de enseñanza-aprendizaje existen diferentes factores que influyen en el desempeño de los estudiantes. Autores como Becerra-González & Reidl (2015) y Rosário et al. (2012) identifican la influencia de los cambios motivacionales y contextuales de los estudiantes con su rendimiento académico (Castellanos, 2020; Leguizamón et al., 2020).

Con el fin de proponer alternativas de enseñanza que brinden un aprendizaje significativo en el área de matemáticas, diferentes autores han generado múltiples investigaciones asociadas a la innovación en los procesos pedagógicos. Entre estas investigaciones se destaca el uso de las TIC para favorecer el desarrollo de competencias matemáticas en los estudiantes por ser un elemento innovador en los procesos de enseñanza. Además, el uso de las TIC disminuye las brechas existentes en las aulas tradicionales puesto que permiten una interacción más abierta entre estudiante-profesor. Lo anterior, permite generar motivación por aprender y favorece la adaptación en función del nivel de aprendizaje de los actores (Arreguín et al., 2012; Sanabria Cárdenas, 2012; Pajarito Cadena, 2016; Martín et al., 2017; Tangarife Chalarca, 2018; Alvis-Puentes et al., 2019; Arévalo-Duarte et al., 2019; Henao Rendón et al., 2019).

Es importante notar, que la adopción de las TIC en el aula de clase implica un reto por parte del docente, puesto que su adaptación requiere llevar a cabo análisis de integración curricular de los medios tecnológicos como herramientas didácticas, así como también llevar a cabo profundizaciones de los entornos culturales de los estudiantes (Sánchez-Otero et al., 2019). Entre las estrategias pedagógicas, diferentes autores han mostrado la importancia de las actividades que contienen problemas, casos, proyectos y procesos integradores (Oseda Gago et al., 2020; Barrón-Hernández & Ramírez-Díaz, 2023). La estrategia del Aprendizaje Basado en Problemas (ABP) inició en 1969 en la Facultad de Medicina de la Universidad de McMaster Ontario en Canadá y tuvo como objetivo llevar a cabo transformaciones en algunas temáticas curriculares de tal manera, que se pudieran proponer actividades asociadas a problemas cotidianos que para solucionarlas requirieran la integración de diferentes áreas del conocimiento (Oseda Gago et al., 2020). Es por ello por lo que el ABP es una metodología educativa que permite que los estudiantes puedan dar solución a problemas planteados, haciendo uso de la creatividad y utilizando caminos alternativos que le permiten solucionar una problemática específica (Castaño & Montante, 2015; Paredes et al., 2015; Ortiz & Vega, 2020; Vera Velázquez et al., 2021).

Como argumenta Suárez (2021), las competencias matemáticas no se desarrollan de forma espontánea, sino que requieren ambientes de aprendizaje enriquecidos por situaciones problemáticas significativas. En Colombia, diferentes autores han desarrollado estrategias pedagógicas mediadas por TIC para fortalecer las competencias en matemáticas; entre otros, Martínez-López & Gualdrón-Pinto (2018); quienes diseñaron secuencias didácticas mediadas con TIC para fortalecer el pensamiento variacional en estudiantes de noveno grado, los resultados obtenidos les permitieron sugerir que la intervención generó cambios significativos en el grupo de estudiantes en lo relacionado al pensamiento variacional. También, Díaz Verdeza (2021), quien, a través de la implementación de una secuencia didáctica mediada con TIC, favoreció el desarrollo de habilidades y destrezas para la construcción e interpretación de gráficos estadísticos de situaciones problemas con los estudiantes de noveno grado de la institución educativa Virginia Gómez del municipio de Ciénaga, Magdalena. Adicional a lo anterior, Garavito (2022) describe la implementación de una propuesta didáctica en la Fundación Ombrella del municipio de San Gil, dirigida a adultos, usando la herramienta Educaplay; el autor menciona que la implementación fue exitosa aumentando la motivación de los alumnos y fomentando su participación en clase.

Por otro lado, Castiblanco Vinchira, Rojas Yomayuza, & Torres Ramírez (2022); resaltan la importancia de la creatividad y la adaptabilidad en la implementación de nuevas propuestas pedagógicas usando TIC en entornos rurales, a pesar de las limitaciones de infraestructura tecnológica; los autores proponen integrar gradualmente los recursos educativos digitales en las prácticas pedagógicas diarias.

En resumen, existe una gran variedad de estudios asociados con la mediación de las TIC en los procesos de enseñanza-aprendizaje de las matemáticas, donde las secuencias didácticas integran diferentes recursos tecnológicos, cuyo diseño se basa en enfoques constructivistas que buscan que el estudiante desempeñe un papel activo en su aprendizaje, desarrolle o fortalezca sus habilidades digitales comprendiendo los conceptos matemáticos de manera profunda y significativa a través de su asociación con la vida cotidiana, promoviendo la resolución de problemas contextualizados.

Sin embargo, se puede analizar que hay áreas poco exploradas, como la evaluación formativa y sumativa de las competencias matemáticas desarrolladas a través de las secuencias didácticas mediadas por TIC; la combinación de diferentes tipos de herramientas tecnológicas, las cuales podrían enriquecer aún más el proceso de enseñanza-aprendizaje y finalmente, la adaptación de las secuencias didácticas a contextos socioeconómicos y culturales de los estudiantes y las instituciones educativas.

De acuerdo a lo anterior, el propósito de este trabajo fue fortalecer a los estudiantes de grado séptimo con bajo desempeño, haciendo uso de recursos educativos digitales a través de secuencias didácticas para mejorar sus competencias matemáticas.

Para lograr este propósito, los objetivos específicos propuestos fueron: 1) identificar el nivel de competencia matemática de los estudiantes de 7º grado a través de una prueba diagnóstica, 2) diseñar una propuesta pedagógica apoyada en el uso de las TIC que permita motivar a los estudiantes y fortalecer las falencias matemáticas identificadas y 3) comparar el nivel de desempeño de los estudiantes en las competencias matemáticas que se buscaron fortalecer, después de aplicar las secuencias didácticas propuestas, haciendo uso de una prueba final.

## 3. Metodología

Para medir la efectividad de la propuesta, se desarrolló una investigación cuantitativa y descriptiva (Hernández-Sampieri & Mendoza, 2018), tomando como base los resultados de las pruebas diagnósticas al inicio y final de la implementación de la propuesta. La información obtenida se analizó por medio de procesos estadísticos y finalmente se señalaron las conclusiones.

La investigación se desarrolló en el segundo periodo del año 2021 en la IE Santa María Goretti con los estudiantes del séptimo grado de la jornada matutina, donde una de las autoras tenía a su cargo la dirección del curso, lo cual facilitó la disposición de los tiempos necesarios para la implementación de la propuesta. La población de estudio estuvo conformada por 180 estudiantes, cuyas edades están comprendidas entre los 10 y 13 años, que viven en barrios del sector y de estratos socioeconómicos 2 y 3. La muestra estuvo conformada por 98 estudiantes de la IE, quienes participaron activamente en el desarrollo de las actividades propuestas a través de la modalidad remota debida a la pandemia de la Covid-19. La elección de la muestra hizo uso de un muestreo no probabilístico por conveniencia.

Las variables consideradas en la investigación fueron cuantitativas, la variable dependiente se relacionó con el nivel de competencia matemática de los estudiantes y la variable independiente con los recursos TIC que mediaron la propuesta.

Para la realización de la prueba diagnóstica inicial, se tomó el instrumento de evaluación formativa evaluar para avanzar de Matemáticas de 6° grado del año 2021-1 propuesto por el Ministerio de Educación Nacional de la República de Colombia, que permite conocer los niveles de competencia de los estudiantes.

Este tipo de examen busca que los estudiantes analicen situaciones problema con diferentes contextos y que, haciendo uso de sus conocimientos matemáticos, puedan realizar toma de decisiones que les permitan elegir la respuesta correcta, en un cuestionario de opción múltiple. El análisis del resultado de esta prueba diagnóstica es un insumo primordial en las prácticas pedagógicas porque ofrece una retroalimentación a docentes y estudiantes. Dicho instrumento toma las competencias definidas en los EBC como metas de aprendizaje (Icfes, 2022) y en el área de matemáticas considera a las competencias descritas en la Tabla 1, donde se relaciona cada una de las 20 preguntas que tuvo la prueba diagnóstica, la competencia evaluada y los saberes conceptuales asociados (Icfes, 2022).

Es importante notar que, las preguntas son elaboradas a través del ICFES utilizando dinámicas de reflexión y discusión entre pares y expertos que garantizan la calidad y pertinencia de cada una de las preguntas. La eficiencia y calidad de las pruebas se evalúa usando el método de Bookmark (Icfes, 2022).

**Tabla 1.**
*Distribución de las preguntas asociadas con la prueba diagnóstica.*

| Pregunta | Competencia | Saberes asociados |
|---|---|---|
| 1 | Comunicación | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 2 | | Sistemas geométricos<br>Sistemas de medida |
| 3 | Resolución de problemas | |
| 4 | Comunicación | |
| 5 | | Sistemas de datos |
| 6 | | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 7 | Resolución de problemas | Sistemas de datos |
| 8 | | |
| 9 | | |
| 10 | Razonamiento | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 11 | Comunicación | Sistemas de datos |
| 12 | Resolución de problemas | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 13 | Razonamiento | Sistemas de datos |
| 14 | | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 15 | Comunicación | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 16 | Resolución de problemas | |
| 17 | Razonamiento | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 18 | Resolución de problemas | |
| 19 | | Sistemas numéricos<br>Sistemas algebraicos y analíticos |
| 20 | Razonamiento | |

Con el fin de llevar a cabo una agrupación de saber-hacer de los estudiantes, se definieron tres grandes grupos temáticos: (i) Introducción a la geometría, que considera a los sistemas geométricos y sistemas de medida, (ii) Estadística que incluye a sistemas de datos, y (iii) Acercamiento a los números enteros que compila a sistemas numéricos, sistemas algebraicos y analíticos.

En las preguntas relacionadas con Introducción a la geometría, el estudiante tenía que formular y resolver situaciones problémicas usando modelos geométricos. En la evaluación de este saber, los estudiantes también debían hacer uso de la conversión de unidades de medida y el cálculo de áreas. Las preguntas de Estadística buscaban que el estudiante mostrará su capacidad para explicar los resultados obtenidos utilizando las medidas de tendencia central y la compresión de gráficas relacionadas. Por último, en las preguntas enfocadas al Acercamiento a los números enteros se buscaba que el estudiante resolviera situaciones relacionadas con la vida cotidiana en las que se requería el uso de los números enteros, así como de sus operaciones.

A partir de la cuantificación de los resultados obtenidos por los estudiantes, se identificó que era necesario fortalecer los saberes asociados con Introducción a la geometría; por lo que se diseñaron dos secuencias didácticas mediadas por las TIC y finalmente, a través de una valoración del desarrollo de las mismas junto con una prueba valorativa final, se evaluó el impacto de la propuesta.

La aplicación de la prueba diagnóstica donde, los saberes cuestionados estaban asociados con las temáticas Introducción a la geometría, estadística y acercamiento a los números enteros. Se implementó

asincrónicamente mediante un formulario de Google y estuvo conformado por 20 preguntas de selección múltiple con única respuesta válida. Para la distribución de la prueba se usó la plataforma institucional INTEGRA, la cual permite gestionar los procesos académicos de las instituciones educativas y es usada por más de 70 instituciones del área metropolitana de Bucaramanga.

Los resultados obtenidos en la prueba diagnóstica se analizaron haciendo uso de tablas de distribución de frecuencias, las cuales permitieron evidenciar que los estudiantes analizados presentaban un bajo desempeño en los saberes asociados con el tema Introducción a la geometría. Por esta razón, fortalecer los saberes asociados a esta temática se convirtió en el principal objetivo de las secuencias didácticas.

El segundo paso de la investigación se relacionó con el diseño y aplicación de las secuencias didácticas, para las cuales se utilizó el ABP por medio de las TIC.

La primera de las secuencias didácticas trató el tema de Unidades de longitud. Una vez profundizada la conceptualización y los elementos propios de esta temática, se implementó la segunda secuencia didáctica en la cual se abordaron particularmente saberes conceptuales asociados a Perímetro y unidades de área. Para la aplicación de las mismas se usaron ejercicios que permiten formular y resolver problemas usando modelos geométricos que hacen necesaria la medición, la conversión de unidades y el cálculo de áreas.

Para el diseño de las propuestas pedagógicas mediadas por las TIC, se tuvo en cuenta la propuesta de Castillo (2008) quién resalta la importancia de algunos elementos fundamentales, que se describen a continuación:

- Objetivos de la propuesta pedagógica, especificando los conocimientos y aptitudes que los estudiantes alcanzarán al finalizar el tema o curso,
- Contenidos y temarios,
- Metodología, donde se determinan y especifican las actividades encaminadas a fortalecer el proceso de enseñanza y mejorar el aprendizaje de los estudiantes,
- Recursos didácticos tales como, videos, simuladores, plataformas, etc.
- Bibliografía, donde se enumeran todas las fuentes de información que fueron consultadas para la construcción de la propuesta pedagógica al igual que otro tipo de material como libros de texto, películas, videos, murales, maquetas, etc.;
- Organización y distribución en el tiempo asociados con el cronograma que se propone para la aplicación de la propuesta pedagógica, detallando los tiempos previstos para el desarrollo de cada una de las unidades y finalmente,
- La evaluación, donde se debe especificar el instrumento que se va a utilizar para evaluar el aprendizaje al igual que los criterios que se usan para la evaluación.

Para llevar a cabo la construcción del cuerpo de la propuesta, se tomó como referencia a Castillo (2008) quien considera las siguientes fases:

- Identificación de saberes previos: en esta etapa se aplican preguntas iniciales con el fin de indagar sobre los conocimientos previos que el estudiante posee sobre el tema a desarrollar.
- Actividades de desarrollo: estas actividades se realizan después de analizar los conocimientos propios que posee el estudiante de la temática tratada, desde un punto de vista conceptual y práctico. Posteriormente el estudiante estará en condiciones de argumentar y proponer a través de actividades como talleres, preguntas y ejercicios que conllevan a una profundización, consolidación y aplicación del conocimiento.
- Actividades de cierre: se realiza por medio de una evaluación a través de preguntas cerradas, para las cuales se establece una rúbrica de evaluación, también se llevan a cabo solución a situaciones problema, y se menciona los recursos bibliográficos utilizados en la propuesta pedagógica.

Para la evaluación de la prueba diagnóstica se empleó la escala valorativa usada por la IE Santa María Goretti. Sin embargo, debido a los requerimientos solicitados por el MEN con ocasión de la pandemia, la IE se vio en la necesidad de flexibilizar dicha escala valorativa. A partir de lo anterior, la escala valorativa adoptada se presenta en la Tabla 2, donde se establecen relaciones entre cualificaciones y cuantificaciones.

**Tabla 2.**
*Escala valorativa Institución Educativa Santa María Goretti con flexibilización.*

| Cualitativa | Cuantitativa |
|---|---|
| Superior | 4.6 hasta 5.0 |
| Alto | 4.0 hasta 4.5 |
| Básico | 3.0 hasta 3.9 |
| Pendiente | 1.0 hasta 2.9 |

## 4. Resultados y discusión

A continuación, se presentan en análisis de resultados obtenido para cada una de las fases desarrolladas.

*Fase 1. Diagnóstica:* Como se mencionó anteriormente, la prueba diagnóstica estuvo conformada por 20 preguntas de selección múltiple correspondientes a los saberes conceptuales manejados en: Introducción a la geometría, Estadística y Acercamiento a los números enteros.

En la Tabla 3 se presentan los resultados de la prueba diagnóstica, mostrando el promedio de su calificación, para cada temática evaluada, usando la escala valorativa de la Tabla 2.

**Tabla 3.**
*Resultado de la prueba diagnóstica por temáticas.*

| Temática | Promedio de la media | Escala cualitativa |
|---|---|---|
| Introducción a la geometría | 3.43 | Básico |
| Estadística | 4.01 | Alto |
| Acercamiento a los enteros | 4.27 | Alto |

De acuerdo con la información presentada en la Tabla 3, todos los estudiantes obtuvieron un desempeño Básico en Introducción a la geometría, por lo que se hizo necesario llevar a cabo el fortalecimiento de dicha temática.

A partir de este resultado se decidió plantear una estrategia didáctica para fortalecer las competencias matemáticas de los estudiantes de séptimo grado de la IE Santa María Goretti de Bucaramanga a través de la integración de las TIC, mediante la implementación de secuencias didácticas que incluyeron ejercicios relacionados con formular y resolver problemas usando modelos geométricos que hacen necesaria la medición, la conversión de unidades y el cálculo de áreas.

*Fase 2. Implementación y evaluación de la secuencia didáctica:* En la primera propuesta se abarcaron saberes conceptuales asociados a las Unidades de longitud y en la segunda propuesta se abarcaron saberes conceptuales asociados con el cálculo de perímetro y unidades de área.

Para el desarrollo de cada una de las propuestas, se planteó una actividad introductoria que hizo uso de los contenidos dispuestos en el programa Colombia Aprende (s.f) que es ofrecido por el gobierno colombiano, con sus correspondientes preguntas de exploración, a partir de las cuales se buscó identificar los conocimientos previos de los estudiantes. Posteriormente, se llevaron a cabo actividades de desarrollo

donde se presentaron las temáticas abordadas desde puntos de vista conceptual y práctico. Finalmente, se desarrolló una actividad de cierre donde se propuso llevar a cabo la solución a situaciones problema haciendo uso del ABP y una evaluación de preguntas cerradas con el fin de emitir un juicio valorativo del desempeño del estudiante. Con el fin de ejemplificar la propuesta pedagógica, en la Figura 1, se presentan imágenes de una de las secuencias didácticas propuestas.

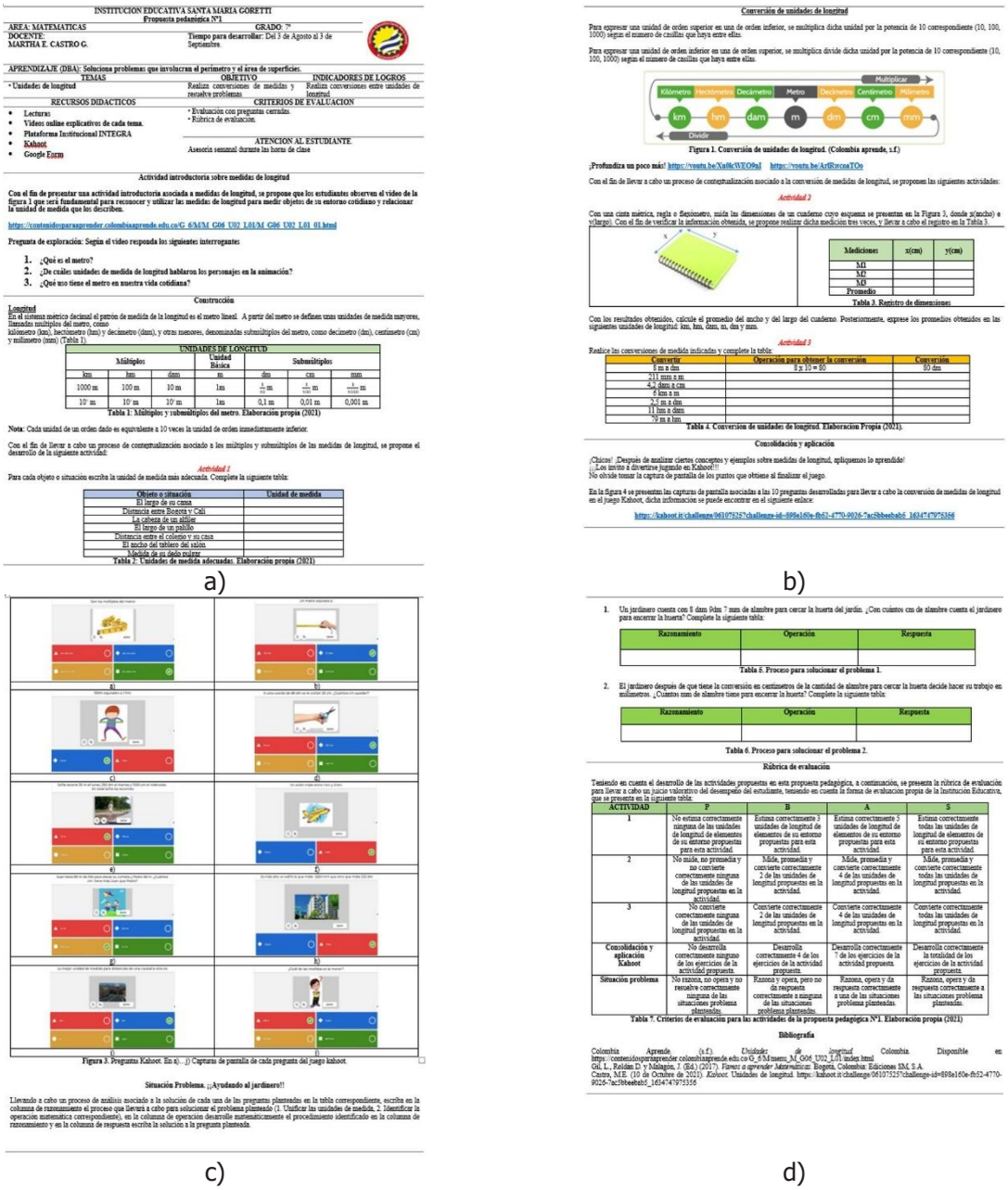


***Figura 1.*** Propuesta pedagógica Nº1.

El resultado de las evaluaciones realizadas al finalizar cada una de las cuatro actividades, durante la implementación de la propuesta No.1 se presenta en la Tabla 4. Como en el caso de la prueba diagnóstica, de nuevo se usó la escala valorativa presentada en la Tabla 1, donde (P) hace alusión a la cualificación

Pendiente, (B) a Básico, (A) a Alto y (S) a Superior. El nivel mínimo para aprobar cada una de las pruebas era Básico.

Para facilitar la lectura de las tablas, cada una de las actividades se identificó con una letra: preguntas de exploración (E), actividades de construcción (C), Actividad de consolidación y aplicación (CA) y ejercicios de situación problema (ABP). Los porcentajes de estudiantes aprobados, se calcularon teniendo en cuenta que cualificaciones superiores a desempeño Básico (B), son las consideradas aceptables, para el desempeño de los estudiantes.

**Tabla 4.**
*Desempeño de los estudiantes en la secuencia didáctica No. 1.*

| Sección | Actividad | Distribución de frecuencias del desempeño de los estudiantes | | | | Porcentaje de desempeño | |
|---|---|---|---|---|---|---|---|
| | | P | B | A | S | Aprobados | Reprobados |
| E | Preguntas de exploración | 4 | 14 | 22 | 58 | 96% | 4% |
| C | Actividad 1 | 19 | 14 | 24 | 41 | 81% | 19% |
| | Actividad 2 | 9 | 21 | 19 | 22 | 91% | 9% |
| | Actividad 3 | 11 | 26 | 16 | 45 | 89% | 11% |
| CA | Actividad | 26 | 33 | 18 | 21 | 73% | 27% |
| ABP | Ejercicios | 20 | 24 | 28 | 26 | 80% | 20% |

Para realizar una evaluación gradual del desempeño de los estudiantes, se utilizó la mediana como medida de tendencia central, lo que permitió realizar un análisis global de los resultados obtenidos por los estudiantes en la secuencia didáctica No.1, considerando que los valores de desempeño en cada una de las secciones cambiaron de manera significativa. De esta manera, se dio el mismo factor de peso a cada una de las actividades propuestas. Los resultados se presentan en la Tabla 5.

**Tabla 5.**
*Desempeño global de los estudiantes en la secuencia didáctica No. 1.*

| Secuencia No. | Mediana | Escala cualitativa |
|---|---|---|
| 1 | 4.4 | Alto |

Los resultados generales permitieron encontrar que el desempeño de los estudiantes estuvo Alto lo que indicó que lograron apropiarse de los saberes presentados en la secuencia didáctica No.1. Se puede entonces afirmar que la secuencia didáctica propuesta, donde se abarcaron saberes conceptuales asociados a las Unidades de longitud, generó un impacto positivo en los estudiantes.

Al igual que en el caso anterior, para la evaluación de la secuencia didáctica No. 2 inicialmente se plantearon preguntas de exploración (E), seguido por actividades de construcción (C), actividad de consolidación y aplicación (CA) y ejercicios de situación problema (ABP). Los resultados se presentan en la Tabla 6. Es de notar que el desempeño de los estudiantes, nuevamente se cualificó según la información presentada en la Tabla 1.

**Tabla 6.**
*Desempeño de los estudiantes en la secuencia didáctica No. 2.*

| Sección | Actividad | Distribución de frecuencias del desempeño de los estudiantes | | | | Porcentaje de desempeño | |
|---|---|---|---|---|---|---|---|
| | | P | B | A | S | Aprobados | Reprobados |
| E | Preguntas de exploración | 6 | 14 | 23 | 55 | 94% | 6% |
| C | Actividad 1 | 3 | 15 | 35 | 45 | 97% | 3% |
| | Actividad 2 | 8 | 27 | 29 | 34 | 92% | 8% |
| | Actividad 3 | 4 | 34 | 25 | 35 | 96% | 4% |
| | Actividad 4 | 12 | 20 | 33 | 33 | 88% | 12% |
| CA | Actividad | 13 | 32 | 26 | 27 | 87% | 13% |
| ABP | Ejercicios | 12 | 27 | 21 | 38 | 88% | 12% |

Para realizar un análisis global de los resultados obtenidos por los estudiantes en la secuencia didáctica No. 2, se utilizó nuevamente la mediana como medida de tendencia central, los resultados se presentan en la Tabla 7.

**Tabla 7.**
*Desempeño global de los estudiantes en la secuencia didáctica No. 2.*

| Secuencia No. | Mediana | Escala cualitativa |
|---|---|---|
| 2 | 4.6 | Superior |

Los resultados generales permitieron encontrar que el desempeño de los estudiantes estuvo en Superior lo que indicó que lograron apropiarse de los saberes evaluados en la secuencia didáctica No. 2 donde se abarcaron saberes conceptuales asociados con el cálculo de perímetro y unidades de área.

*Fase 3. Evaluación:* Luego de los resultados positivos de la implementación y evaluación de las secuencias didácticas No. 1 y No. 2, se realizó una actividad evaluativa de cierre, en la cual se utilizó nuevamente la prueba diagnóstica, la cual no se había socializado con los estudiantes, lo anterior, con el fin de comparar el desempeño de los estudiantes antes y después de la implementación de la propuesta (Lozano García, 2021).

Con el fin de llevar a cabo una comparación de los desempeños de los estudiantes, antes y después de la propuesta, se presentan en la Figura 2, el promedio de los desempeños obtenidos por los estudiantes para las tres áreas temáticas evaluadas en la prueba diagnóstica. En ella se evidencia que el desempeño de los estudiantes en el área Introducción a la geometría fue Básico, razón por la cual esta temática fue el insumo fundamental para el desarrollo de esta propuesta.

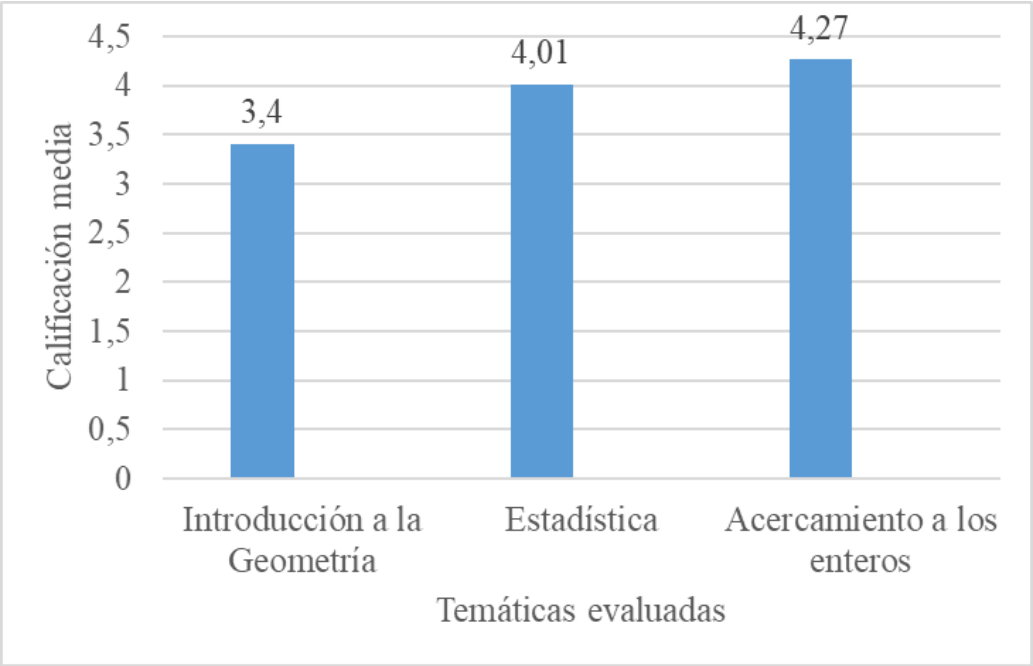


***Figura 2.*** Desempeño de los estudiantes en la prueba diagnóstica inicial por temáticas.

El impacto de la propuesta se hace evidente en la Figura 3, en ésta se presenta el desempeño de todos los estudiantes en las pruebas inicial (diagnóstica) y final, considerando únicamente los saberes conceptuales asociados a Introducción a la geometría.

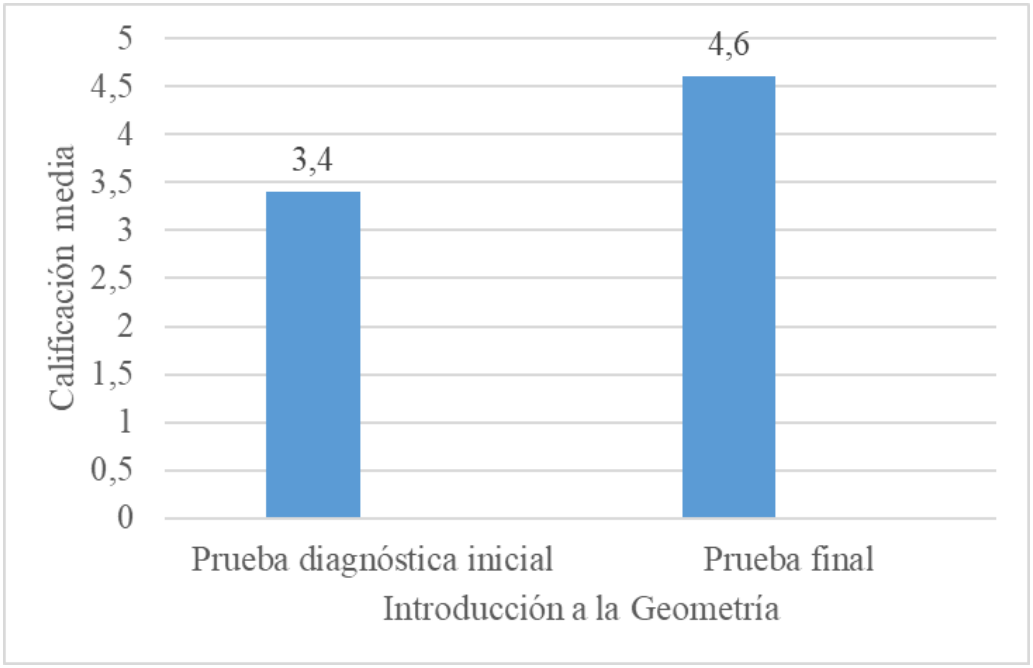


***Figura 3.*** Comparación entre el desempeño de los estudiantes en la prueba diagnóstica inicial y la prueba final para la temática Introducción a la geometría.

La Figura 3 muestra el impacto positivo de la propuesta para el mejoramiento de los saberes conceptuales en la temática de Introducción a la geometría. Podemos afirmar que las secuencias didácticas impactaron positiva y directamente en las competencias matemáticas de los estudiantes del séptimo grado de la IE Santa María Goretti de Bucaramanga.

Es posible afirmar lo anterior ya que los parámetros que debe satisfacer el estudiante en esas competencias, de acuerdo al ICFES (2018), hacen referencia a las habilidades necesarias para comprender cierta información y representarla usando diferentes tipos de formatos como tablas, gráficas, diagramas, esquemas, etc. Así como a la capacidad de establecer patrones y relaciones matemáticas a partir de esas representaciones y aplicar habilidades desarrolladas en los distintos pensamientos enfocadas a la resolución de problemas. Lo antes mencionado se pudo evidenciar en cada una de las actividades planteadas en las dos propuestas pedagógicas desarrolladas.

Como se mencionó anteriormente, para el desarrollo de cada una de las propuestas de las secuencias didácticas se planteó una actividad introductoria, seguida por la presentación de las temáticas abordadas desde puntos de vista conceptual y práctico. El propósito de estas actividades es que el estudiante lograra la consolidación y aplicación de los saberes conceptuales, mediante la metodología presentada por Kahoot (Dos Santos Teotônio et al., 2021; Umboh et al., 2021) y PheT Colorado (Díaz Pinzón, 2018; de Sousa & Alves, 2022) las cuales son herramientas gratuitas, de acceso libre utilizados por profesores de educación básica, que están muy comprometidas dentro de la gamificación en el contexto educativo puesto que permite desplegar actividades que motivan y estimulan el desarrollo cognitivo de los estudiantes.

Los resultados presentados, luego de la implementación de las secuencias didácticas, confirman la hipótesis propuesta por diferentes autores Duarte (2014), Ríos Londoño & Yañez Figueroa (2016), Carreño Gómez et al. (2018), Grisales Aguirre (2018) y Conde-Carmona et al. (2021) quienes resaltan la importancia del uso y apropiación de los recursos TIC en el aula de clase y el impacto positivo que tienen en los procesos de aprendizaje de las matemáticas y su relación con el desarrollo de las habilidades para la resolución de problemas en distintos contextos.

Finalmente, se comprobó que la mediación de las TIC en la enseñanza de las matemáticas, permite a los estudiantes desarrollar competencias que le permitan comprender la complejidad de una situación problémica, como lo afirma (Lozano García, 2021).

## 6. Conclusiones

La aplicación de la prueba diagnóstica permitió identificar falencias asociadas a la temática que se debía reforzar, en este caso Introducción a la geometría.

La selección de la plataforma institucional INTEGRA como recurso TIC para la implementación de la propuesta didáctica, fue un aspecto positivo que favoreció a los estudiantes de bajos recursos, para participar en todas las actividades escolares a través del trabajo en modalidad remota, permitiendo el cumplimiento de sus deberes escolares a pesar de la emergencia sanitaria debida a la pandemia generada por la COVID-19.

La incorporación de las ABP en las secuencias didácticas mediadas por las TIC, favoreció la apropiación de los conceptos matemáticos, puesto que los estudiantes solucionaron situaciones problémicas en distintos contextos.

Los resultados generales posteriores a la implementación de las propuestas pedagógicas, valorados de acuerdo con la escala cualitativa de la IE, mostraron que el desempeño de los estudiantes mejoró ya las calificaciones, se ubicaron en Superior, lo que indica que lograron apropiarse de los saberes evaluados.
Los resultados iniciales y finales, permitieron demostrar el impacto positivo que generaron las secuencias didácticas en los estudiantes, puesto que en la prueba inicial "Diagnóstica" el desempeño de los estudiantes del séptimo grado fue Básico y en la prueba final "Aprender para evaluar" fue Superior.

También se pudo concluir que el diseño e implementación de secuencias didácticas mediadas por TIC, permitió fortalecer las competencias matemáticas asociadas con Introducción a la geometría, abordadas por estudiantes del séptimo grado de la IE Santa María Goretti de Bucaramanga.

Todo lo anterior, permitió dar respuesta a la pregunta de investigación, por lo tanto, se pudo afirmar, que a través del uso de las TIC los estudiantes del grado séptimo de la IE Santa María Goretti de Bucaramanga mejoraron sus competencias matemáticas asociadas con Introducción a la geometría.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.5

Cómo citar:
González Torres, A., Pereira Hernández, M.L., & Lacruhy Enríquez, C.C. (2024). Hombres y mujeres en el aprendizaje virtual: ¿Opinión diferenciada de la calidad en la formación en línea? Revista Eduweb, 18(1), 66-80. https://doi.org/10.46502/issn.1856-7576/2024.18.01.5

# Hombres y mujeres en el aprendizaje virtual: ¿Opinión diferenciada de la calidad en la formación en línea?

## Men and women in the e-learning era: Differential views on quality in online training?

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Recibido: 10/02/24
Aceptado: 26/03/24

**Resumen**

La finalidad de la presente examinación fue evaluar si existe una percepción diferente entre hombres y mujeres en relación a la excelencia y calidad de los cursos de formación en línea. Para la ejecución del estudio se empleó una sistemática cuantitativa de alcance descriptivo, se destinó un instrumento a 95 escolares. Los resultados mostraron que tanto hombres como mujeres valoran positivamente la flexibilidad y accesibilidad que ofrece la educación en línea. Se concluye que ambos géneros están de acuerdo en la relevancia de la interacción con el docente y los compañeros para una experiencia educativa enriquecedora. Se reconoce el provecho de las herramientas didácticas disponibles en las plataformas virtuales.

**Palabras clave:** aprendizaje virtual, calidad educativa, género, educación a distancia.

**Abstract**

The purpose of this study was to evaluate whether there is a different perception between men and women about the excellence and quality of online training courses. A descriptive quantitative systematic approach was used to carry out the study, and an instrument was administered to 95 schoolchildren. The results showed that both men and women value positively the flexibility and accessibility offered by online education. It is concluded that both genders agree on the relevance of interaction with teachers and classmates for an enriching educational experience. The benefits of the didactic tools available on virtual platforms are recognized.

**Keywords:** Virtual learning, educational quality, gender, distance education.

## 1. Introducción

El avance hacia la consecución del Objetivo de Desarrollo Sostenible 4, relacionado con la educación de calidad en el marco de la Agenda 2030, se vio impactado por la pandemia de Covid-19, especialmente en lo que respecta a "la meta 4.3. Dicha meta tiene como objetivo asegurar, para el año 2030, un acceso equitativo a una educación técnica, profesional y superior de calidad para todos, sin importar su género, lo que abarca la enseñanza universitaria" (Naciones Unidas, 2023).

Con el fin de tener acceso a la enseñanza, las universidades a nivel internacional migraron sus modelos educativos con sus procesos tradicionales de formato presencial a un modelo online sobre la marcha. Lo que permitió experimentar e implementar acciones estrategias de enseñanza-aprendizaje y demostró que el sistema educativo es adaptable a las necesidades del entorno (Bakkronova, 2021).

Sin embargo, la educación en virtual conlleva desafíos y perspectivas en el desarrollo de mejores prácticas para el aprendizaje de los educandos, desde el proceso de enseñanza – aprendizaje virtual (Espina, 2022); la modalidad mejoró aceleradamente a lo largo de la pandemia en beneficio del estudiante y profesor.

La calidad educación en línea se influyen por diversos factores, entre ellos la percepción de género, por esta razón, el propósito del artículo fue analizar si hay una divergencia en la percepción entre hombres y mujeres respecto a la eficacia de la educación en línea.

Esta investigación participó una Institución de Educación Superior en el escenario de la pandemia en México, a un programa educativo de las carreras: Ingeniería en Gestión Empresarial y Bioquímica, donde es se desconoce si existe percepción diferenciada por el género.

El artículo se estructura además de la introducción, en la segunda sección con referentes teóricos, en la tercera sección la metodología de corte cuantitativo y en la quinta sección la conclusión de los autores.

## 2. Referentes teóricos o revisión de literatura

La Calidad educativa en la educación a distancia, se influye con diversos factores, entre ellos la interacción entre docentes y estudiantes, así como el material de aprendizaje (Lui et al., 2016).

Por su parte, Inojosa, (2023) reconoce las competencias de estudiante influyen en la calidad de su aprendizaje, desde la organización de manera autónoma, interacción de aprendizajes entre pares para la construcción de conocimiento, el desarrollo de dialogo constructivo, desarrollo de estrategias de administración del tiempo y la capacidad de usar las tecnologías de información con autonomía en su aprendizaje.

Jaramillo, Sarango & Zambrano, (2023) identificaron a las plataformas, recursos digitales, acompañamiento docente son herramientas que facilitan las buenas prácticas en el entorno de aprendizaje virtual. Por último, Marciniak & Garín (2016) sintetizaron las dimensiones de las estructuras para valorar la aptitud de la formación virtual presentadas en la tabla 1.

**Tabla 1**.
*Modelos de evaluación de calidad educativa*

| Modelo | Nación/Año | Objetivo | Dimensión |
|---|---|---|---|
| Open ECBCheck | Bélgica, 2010. | Coadyuvar a las compañías en la gestión de la formación en línea para lograr el éxito. | Datos ordinarios del programa.<br>Receptores.<br>Aptitud.<br>Esbozo del plan de estudios.<br>Valoración y monitoreo. |
| CALED | América Latina y Caribe, 2010. | Favorecer al progreso de la aptitud en la formación en línea en los institutos de América Latina y Caribe. | Herramientas innovadoras<br>Alineación<br>Planificación curricular<br>Bienes<br>Respaldo |
| E-Quality Framework for E-learing | Suecia, 2012. | Perfeccionar la aptitud de la formación en línea de manera clara. | Elemento tecnológico<br>Componente planificación curricular<br>Respaldo de la institución.<br>Apoyo al alumno.<br>Elemento de valoración.<br>Elemento didáctico. |
| Valoración de formación virtual | España, 2015 | Coadyuvar a las instituciones a ejecutar la valoración comparativa de la aptitud de formación en línea dada con un benchmarking. | Planificación del entorno<br>Contexto de la institución<br>Procedimientos.<br>Procesos pedagógicos<br>Plataforma educativa. |
| Excellence Model | Unión Europea, 2016. | Plantear una sistemática y recursos para el apoyo de la aptitud de la formación en línea en educación universitaria. | Formulación de estrategias<br>Planificación curricular Esbozo del curso.<br>Entrega del curso.<br>Respaldo de las personas.<br>Apoyo del escolar. |

Fuente: adaptado de Marciniak & Garín (2016).

En los modelos anteriores, no se observa, la Influencia del género en el aprendizaje virtual. Mercado & Otero (2022) en México determinaron efectos diferenciados en estudiantes de carreras económico-administrativas, las mujeres mostraron mayores afectaciones en salud mental y física, sin embargo, eran más participativas y mostraron evidencia de poner en práctica habilidades meta- cognitivas.

Concordado con los estudios jóvenes universitarios ecuatorianos, donde encontraron que la satisfacción en el aprendizaje virtual participantes mujeres fueron mayores que los hombres con una correlación positiva (Jaramillo, Sarango & Zambrano, 2023).

## 3. Metodología

La metodología fue un enfoque cuantitativo con un diseño no experimental, con alcance descriptivo. En el campo de la investigación cuantitativa, se ha evidenciado un marcado perfeccionamiento de los modelos matemáticos para descifrar relaciones complejas en entornos sociales; estos avances han demostrado ser particularmente significativos en disciplinas como educación, salud, psicología y sociología, a pesar de ser disciplinas avocadas al ámbito social, la metodología cuantitativa persiste en la cuantificación de resultados, conserva su característica distintiva, otorgándole la capacidad de validar o refutar teorías mediante la evidencia empírica (Babativa, 2017).

El análisis de datos mediante estadísticas, ofrece la capacidad de anticipar situaciones conforme al marco teórico establecido, además de proporcionar explicaciones sobre eventos basándose en datos de muestra;

permite simplificar el proceso de toma de decisiones en la solución de problemas de investigación, además, la orientación de este diseño persigue la observación del fenómeno de estudio en su entorno natural, con el objetivo de reflexionar y derivar conclusiones en un momento posterior (Babativa, 2017).

### Diseño no experimental

La investigación no experimental carece de la manipulación de una variable independiente y la asignación aleatoria; en cambio, los investigadores simplemente observan y miden variables tal como ocurren naturalmente, de igual manera, abarca diversas aproximaciones como descriptiva, comparativa causal, evaluativa, basada en datos existentes, metaanálisis, entre otras (Mohajan, 2020). Para esta investigación se realizó una investigación descriptiva para comprender en detalle la percepción del estudiantado acerca del proceso de aprendizaje en línea durante el periodo de la pandemia, lo que implicó observar y medir variables relevantes, como la satisfacción del estudiante, la participación en clases en línea, la eficacia de las herramientas tecnológicas utilizadas, entre otras, sin manipular ninguna variable independiente ni asignar aleatoriamente participantes a condiciones, utilizando un cuestionario tipo escala de Likert.

### Instrumento

El instrumento estuvo estructurado en tres secciones de preguntas: una dedicada a la interacción con los profesores (7 preguntas), otra relacionada a la interacción entre pares (6 preguntas), y una tercera sección con 19 preguntas concernientes a la metodología (9 preguntas) y la conectividad (10 preguntas). Las respuestas se registraron en cuatro posibles respuestas donde "totalmente en desacuerdo" equivale a 1, "desacuerdo" a 2, "acuerdo" a 3 y "totalmente de acuerdo" a 4. La escala de categorías es una técnica de medición de creencias, preferencias y actitudes ampliamente utilizada en la investigación del comportamiento, esta técnica, implica que los sujetos asignen cuantificadores relacionados con la frecuencia (siempre, a veces, nunca, etc.) o la cantidad (todo, algo, nada, etc.); las respuestas deben estar alineadas con los objetivos del investigador, y la escala permite recabar más información en menos tiempo (Cañadas & Sánchez, 1998).

La validez del instrumento fue evaluada mediante un examen realizado por un grupo compuesto por nueve personas. En cuanto a su certeza, se fijó manejando la Cifra Alfa de Cronbach, alcanzando un dígito de 0.887.

### La muestra

Para esta investigación se utilizó una muestra representativa de 95 estudiantes. Se utilizó el procedimiento de muestreo por cuotas implicando la formación de grupos tomando en cuenta características compartidas (Ñaupas et al., 2014). En este caso, estudiantes que hubieran participado de manera constante en los programas en línea durante pandemia en las asignaturas de: Plan de Negocios, Formulación y Evaluación de Proyectos, Formulación y Evaluación de Proyectos y Calidad aplicada a la Gestión Empresarial.

## 4. Resultados y discusión

Para esta sección se presenta en la tabla 2 la distribución de asignaturas examinadas y la estratificación por género.

**Tabla 2**.
*Distribución de personas y asignaturas*

| Materia | Hombres | Mujeres |
|---|---|---|
| Plan de Negocios | 8 | 11 |
| Formulación y Evaluación de Proyectos B92 | 4 | 13 |
| Formulación y Evaluación de Proyectos B91 | 11 | 29 |
| Calidad Aplicada a la Gestión Empresarial | 8 | 11 |

La tabla preliminar se observa que la asignatura de Formulación y Evaluación de Proyectos B91 tuvo un mayor número de personas, seguido de las asignaturas de Calidad Aplicada a la Gestión Empresarial y Plan de Negocios, por último, la materia que obtuvo un número de personas menor fue la de Formulación y Evaluación de Proyectos B92.

La distribución de género en las asignaturas del programa educativo revela patrones interesantes. La asignatura de Formulación y Evaluación de Proyectos B91 cuenta con la mayor cantidad de estudiantes, destacando una marcada mayoría de mujeres en comparación con hombres. Este fenómeno podría atribuirse a factores como la percepción de las mujeres hacia los temas abordados en esta asignatura o sus intereses profesionales. Por otro lado, en la asignatura de Formulación y Evaluación de Proyectos B92, aunque el número total de estudiantes es menor, se observa una proporción significativamente mayor de mujeres, sugiriendo un posible mayor interés de este grupo por ciertos aspectos específicos del campo. En contraste, las asignaturas de Calidad Aplicada a la Gestión Empresarial y Plan de Negocios muestran distribuciones de género más equitativas, indicando un interés relativamente similar entre hombres y mujeres en estas áreas de estudio. Estas disparidades de género pueden tener implicaciones en la dinámica del aula y subrayan la importancia de diseñar estrategias inclusivas que fomenten la participación equitativa de todos los estudiantes, independientemente de su género, en todas las áreas de estudio del programa educativo.

La tabla 3 presenta el coeficiente Alfa de Cronbach, utilizado como medida de fiabilidad del instrumento de investigación. Con un valor de 0.979, se demuestra una alta consistencia interna entre las variables evaluadas en el estudio. El resultado es consistente con las ideas expuestas por Botigué (2013) e Hinojosa (2022), quienes señalan que un coeficiente Alfa de Cronbach cercano a 1 indica una alta confiabilidad del instrumento utilizado. Por lo tanto, se puede afirmar que el instrumento empleado en la investigación es altamente confiable para medir las variables consideradas.

**Tabla 3**.
*Cifras de certeza*

| Alfa de Cronbach | No. de variables |
|---|---|
| .979 | 32 |

Asimismo, la tabla 4 se visualizan los dígitos de las 4 extensiones del instrumento empleado para la examinación.

**Tabla 4**.
*Cifras de certeza*

| Dimensión | Alfa de Cronbach | No. de elementos |
|---|---|---|
| 1era | .907 | 7 |
| 2da | .881 | 6 |
| 3era | .912 | 9 |
| 4ta | .925 | 10 |

Los resultados confirman la validez y confiabilidad del instrumento utilizado en el estudio, respaldando las conclusiones obtenidas en la tabla 2. La consistencia interna observada en todas las dimensiones sugiere que las mediciones realizadas son precisas y confiables, lo que fortalece la credibilidad de los hallazgos del estudio. Además, la concordancia de estos resultados con las ideas de Zambrano & Haro (2023) subraya aún más la robustez de las mediciones y la validez del estudio en general.

La figura 1 alude a la percepción por parte del género a la asignatura Calidad Aplicada a la Gestión Empresarial, destacando una diferencia mínima a favor de los hombres.

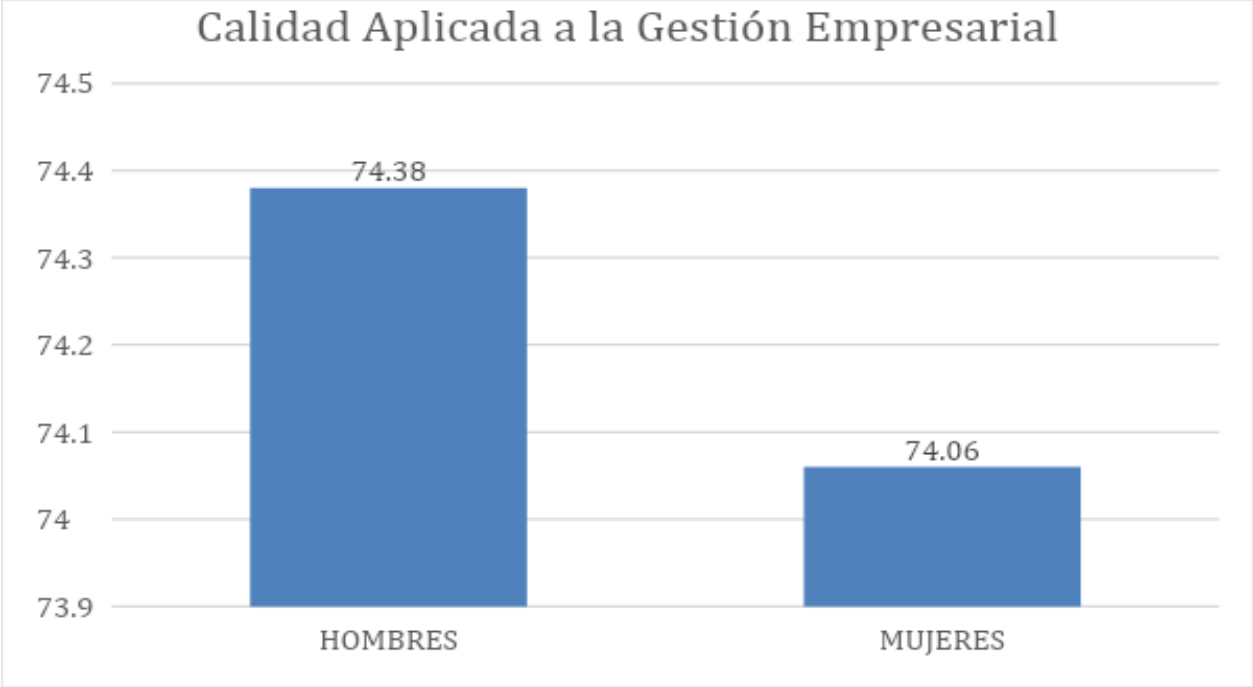


***Figura 1***. Opinión del género.
Fuente: Elaboración propia con base en el programa SPSS, versión 25.

La figura 2 indica a la percepción por parte del género en la materia Formulación y Evaluación de Proyectos B91, destacando una diferencia a favor de los hombres. Los resultados sugieren que, aunque la diferencia en las puntuaciones promedio es mínima, podría indicar posibles disparidades en la percepción de la calidad de la enseñanza o el contenido del curso entre hombres y mujeres en esta asignatura específica. Sin embargo, es importante tener en cuenta que la diferencia es bastante pequeña y podría no ser estadísticamente significativa.

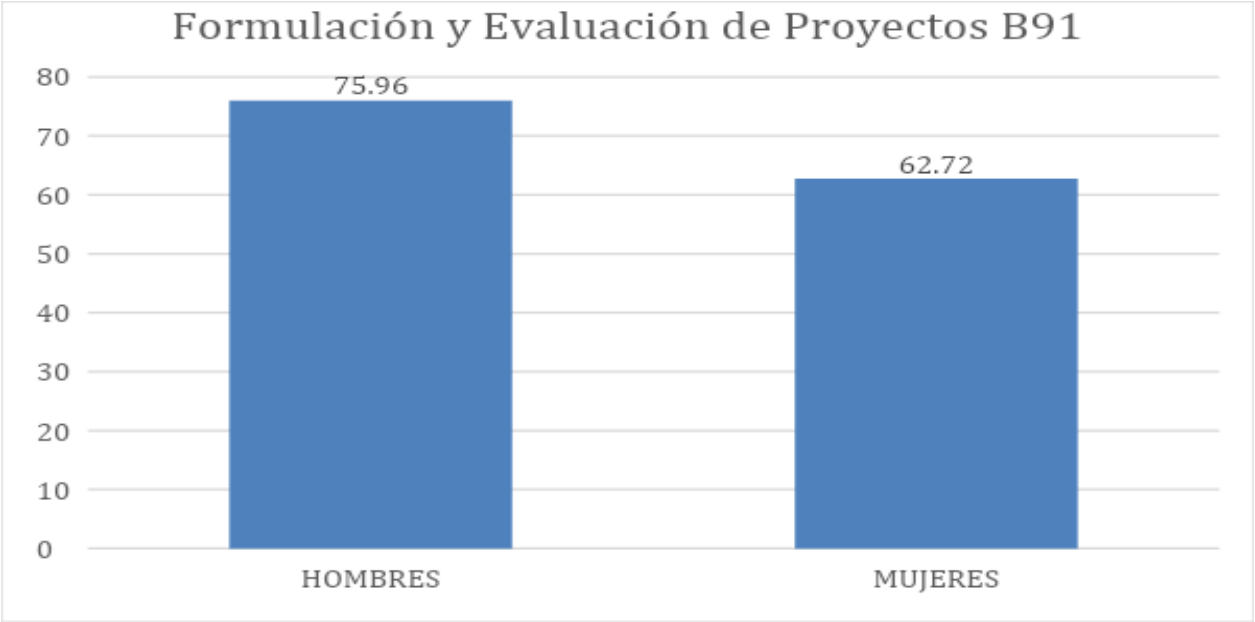


***Figura 2***. Informe del género.
Fuente: Elaboración propia con base en el programa SPSS, versión 25

La figura 3 revela a la percepción por parte del género en la asignatura Formulación y Evaluación de Proyectos B92, destacando una diferencia a favor de las mujeres.

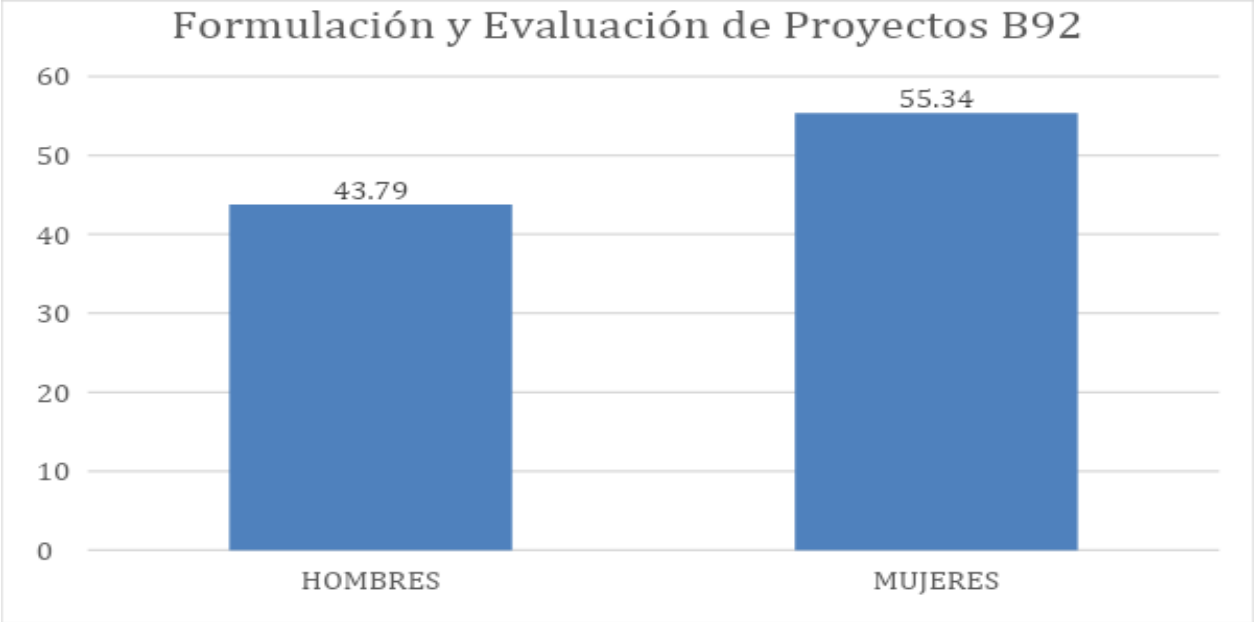


***Figura 3***. Opinión del género.
Fuente: Elaboración propia con base en el programa SPSS, versión 25.

Los resultados de la figura 3. sugieren una disparidad significativa en la percepción de la calidad de la enseñanza o el contenido del curso entre hombres y mujeres en esta asignatura específica. La diferencia en las puntuaciones promedio puede indicar que las mujeres perciben la asignatura de Formulación y Evaluación de Proyectos B92 de manera menos favorable en comparación con los hombres.

Esta discrepancia en la percepción entre hombres y mujeres podría tener implicaciones en términos de compromiso estudiantil, satisfacción académica y desempeño en el curso. Es fundamental abordar estas disparidades de género y trabajar hacia un ambiente educativo más inclusivo y equitativo para garantizar que todos los estudiantes, independientemente de su género, tengan experiencias educativas positivas y exitosas.

La figura 4 enseña la percepción por parte del género en la materia Plan de Negocios, destacando una diferencia a favor de las mujeres.

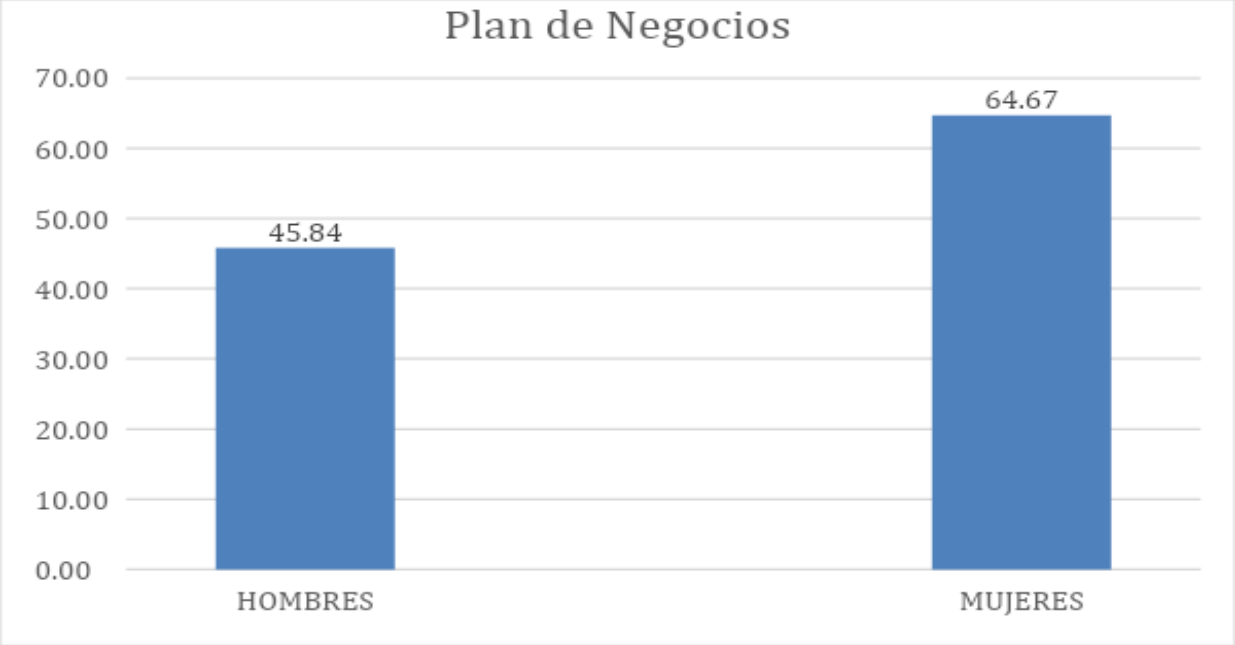


***Figura 4***. Informe del género.
**Fuente**: Elaboración propia mediante el programa SPSS, versión 25.

La figura 4 revela una diferencia significativa en la percepción entre hombres y mujeres en la asignatura de Plan de Negocios. Los hombres muestran una puntuación promedio de 45.84, mientras que las mujeres muestran una puntuación promedio considerablemente más alta de 64.67.

Los resultados sugieren una disparidad importante en la percepción de la calidad de la enseñanza o el contenido del curso entre hombres y mujeres en esta asignatura específica. La diferencia en las puntuaciones promedio puede indicar que las mujeres perciben la materia de Plan de Negocios de manera más favorable en comparación con los hombres.

La tabla 5 alude el comportamiento de los datos para el género masculino. Para ello se formuló la siguiente prueba de hipótesis basada en argumentos de Sucso (2023):

$H_o$: Los datos del género siguen una distribución normal.
$H_1$: Los datos del género no siguen una distribución normal.

Para ello, se siguió lo descrito por Asto & Pavel (2023), los cuales aluden que, si la muestra de datos es menor a 50, se debe de emplear la prueba Shapiro Wilk.

**Tabla 5**.
*Cifras de certeza*

| | **Shapiro-Wilk** | | |
|---|---|---|---|
| | Estadístico | gl | Sig. |
| **Hombres** | 0.926 | 31 | 0.034 |

Las cifras de la tabla anterior concluyen que los datos del género masculino no siguen tiene una distribución normal, debido a que el resultado Sig. De 0.034 es menor que 0.05 y concuerdan con lo descrito por Luzuriaga et al. (2023).

La tabla 6 apunta el comportamiento de los datos para el género femenino. Para ello se formuló la siguiente prueba de hipótesis, la cual siguió argumentos de Sánchez et al. (2022):

$H_o$: Los dígitos del género siguen una distribución normal.
$H_1$: Los dígitos del género no siguen una distribución normal.

Para ello, se siguió lo descrito por Núñez & Villanueva (2023) para poder emplear la prueba Kolmogorov-Smirnov.

**Tabla 6**.
*Cifras de fiabilidad*

| | **Kolmogorov-Smirnov[a]** | | |
|---|---|---|---|
| | Estadístico | gl | Sig. |
| **Mujeres** | 0.115 | 64 | 0.034 |

Los dígitos de la tabla anterior concluyen que los datos del género femenino no siguen tiene una distribución normal, debido a que el resultado Sig., de 0.034 es menor que 0.05, está interpretación coincide con lo señalado por Viteri y De Jesús (2023).

Una vez que se conoce que los números de ambos géneros no tiene una distribución normal, se optó por emplear la prueba W de Mann-Whitney, esta decisión se optó por lo sugerido por Aquino et al. (2023). Para ello se empleó un nivel de significancia de 0.05, debido a que es el que más se utiliza en la disciplina de ciencias sociales.

Conjuntamente, se formuló la siguiente prueba de hipótesis, la cual sigue recomendaciones de Acosta et al. (2023):

Ho: Los datos del género no presentan diferencias en el nivel de percepción.
H1: Los datos del género si presentan diferencias en el nivel de percepción.

La tabla 7 manifiesta las cifras obtenidas de los rangos en el género una vez aplicado el análisis de W de Mann-Whitney.

**Tabla 7**.
*Hallazgos de rangos del género*.

| **Rangos** | | | | |
|---|---|---|---|---|
| | Género | N | Rango promedio | Adición de rangos |
| **Puntuación** | Hombre | 31 | 49.45 | 1533.00 |
| | Mujer | 64 | 47.30 | 3027.00 |
| | Total | 95 | | |

Los dígitos de la tabla anterior en la columna de rango medio son originarios de las cifras del género femenino y dan un numero casi igual al procedente de los dígitos del grupo de hombres, esto quiere decir, que posiblemente no existirán discrepancias entre las apreciaciones por estos dos colectivos.

La tabla 8 manifiesta las cifras obtenidas en el género una vez aplicado el análisis U de Mann-Whitney.

**Tabla 8**.
*Hallazgos de la prueba W de Mann-Whitney*

| **Cifras de prueba[a]** | |
|---|---|
| | Puntuación |
| **U de Mann-Whitney** | 947.000 |
| **W de Wilcoxon** | 3027.000 |
| **Z** | -.358 |
| **Sig. asintótica(bilateral)** | .721 |
| **a. Variable de agrupación: Género** | |

Las cifras de la tabla anterior aluden en la variable Sig. Asintótica alcanzó un dígito de 0.721, el cual es mayor a 0.05, por esa razón, se concluye que no se tiene que contradecir la hipótesis nula, aludiendo a ideas de Carbajal (2024); igualmente, se finiquita que el nivel de percepción es igual entre los géneros.

Las cifras de la examinación manifiestan la opinión entre de los escolares universitarios y la eficacia de las sesiones en línea en tiempos de pandemia, el digito logrado manifiesta que no existe discrepancia entre la opinión y los géneros estudiados, hallazgos similares por Rocha (2020); De León Villarreal et al. (2020); Levet et al. (2020); González (2021); Lerner (2021); Remache (2022); Rivas & Neto (2023) y Jara (2023).

Como aportes finales se puede decir en cuanto a los hallazgos obtenidos que los análisis realizados proporcionan información valiosa sobre la percepción de los estudiantes, tanto hombres como mujeres, respecto a la eficacia de las sesiones en línea durante la pandemia, además a partir de los resultados, se pueden extraer varias consideraciones importantes:

En lo referente a la distribución no normal de datos, se puede decir que, tanto para el género masculino como femenino, se encontró que los datos no siguen una distribución normal. Esto sugiere que las percepciones de los estudiantes pueden variar significativamente y no siguen un patrón predecible, por lo que es crucial tener en cuenta esta falta de normalidad al interpretar los resultados y al diseñar estrategias educativas que sean inclusivas y efectivas para todos los estudiantes, en este sentido Mena, Rengel, Constante, Molina & Riegra (2020) concuerdan que " El derecho a una educación de calidad se fundamenta en la participación activa e igualdad de oportunidades de todos los estudiantes en los procesos pedagógicos, independientemente de su condición física, económica, social, etc." (p.55), es decir que la universidad al ser inclusiva debe aplicar las adecuaciones curriculares para el desarrollo de competencias; esto implica que la universidad debe implementar estrategias y adaptaciones curriculares para satisfacer las necesidades individuales de cada estudiante y promover su pleno desarrollo de competencias. Estas adecuaciones pueden

incluir ajustes en la presentación de la información, en los métodos de evaluación o en el ambiente de aprendizaje, con el objetivo de garantizar que todos los estudiantes tengan la oportunidad de alcanzar su máximo potencial académico. En resumen, la inclusión en la educación superior implica no solo reconocer la diversidad de los estudiantes, sino también tomar medidas concretas para garantizar su éxito educativo.

En relación a las percepciones similares entre géneros, se considera que, a pesar de las diferencias en la distribución de los datos, se encontró que no existen diferencias significativas en el nivel de percepción entre hombres y mujeres en cuanto a la eficacia de las sesiones en línea durante la pandemia; sugiriendo que, independientemente del género, los estudiantes comparten percepciones similares sobre la experiencia de la educación en línea durante este período desafiante, concordado con los estudios de Franco, Aguirre, Aguirre, Ortega & Fiallos (2022) donde evidenciaron que las capacidades relacionadas con habilidades y uso de Tecnologías de Información y las berreras de entrada no presentan diferencias significativas en cuento a género. Lo anterior refuerza la idea de que, en términos de habilidades tecnológicas y barreras de acceso a la tecnología, el género no debería ser un factor determinante. Por lo tanto, las políticas y programas destinados a promover la inclusión digital y el desarrollo de habilidades en el ámbito tecnológico deben centrarse en aspectos universales y no en diferencias de género. Es esencial garantizar que todas las personas tengan igualdad de oportunidades para aprovechar al máximo las herramientas y recursos tecnológicos disponibles, independientemente de su identidad de género.

En referencia a la importancia de la equidad de género, se opina que, aunque no se encontraron diferencias significativas entre hombres y mujeres en cuanto a la percepción de la educación en línea, es importante continuar promoviendo la equidad de género en el ámbito educativo, implicando garantizar que todos los estudiantes, independientemente de su género, tengan igual acceso a oportunidades de aprendizaje de calidad y apoyo académico.

Sin embargo, existen estudios donde hay diferencias en cuanto al percepción de la educación en línea, por ejemplo en el caso de Ecuador, Posso, León, Narváez, & Posso (2022) evidenciaron una brecha de género en estudiantes universitarias que en comparación con los hombres en cuanto a: disponibilidad de equipos de cómputos, internet, y disponibilidad de tiempo para sus estudios en la pandemia.

Concordado con Riquelme, Maureira & Navarro (2021) que afirman que las mujeres e en el aprendizaje en línea reportan mayor nivel de ansiedad, si bien es un factor no se analizó en esta investigación, influye en la percepción de calidad de la formación en línea, principalmente en la pandemia.

Se considera entonces, la importancia de considerar las diferentes experiencias y desafíos que enfrentan hombres y mujeres en la educación en línea, así como la necesidad de implementar medidas específicas para abordar estas disparidades. Es fundamental ofrecer un ambiente educativo inclusivo y de apoyo que reconozca y responda a las necesidades individuales de todos los estudiantes, independientemente de su género, para garantizar una experiencia educativa equitativa y de calidad para todos.

En cuanto a la adaptación y mejora continua, se asume que la pandemia ha demostrado la capacidad del sistema educativo para adaptarse a circunstancias extraordinarias, como la transición rápida al aprendizaje en línea. Los resultados de este estudio sugieren que, si bien puede haber desafíos asociados con la educación en línea, también hay oportunidades para mejorar y optimizar esta modalidad de enseñanza, por lo que es fundamental continuar identificando áreas de mejora y adoptar enfoques innovadores para garantizar una educación de calidad y equitativa para todos los estudiantes, concordando con Ficco, Chiecher, Luna & Bersía, (2023) que afirman que "esta conjunción de aspectos positivos y negativos, que afloran a partir de la enseñanza remota de emergencia, avala la idea de que la actual discusión en torno a la virtualización de la educación superior debería privilegiar las modalidades híbridas, que articulen lo presencial y lo virtual"( p.103), más allá de la decisión de la continuar utilizando herramientas de la web

2.0, la modalidad híbrida, es la consideración de la percepción de género en el diseño de las estrategias de enseñanza aprendizaje, lo que definitivamente aportaría un proceso de mejora continua y calidad educativa.

Los hallazgos de este estudio resaltan la necesidad de comprender las percepciones de los estudiantes sobre la educación en línea durante la pandemia, así como la necesidad de abordar los desafíos identificados y trabajar hacia una educación más inclusiva, adaptable y efectiva para todos los estudiantes.

## 5. Conclusiones

El estudio proporciona una visión inicial sobre la percepción de la calidad de la educación en línea entre diferentes géneros, destacando la importancia de continuar investigando en este campo. Se ha observado que tanto hombres como mujeres valoran positivamente la flexibilidad y disponibilidad de la educación en línea, así como la interacción con profesores y compañeros, y la eficacia de los recursos didácticos virtuales, se puede afirmar que, aunque no se encontraron discrepancias notables en la percepción de la calidad de la educación en línea entre géneros, este análisis proporciona una oportunidad para investigaciones posteriores que profundicen en las diferentes variables que pueden afectar la experiencia educativa digital. Es crucial resaltar que la promoción de la igualdad de oportunidades en la educación debe ser un compromiso constante, y la enseñanza virtual presenta la posibilidad de ser una herramienta efectiva para lograr este propósito.

Tanto hombres como mujeres aprecian la flexibilidad y disponibilidad que proporciona la educación en línea. Ambos sexos están de acuerdo en la relevancia de interactuar con los profesores y los compañeros para una experiencia educativa enriquecedora. Se reconoce la eficacia de los recursos y materiales didácticos disponibles en las plataformas virtuales. Es esencial subrayar que la promoción de la igualdad de oportunidades en la educación debe ser un compromiso constante, y la educación virtual puede ser una herramienta efectiva para alcanzar este objetivo. Aunque el estudio no ha encontrado discrepancias significativas en la percepción entre géneros en las áreas específicas evaluadas, los resultados sugieren la necesidad de continuar investigando y profundizando en las variables que influyen en la experiencia educativa digital.

Es aconsejable entonces, aumentar el tamaño de la muestra y ampliar la gama de variables consideradas para obtener una comprensión más exhaustiva del tema. Se sugiere utilizar métodos de investigación cualitativos para explorar con mayor detalle las experiencias y percepciones de los participantes. Además, se propone incorporar el análisis de otras disciplinas y áreas de conocimiento para obtener una perspectiva más holística del entorno educativo en línea.

Aunque no se observaron discrepancias notables en la percepción de la calidad de la educación en línea entre hombres y mujeres en las áreas de plan de negocios, formulación y evaluación de proyectos, y calidad aplicada a la gestión empresarial, el estudio revela aspectos significativos. Es crucial persistir en la investigación para profundizar en las variables que afectan la percepción de la calidad de la educación en línea, con el fin de diseñar estrategias que favorezcan a todos los estudiantes, sin importar su género.

A partir de la investigación planteada, se pueden considerar varias futuras líneas de investigación pertinentes como explorar cómo otras variables, como el nivel socioeconómico, el acceso a la tecnología, el apoyo familiar y la experiencia previa en educación en línea, pueden influir en la percepción de la calidad de la educación digital entre diferentes géneros; realizar estudios comparativos entre diferentes países o regiones para analizar cómo las diferencias culturales pueden afectar la percepción de la calidad de la educación en línea entre hombres y mujeres; profundizar en las experiencias de aprendizaje específicas de hombres y mujeres en entornos virtuales, incluyendo cómo perciben la interacción con profesores y compañeros, la efectividad de los recursos didácticos y su nivel de satisfacción general con la educación en línea; diseñar y evaluar intervenciones específicas dirigidas a mejorar la calidad de la educación en línea para todos los

estudiantes, teniendo en cuenta las diferencias de género y las necesidades individuales; investigar la percepción de los docentes sobre la educación en línea y cómo sus prácticas pedagógicas pueden influir en la experiencia de aprendizaje de los estudiantes, especialmente en lo que respecta a la equidad de género; estudiar las barreras de acceso y participación en la educación en línea para diferentes grupos de género, así como desarrollar estrategias para abordar y superar estas barreras; investigar los efectos a largo plazo de la educación en línea en el éxito académico y profesional de hombres y mujeres, así como su impacto en la igualdad de oportunidades en el mercado laboral.

Cabe señalar, que la institución del estudio de caso, adaptó su modelo educativo presencial a las necesidades del entorno a un modelo virtual, con ello contribuyó al ODS 4 Educación de Calidad, asegurando un acceso equitativo, sin importar el género y garantizando la continuidad académica en un escenario adverso.

Las líneas de investigación, antes expuestas pueden contribuir a una comprensión más completa de cómo mejorar la calidad y la equidad de la educación en línea para todos los estudiantes, independientemente de su género.

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Revista de Tecnología de Información y Comunicación en Educación • Volumen 18, N° 1. Enero-marzo 2024

Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.6

Cómo citar:
Karabin, O., Hladun, T., Romaniuk, V., Vitchenko, A., & Hrytsenko, V. (2024). The impact of virtual learning environment on future teachers' professional competence in lifelong learning. Revista Eduweb, 18(1), 81-92. https://doi.org/10.46502/issn.1856-7576/2024.18.01.6

# The impact of virtual learning environment on future teachers' professional competence in lifelong learning

## El impacto del entorno de aprendizaje virtual en la competencia profesional de los futuros docentes en el aprendizaje permanente

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Recibido: 08/12/23
Aceptado: 04/03/24

**Abstract**

The study aimed to empirically test the impact of a virtual learning environment on the professional competence of future computer science teachers in lifelong learning by conducting a survey and comparing the professional competence of bachelor and master students, as well as their opinions on the impact of the virtual learning environment on future teachers' professional competence in lifelong learning. The surveying methods were cognitive, motivational, activity-based, and value-based. A survey of students found that a virtual learning environment has the most significant impact on the activity component of professional competence, and most students are motivated to use virtual learning environments to improve their professional competence. The survey of teaching staff revealed a positive attitude towards professional development through virtual learning environments, the prevalence among students of high and sufficient levels of professional competence and digital literacy. The obtained results can be used to

adjust the virtual educational process of future teachers' professional training in the system of Ukrainian HEIs.

**Keywords:** academic staff, computer science teachers, HEIs, lifelong learning, professional development, students, virtual tools.

**Resumen**

El estudio tuvo como objetivo probar empíricamente el impacto de un entorno de aprendizaje virtual en la competencia profesional de los futuros profesores de informática en el aprendizaje permanente mediante la realización de una encuesta y la comparación de la competencia profesional de estudiantes de licenciatura y maestría, así como sus opiniones sobre el impacto del entorno de aprendizaje virtual sobre la competencia profesional de los futuros docentes en el aprendizaje permanente. Los métodos de encuesta fueron cognitivos, motivacionales, basados en actividades y basados en valores. Una encuesta entre estudiantes encontró que un entorno de aprendizaje virtual tiene el impacto más significativo en el componente de actividad de la competencia profesional, y la mayoría de los estudiantes están motivados para utilizar entornos de aprendizaje virtuales para mejorar su competencia profesional. La encuesta al profesorado reveló una actitud positiva hacia el desarrollo profesional a través de entornos virtuales de aprendizaje, la prevalencia entre los estudiantes de niveles altos y suficientes de competencia profesional y alfabetización digital. Los resultados obtenidos se pueden utilizar para ajustar el proceso educativo virtual de formación profesional de futuros docentes en el sistema de las IES de Ucrania.

**Palabras clave:** aprendizaje permanente, desarrollo profesional, docentes de informática, estudiantes, herramientas virtuales, IES, personal académico.

## 1. Introduction

Due to the continuous digitalisation of society and all spheres of human life and activity, the role of virtual environments in the educational process is increasing significantly. Moreover, virtualisation has enabled the educational system to respond adequately to the challenges posed by the global pandemic and the full-scale military invasion. However, the introduction of virtual platforms and digital tools into the educational process has increased the requirements for the teachers' professional competence in terms of improving digital skills, as the virtual space is dynamic today and requires constant changes from all its subjects. The above makes it necessary to empirically determine the impact of virtual learning environments on teachers in lifelong learning.

Total virtualisation of the educational space poses new challenges to the pedagogical community. They are professional mobility, a high level of mastery of digital innovations, readiness to work in a dynamic educational environment, and constant motivation to improve one's digital competence. A decade ago, the main thing for teachers was mastering the latest technologies, and today, the main thing is readiness for constant improvement of skills and abilities of rational use of digital innovations in a multi-format educational space: in face-to-face, mixed and distance learning formats. Digital innovations change quite dynamically. And if a modern teacher does not have time to master them, he will certainly face the problem of the inconsistency of the virtual tools he uses in pedagogical practice with the requests of education seekers. After all, in today's conditions, students are well versed in digital innovations and know how to use virtual educational opportunities properly. Therefore, for the virtual educational environment to function effectively, pedagogical workers must master digital innovations at a high level and use them rationally to solve educational tasks. This approach creates conditions for teachers' continuous professional development throughout their professional career. Therefore, it is quite fair to assume that the virtual educational environment has an effective influence on the professional growth of teachers.

## 2. Literature review

Scientific studies dwell on forming and developing future teachers' professional skills and competencies and confirm the importan ce of creating a virtual educational environment, identifying the challenges associated with changing the e-learning process, broadcasting engaging and interactive content to students, the need to bring the competencies of teachers and students in line with the requirements of the virtual educational environment, the importance of their readiness to work in a virtual academic format (Molotsi, 2020). Researchers emphasise the need to update teachers' digital competencies to meet the challenges of the twenty-first century (Caena & Redecker, 2019) and claim that the use of virtual educational tools is essential to improve self-efficacy and self-development and to educate students (Amhag et al., 2019).

The development of professional competence is often considered as a unity of self-identification, self-esteem, self-determination, self-management, and self-development and as a means of successful professional development (Torres et al., 2021). Professional self-development correlates with creating a personality's individual educational and professional trajectory (Kravchenko et al., 2021) and continuous professional growth in the sustainable development of education and science (Sydorenko et al., 2020). The importance of professional self-development is increasing in the context of lifelong learning and the creative self-realisation of specialists in any field of activity (Mushynska, 2018). Professional self-development is related to spiritual and moral behaviour, the development of the person's emotional and motivational sphere, self-analysis skills, and the analysis of human relationships (Yekimov et al., 2020). In times of social challenges and pandemic restrictions, it is essential to build a creative educational environment for professional self-development in the context of modern trends in digital education (Bashkireva et al., 2021). Researchers emphasise the significant role of self-education (Demchenko, 2019) and digital skills in developing future teachers' professional competence (Budnyk, 2021). All this confirms the complexity and multifacetedness of continuous professional training of future teachers (Kanibolotska, 2020), the dynamism of the "professional competence" concept (Koreneva & Kyryenko, 2023), and the determinism of a teacher's professional competence by modern information challenges (Voitovych, 2020).

Scientists stress the importance of a teacher's professional competence and digital competence as key to a teacher's professional development in lifelong learning (Henseruk, 2019). Future computer science teachers' digital competence includes information, media, communicative and technical competences. There is a clear correlation between the high level of a future computer science teacher's digital competence and the development of a teacher's professional competence in general, as it consolidates knowledge, skills and abilities to use digital technologies for the successful organisation of the educational process, critical evaluation of information resources, their correct use in teaching activities, and readiness to introduce technological innovations (Klieba, 2019). Forming professional competence in future computer science teachers requires their enthusiasm for using digital technologies in education (Skaskiv & Hlad, 2021). The academic component of this professional competence involves virtualising the educational environment to ensure the continuous acquisition, mastery, formation and development of future teachers' professional competences (Karabin & Gromiak, 2022). Students' professional competence is considered in the context of informatisation and computerisation of the educational process (Isyanov et al., 2020), the ability to plan their further professional development (Khasanov, 2022), the use of the latest digital platforms and tools for future teachers' professional training (Makhkamova, 2023).

Scientists claim that virtual learning environments benefit teachers' continuous professional development as they expand the use of formal and non-formal learning (Jafar et al., 2020).

Researchers confirm the apparent correlation between the challenges of virtualisation of the educational process and the needs and interests of modern students, who increasingly use digital tools, virtual learning environments and social media (Lacka & Wong, 2021). But at the same time, it is inappropriate to overuse those virtual learning formats that were acceptable in the era of the global pandemic, as the impact of

virtual learning environments on students' achievement of higher education goals has not been studied yet (Lacka et al., 2020). However, despite this, the use of "smart" virtual learning environments (virtual reality; information, design, interactive, training, game-based and other learning) remains relevant for improving the quality of education and the new educational paradigm (Odrekhivskyy et al., 2019). Teaching staff worldwide use virtual educational platforms and immersive computer applications. Numerous surveys have confirmed students' satisfaction with new digital learning tools and their intention to participate in improving virtual products used in the educational process (Bogusevschi et al., 2020). At the same time, teachers' readiness to work with virtual educational platforms is a significant concern, as empirical research confirms the insufficient level of teachers' digital competence in the lifelong learning system, which hinders the promotion of a new way of teaching (Garzón Artacho et al., 2020). At the same time, students are dissatisfied with methodological approaches to teaching in a virtual learning environment. Scientists have proven the importance of using virtual educational platforms for future teachers' training. There is also growing concern about the quality of education in the context of its virtualisation. It is necessary to develop measures to improve the effectiveness of the virtual learning process, in particular for students to increase learning motivation and self-discipline to participate in online classes and for teachers to improve the system of formative assessment, introduce group activities (quizzes, competitions) to stimulate group exchanges and develop social skills (Dung, 2020).

The studies mentioned above focus on the advantages and disadvantages of introducing virtual platforms into the educational process and the importance of teachers and students' readiness to use virtual platforms to achieve academic goals. However, the impact of virtual learning environments on future teachers' professional competence in lifelong learning has not been adequately studied.

The study aims to empirically determine the impact of virtual learning environments on the professional competence of future computer science teachers in lifelong learning.

Research objectives:

- to determine the educational and qualification level of professional competence of future computer science teachers;
- to determine the impact of virtual learning environments on future teachers' professional competence in lifelong learning (through a survey);
- to conduct a survey of teaching staff in HEIs on the impact of virtual learning environments on the professional competence of future computer science teachers in lifelong learning;
- to make a comparative analysis of the level of professional competence of future computer science teachers in terms of students' educational qualification levels;
- to make a comparative analysis of the impact of virtual learning environments on the professional competence of future computer science teachers in the context of lifelong learning in terms of students' educational and qualification levels.

The research hypothesis is that virtual learning environments contribute to the growth of future computer science teachers' professional competence and motivate them to continue self-improvement.

## 3. Methods

### a. Research design

The empirical testing included the following stages: preparatory, empirical, and final. At the preparatory stage, we formed a sample, selected research methods, and formulated the aim and objectives. At the empirical phase of the study, a survey of respondents was conducted on the impact of the virtual learning environment on the professional competence of future computer science teachers, diagnosing their level

of professional competence. The results were interpreted at the final stage, and conclusions were drawn. The pilot study was initiated by the scientific communities of Ukrainian higher education institutions: HEI 1, HEI 2, and HEI 3.

### b. Sampling

In total, 140 future computer science teachers – bachelor and master students – aged 23 – 26 years – participated in the study. The reason for choosing students of different educational qualification levels is the need to identify students' focus on continuous education, which should increase with the achievement of the appropriate level of training. All students worked in the "Moodle" virtual environment.

The reasons for drawing such a sample are as follows:

1) Students' involvement in the use of virtual learning environments in the educational process;
2) students have a long experience of acquiring competences in a virtual learning environment;
3) students' readiness and ability to use the resources and tools of the virtual learning environment.

Fifty academic staff members aged 40 – 50 years, involved in training students of pedagogical specialities, participated in the study.

All participants gave their voluntary consent to participate in the survey. The study was conducted during extra-curricular time and did not interfere with HEIs' educational processes.

### c. Research methods

The following methods were used in the study: diagnostics of future computer science teachers' professional competence, surveys, qualitative and quantitative analysis of the data, and comparative analysis.

The diagnostics of future computer science teachers' professional competence included a control test of students' knowledge, skills and abilities conducted by teachers of HEIs (the levels: high, sufficient, average, and low).

The study also involved determining the impact of virtual learning environments on the professional competence of future teachers in lifelong learning through a survey of students and teaching staff.

The respondents were surveyed using Google Forms, based on the author's questionnaire of bachelor and master graduate students of pedagogical specialities. The questionnaire included 16 questions in four blocks: cognitive, motivational, activity-based, and value-based (Table 1).

**Table 1.**
*The structure of the author's questionnaire to determine the impact of virtual learning environments on future teachers' professional competence in lifelong learning*

| Blocks | Diagnostic Method |
|---|---|
| Cognitive | Respondents' orientation towards expanding their knowledge on the use of virtual learning environments for professional self-development |
| Motivational | desire to use the virtual learning environments for professional development |
| Activity-based | positive experience of using virtual learning environments for professional development |
| Value-based | formation of a positive value attitude to the use of learning environments for professional development |

**Source:** author's development.

To determine the impact of virtual learning environments on future teachers' professional competence in lifelong learning, we surveyed teaching staff, whom we asked to rate with a score from 1 to 12 the following diagnostic indicators of students: formation of professional competence, digital literacy, readiness to use virtual learning environments for self-development, understanding of the need for continuous professional development, positive attitude to professional development through virtual learning environments.

The primary data was recorded in the Excel spreadsheet processor. Statistical processing of the research results was carried out using Spearman's rank correlation coefficient. Cronbach's analysis (with Cronbach's alpha value – 0.8) was used to determine the reliability of the author's questionnaire.

## 4. Results and discussion

The data on the diagnostics of future computer science teachers' professional competence are shown in Figure 1. As can be seen from Figure 1, a higher level of professional competence was found among master students, which indicates their higher readiness for professional development in the framework of lifelong learning.

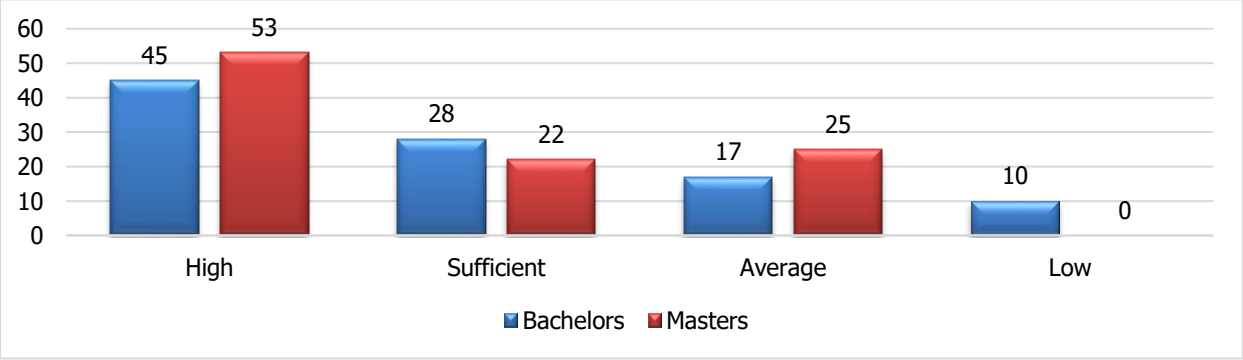


***Figure 1.*** Professional competence of future computer science teachers, %.
**Source:** author's development.

The survey results of all respondents in percentage terms for each block of the questionnaire are summarised in Table 2.

**Table 2.**
*Averaged data on the impact of virtual learning environments on the professional competence of future computer science teachers in the framework of lifelong learning (%)*

| Categories of respondents | Blocks of the questionnaire | | | | Mean value |
|---|---|---|---|---|---|
| | *Cognitive* | *Motivational* | *Activity-based* | *Value-based* | |
| Bachelor students of HEI 1 | 60 | 70 | 69 | 65 | 66,0 |
| Master students of HEI 1 | 40,5 | 80 | 87 | 70 | 69,4 |
| Bachelor students of HEI 2 | 55 | 74 | 89 | 67 | 71,3 |
| Master students of HEI 2 | 47,3 | 56 | 76 | 56,3 | 58,9 |
| Bachelor students of HEI 3 | 34,1 | 67 | 69 | 45 | 53,8 |
| Master students of HEI 3 | 45 | 54 | 65 | 43,9 | 52,0 |
| Mean value | 47,0 | 66,8 | 75,8 | 57,9 | 61,9 |

**Source:** author's development.

As can be seen from Table 2, virtual learning environments have the most significant impact on the activity-based component of students' professional competence. This indicates that most respondents have positive experiences using virtual learning environments to develop their professional competence and are motivated to improve it. However, the students lack the knowledge, skills and abilities to use all the possible advantages of virtual educational space in the context of lifelong learning. This is also the reason for insufficient readiness to use virtual learning environments to improve future teachers' professional competence.

We conducted a comparative analysis of bachelor and master students regarding the impact of virtual learning environments on the professional competence of future computer science teachers in the framework of lifelong learning (Figure 2).

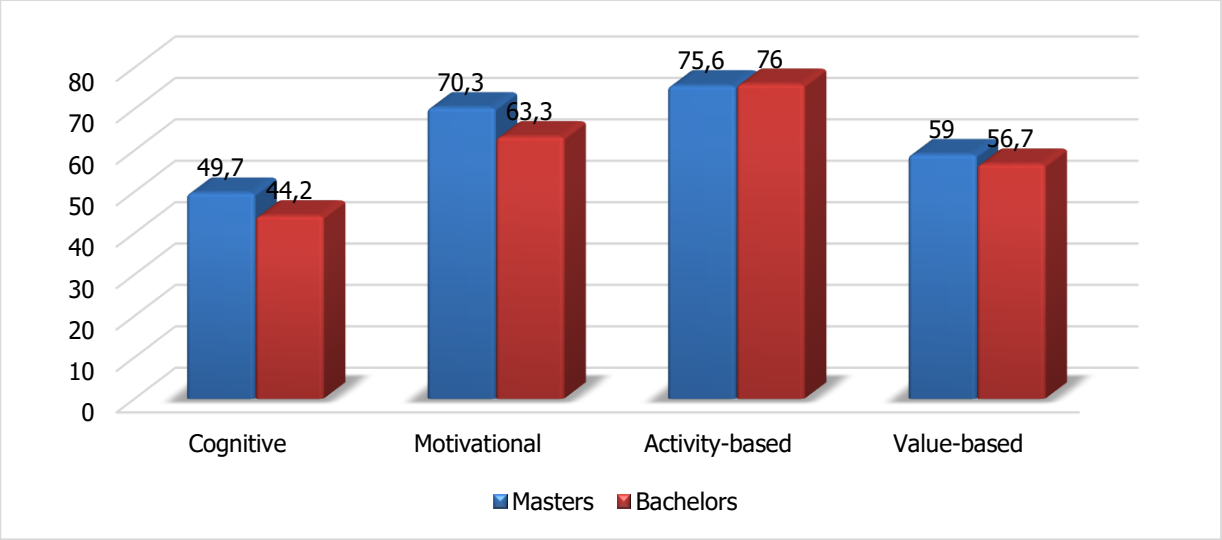


***Figure 2.*** Comparative analysis of the survey of masters and bachelors on the impact of virtual learning environments on the professional competence of future computer science teachers in lifelong learning, %
**Source:** author's development.

As can be seen from Figure 2, master students have slightly higher scores than bachelor students. This indicates that masters, compared to bachelors, have:

- a more pronounced focus on deepening the knowledge of virtual learning environments for professional self-development;
- more examples of positive experiences of using virtual learning environments for professional development;
- a more pronounced positive attitude towards using learning environments for professional development.

They are also more likely to use the resources of virtual learning environments for professional development.

Based on the data in Table 3, it can be argued that most teaching staff note future teachers' positive attitude towards professional development through virtual learning environments. More than half of the surveyed report the prevalence of high and sufficient levels of professional competence, digital literacy, and understanding of the need for continuous professional development in students. At the same time, students have an average level of readiness to use virtual learning environments for self-development, which may be due to the lack of effective models for using virtual tools for professional growth.

**Table 3.**
*The results of the survey of teaching staff on the impact of virtual learning environments on the professional competence of future computer science teachers in lifelong learning (%)*

| **Diagnostic methods** | **Levels** | | | | **Mean value** |
|---|---|---|---|---|---|
| | *High* | *Sufficient* | *Average* | *Low* | |
| Formation of professional competence | 54 | 46 | 0 | 0 | 25 |
| Digital literacy | 68 | 22 | 20 | 0 | 27,5 |
| Readiness to use virtual learning environments for self-development | 22 | 28 | 50 | 0 | 25 |
| Understanding the need for continuous professional development | 62 | 28 | 10 | 0 | 25 |
| Positive attitude to professional development through virtual learning environments | 78 | 22 | 0 | 0 | 25 |
| Mean value | 56,8 | 29,2 | 16 | 0 | 25,5 |

**Source:** author's development.

The study makes it possible to identify the main directions for improving the use of virtual educational environments to develop the professional competence of future computer science teachers in lifelong learning:

- creating conditions for expanding students' knowledge base on the use of virtual learning environments for professional self-development;
- increasing the level of readiness to use virtual learning environments to improve the professional competence of future computer science teachers;
- forming a base of positive experience in using virtual learning environments for the professional development of future computer science teachers;
- creating consulting platforms for future computer science teachers on the use of virtual learning environments for professional self-development.

The following measures can be proposed to improve the use of virtual educational environments for the development of future computer science teachers' professional competence in lifelong learning:

1. Involvement of students in choosing different virtual educational environments to improve their professional competence.
2. Use of various virtual educational environment tools in the professional training of future computer science teachers.
3. Involvement of students in creating virtual didactic content for educational environments.
4. Avoidance of monotony in a virtual educational environment when conducting classes and monitoring learning achievements.
5. Motivation of academic staff to improve the methodology of organising students' work in the virtual educational environment.

Scientists (Henseruk, 2019; Kanibolotska, 2020) have identified the importance of using virtual educational environments in the professional competence development of future computer science teachers in lifelong learning. Researchers also emphasise the need to use virtual instruments in the training of students and the readiness of teachers and students to work in the new virtual format of an interactive learning environment to be on par with their peers worldwide. Empirical research proves the convenience and speed of using educational content in the virtual space and the role of virtual tools in developing digital skills (Molotsi, 2020). Researchers note the impact of virtual learning environments on learners' career development (Caena & Redecker, 2019). A survey of teachers in Swedish educational institutions stated the systematic need for teachers and students to improve digital skills in the context of education virtualisation and the need for adequate scientific and methodological support for creating digital teaching and learning environments (Amhag et al., 2019). While noting the predominantly positive impact of virtual learning environments on the educational process, scholars identify problems that can hinder CPD because, without a vibrant online learning community, any constructive CPD requests cannot be met (Toole, 2019). However, it is necessary to avoid excessive use of virtual tools, so it is inappropriate to rely exclusively on digital, virtual instruments in the educational process (Pererva et al., 2020). The students' intention to participate in developing and improving existing virtual learning environments used by HEIs has been empirically proven (Bogusevschi et al., 2020). At the same time, some studies have revealed students' dissatisfaction with the methodology of using virtual learning environments, which raises the need to pay special attention to training teachers to use virtual educational platforms, as students believe that teachers lack knowledge of using graphic editors, video editors, computer graphics editors, and the perfect use of planning, monitoring and control procedures. Research by the University of Granada proved the need for additional and thorough study of the opinions of students and teachers on the use of virtual learning environments (Pererva et al., 2020), which was implemented in our research.

However, most studies focus on the advantages and disadvantages of using virtual learning environments in developing future teachers' professional competence in lifelong learning.

Our research is distinguished by a comprehensive approach to studying students' opinions and the parameters for assessing the impact of virtual learning environments on future teachers' professional competence, which we offered to students (cognitive, motivational, activity-based, and value-based blocks of the survey) and teachers (formation of professional competence, digital literacy, readiness to use virtual learning environments for self-development, understanding of the need for continuous professional development, positive attitude to raising professional level through virtual learning environments).

Our research is essential due to studying the influence of virtual learning environments on future teachers' professional competence in lifelong learning.

The research gives grounds for developing future teachers' professional competence in the virtual learning space in lifelong learning.

## 5. Conclusions

The introduction of virtual learning environments into the professional training of future computer science teachers has necessitated the study of the impact of this environment on the professional competence of future teachers in lifelong learning. Virtual learning environments have been proven to affect future teachers' professional competence. After all, they motivate students to use virtual learning environments for professional self-development. Working in virtual learning environments allows students to gain positive experience and form a positive attitude towards using learning environments for professional development. Virtual learning environments also positively impact the formation of professional competence, digital literacy, readiness to use virtual learning environments for self-development, understanding of the need for continuous professional development, and a positive attitude towards professional development through virtual learning environments.

The research results confirm the hypothesis that virtual learning environments contribute to the growth of future teachers' professional competence and motivate them to improve continuously.

Further scientific research may focus on various models for developing future teachers' professional competence in virtual and lifelong learning. Of particular empirical interest may be determining the parameters of a productive, rationally organised virtual learning environment as an essential component of future teachers' professional development.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.7

Cómo citar:
Kharkevych, H., Kruhlij, O., Pechko, N., Sobol, N., & Shyba, A. (2024). Features of using innovative technologies in teaching English language in higher education institutions. Revista Eduweb, 18(1), 93-108. https://doi.org/10.46502/issn.1856-7576/2024.18.01.7

# Features of using innovative technologies in teaching English language in higher education institutions

## Peculiaridades del uso de tecnologías innovadoras en la enseñanza del inglés en instituciones de educación superior

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Recibido: 01/12/23
Aceptado: 02/03/24

**Abstract**

The peculiarities of using innovative technologies in teaching English in institutions of higher education have been clarified. The meaning of the concepts "innovation" and "educational innovation" is revealed. The main criteria of manufacturability, which must be met by pedagogical innovation technology, are shown. The main principles by which innovative activities are carried out in institutions of higher education are highlighted. Approaches containing innovative technologies in teaching English are disclosed. The most effective innovative technologies are grouped and effective technologies for teaching English are considered. that deserve attention in teaching English in institutions of higher education (interactive

learning technology, distance learning, multimedia technologies, virtual environment technology). Taking into account the peculiarities of the use of innovative technologies in teaching English in higher education institutions, microlearning (bite-sized learning) technology attracts attention, the content and advantages of which are shown in the article. The advantages of using innovative technologies in teaching English in higher education institutions are shown. The main tasks in high-quality English language teaching are the development of the following basic skills: reading, listening, communication, and writing. The role of each individual skill is shown and the content of technologies that can be applied for improvement and development is revealed.

**Keywords:** innovations, innovative technologies, educational innovation, teaching English, institutions of higher education.

**Resumen**

Se han aclarado las peculiaridades del uso de tecnologías innovadoras en la enseñanza del inglés en instituciones de educación superior. Se revela el significado de los conceptos "innovación" e "innovación educativa". Se muestran los principales criterios de capacidad de fabricación que debe cumplir la tecnología de innovación pedagógica. Se destacan los principios fundamentales por los cuales se llevan a cabo actividades innovadoras en las instituciones de educación superior. Se revelan enfoques que contienen tecnologías innovadoras en la enseñanza del inglés. Se agrupan las tecnologías innovadoras más efectivas y se consideran las tecnologías efectivas para la enseñanza del inglés. que merecen atención en la enseñanza del inglés en instituciones de educación superior (tecnología de aprendizaje interactivo, aprendizaje a distancia, tecnologías multimedia, tecnología de entorno virtual). Teniendo en cuenta las peculiaridades del uso de tecnologías innovadoras en la enseñanza del inglés en las instituciones de educación superior, llama la atención la tecnología de microaprendizaje (aprendizaje del tamaño de un bocado), cuyo contenido y ventajas se muestran en el artículo. Se muestran las ventajas del uso de tecnologías innovadoras en la enseñanza del inglés en instituciones de educación superior. Las principales tareas en la enseñanza de alta calidad del idioma inglés son el desarrollo de las siguientes habilidades básicas: lectura, comprensión auditiva, comunicación y escritura. Se muestra el papel de cada habilidad individual y se revela el contenido de las tecnologías que se pueden aplicar para la mejora y el desarrollo.

**Palabras clave:** innovaciones, tecnologías innovadoras, innovación educativa, enseñanza del inglés, instituciones de educación superior.

## 1. Introduction

The relevance of this work is determined by the need for further development of the problem of introducing modern technologies into the educational process. Computerization of educational institutions began relatively recently, and teachers experience several difficulties caused by objective factors, among which, students' insufficiently developed ability to use a computer as a means of working with information.

In modern society, the role of foreign languages is growing more and more. Knowledge of a foreign language makes it possible to get involved in world culture, to use the potential of extensive Internet resources in one's activities, as well as to work with information and communication technologies and multimedia learning resources. In connection with this, there is a need to develop the methodology of using informational computer technologies in teaching a foreign language. New informational pedagogical technologies become part of the educational process. Therefore, computer technologies are an actual direction in the methodology, which requires new approaches and non-standard solutions.

The implementation of modern approaches and methods, and innovative technologies is now an urgent condition in the educational process of institutions of higher education, which contributes to the

strengthening of motivation among students of education, increasing cognitive interest in learning the English language, and effective formation of their communication skills and abilities. In today's information society, knowledge of a foreign language is of great importance for the self-realization of an individual. The use of innovative learning technologies, which is the optimal approach for high-quality training of a competitive specialist, deserves special attention to solve this issue. In the practice of teaching English, with the help of innovations, it is possible to determine the most effective methods of intersubjective enhanced purposeful interaction between students and the teacher, the implementation of a consistent process that creates quality conditions for their professional development (Efendiieva, 2017).

The study of the use of innovative technologies in teaching English in higher education institutions was, is, and will remain relevant since the integration of a foreign language into all spheres of life is a dynamic process. Therefore, an extremely urgent problem today is the effective and correct choice of educational technology. For the qualitative selection of the necessary content, it is necessary to apply the most effective means and methods of education. This is the task of a foreign language teacher (Khrystych & Borysova, 2022).

We conducted an experiment that included a survey of teachers of higher educational institutions and students to reveal their ideas about the use of innovative technologies in teaching English in higher educational institutions, the specifics and significance of technologies, about the peculiarities of professional training.

## 2. Literature review

Training future specialists for the use of innovative foreign language learning technologies is a new aspect of their professional training. It should be noted that the traditional approaches used for teaching foreign languages are not always appropriate in the context of the teacher's activities. That is why an important scientific task is the search for innovative technologies for training specialists, taking into account the need for the latter to teach foreign languages.

The problem of training specialists for the application of innovative foreign language learning technologies is quite complex, multifaceted and interdisciplinary. Various scientists contributed to its solution. Thus, issues of professional education were studied in the works of O. Reida, K. Ivleva, & D. Hulieva (2020). They singled out innovative teaching methods, with the help of which it is possible to increase the effectiveness of the educational space of education seekers, modernize the learning process, increase the foreign language level of education seekers, and provide an opportunity for teachers to improve and implement new methods of work of future specialists. In the methodology of teaching foreign languages, the main innovative technologies are considered in detail; the concept of "innovative technologies" is explained.

Various aspects of modern methods of teaching foreign languages in institutions of higher education were studied by M. Kudria (2018). M. Kudria reviewed ways of using innovative multimedia technologies in the educational space are revealed, which allows the learning process exciting, meaningful, interesting, and at the same time continuous throughout the professional and personal life of the future specialist. E-learning, which is carried out using mobile devices and which is implemented using special software based on modular and interdisciplinary approaches, is considered.

The general methodology for applied research of innovative learning technologies is highlighted in the works of T. Kapitan (2021). T. Kapitan considered the most popular and highlighted the main educational concepts that should be applied in the process of learning a foreign language by students of education and that exist inextricably with innovative technologies. Yu. Herasymenko (2021) analyzed the use of the integration model of the interactive database, thanks to which a flexible model of the educational process is created in different conditions; peculiarities of the organization of the educational process of teaching a

foreign language using innovative educational technologies; ways of expanding the functions of innovative technologies, as increasing and maintaining the motivation of education seekers to study, as well as a tool of the educational process, are considered; ways of implementing an educational virtual environment and methods of its existence, including various Internet sources, are proposed; a comprehensive approach to innovative technologies with the use of several resources is shown. O. Vasiukovych (2020), the increase in the complexity and volume of the researched material is shown by the modification of the content of foreign language learning; the main methods of using modern information technologies, which have become the main tool in teaching ESP, are noted; in the teaching of professional English, the actual problem of using innovative technologies is investigated; the effectiveness of innovative methods of the educational process is shown; the main ways of implementation by teachers of technology integration into their courses are emphasized, to bring them into line with the future professional needs of students.

The issue of using innovative technologies in teaching foreign languages actively researched by L. Konoplianyk (2020) shows the need for global changes in the field of higher education, the revision of the education system, which is required by the globalization and integration of the European educational space, as well as the rapid changes that exist in society and the processes of digitalization of the world, which require significant modernization of the educational field. M. Shevchenko (2020) considered the process of improving English language skills and highlighted the role of innovative technologies for higher education students. Ways of applying various innovative technologies, which are part of the process of learning and teaching a foreign language, are revealed, and innovative methods using the latest learning technologies to improve language skills are proposed. N. Khrystych, & N. Borysova (2022) showed the scientific results of the search for the selection of innovative technologies for the educational process for quality training of future English language specialists.

In turn, scientists from Latin American countries consider the problem of the English language in universities and pay attention to the importance of innovative technologies in teaching English in universities.

According to the scientists of Latin American countries, attention is focused on the need to use innovative technologies in the entire educational process, which will make it possible to form a highly information culture of the world's youth. The formation of innovative technologies in teaching English requires, first of all, a high level of the teacher's information culture and methodical literacy in teaching English.

Scientists J. Cárdenas & I. Esteban (2021) emphasize that an innovative methodological vision in the teaching-learning process of the English language focused on the inclusion of all its students in a heterogeneous learning environment. J. Álvarez Martínez & J. Gómez (2023) in their article they focus on the fact that E-learning and ICT have developed an innovative way of teaching English. To make sure the learning of this foreign language is effective, educational establishments and universities adjusted their infrastructure and technological devices. V. Zacchi (2018) rightly notes that digital epistemologies in the area of literacies and language teaching are becoming increasingly important, due to the radical transformations that our society is undergoing as a result of the advent of the new technologies of communication and processes linked to globalization. It is a quite relevant and pressing issue since children and the youth are coming to school in possession of a great deal of knowledge about and competence with digital tools and discourses. On the other hand, there are still a great number of students who lack digital literacy and face difficulties in reading from the screen. Connecting all these topics may bring innovative results with the potential to be applied to English language teaching and teacher education and solidify the research in this area.

However, even though various aspects of professional training of specialists are constantly in the circle of scientific interests of scientists, the issue of training specialists pay insufficient attention to the application of innovative technologies for teaching foreign languages.

In addition, the relevance of the identified problem is enhanced by several contradictions between a public order for the training of teachers capable of innovative activities in the educational process, and the insufficient focus of higher education institutions on solving this problem; the objective need for the training of specialists for the use of innovative foreign language teaching technologies and its insufficiently effective implementation in practice in higher education institutions; the need to form the readiness of specialists to use innovative technologies for learning foreign languages and the inadequacy of content-methodical provision of such training.

Therefore, the objective need to solve the specified problem is insufficient theoretical and practical development, the need to overcome the above contradictions determined the choice of the topic of our article.

**Purpose:** to find out the peculiarities of the use of innovative technologies in teaching English in higher education institutions.

## 3. Methodology

The research is empirical.

The following research methods were used at various stages of scientific research:

theoretical- generalization and analysis of modern educational and methodological, psychological and pedagogical, philosophical, sociological literature, dissertations, scientific works, articles in dictionary editions with the aim of obtaining information about the current state of the problem and its development, highlighting the main idea of the study, clarifying the essence of the problem , the selection of conceptual ideas, which are the methodological basis and theoretical-methodological basis for the introduction and development of innovative technologies in the teaching of English in institutions of higher education into the educational process; empirical – application of methods of observation, interviews, surveys, questionnaires in order to study the research problem; conducting a pedagogical experiment to collect data on the effectiveness of the developed approach to the problem; statistical: registration and processing of experiment results using computer programs, in particular MS Excel and SPSS for statistical processing of the obtained data; graphic: visualization of the results of experimental work: diagrams, tables; modeling and synthesis, which made it possible to summarize information about the object of research, to form and systematize the terminological apparatus of research.

The methodological concept reflects the ideas of forming the professional competence of education seekers using innovative technologies in teaching English in institutions of higher education.

The methodological concept is based on provisions about: dialectical connection of theory, practice, general principles of cognition, definition of development, self-movement, sources of movement, self-development of personality (philosophical level); components and nature of the process of knowledge of reality by an individual using the principles of cultural appropriateness and humanization in the unity of ideas of personal, systemic, competence, and personally oriented approaches, which illuminate the essence of the individual in the process of the universe (level of general scientific methodology); the use of modern world achievements of innovations in education and science for qualitative use of innovative technologies in teaching English in institutions of higher education; the study of internal and external factors, to show the innovative activity of an education seeker in society; inseparability of innovative technologies from the training of a competent specialist, real life; understanding ways of using innovative technologies in teaching English in higher education institutions; application in the educational process of modern innovative technologies that have an impact on the formation of professional competence in students (level of specific scientific methodology).

The methodical concept contributes to the coverage of a complex of diagnostic, monitoring, educational and methodological, technological, didactic, and methodological support, the formation of competence in education seekers, and the selection of innovative forms and methods.

The main function of the practical concept is to check the efficiency and effectiveness of the formation of a system of using innovative technologies in teaching English in institutions of higher education.

The methodological basis of the study is a multi-level complex principle, approaches, methods, and technological methods, which are methodological guidelines and tools of scientific research. Their use is the conditional interdisciplinary nature of the work.

Experimental verification of the use of innovative technologies in teaching English in institutions of higher education involved conducting a pedagogical experiment, which was considered as a leading research method, which allows obtaining the most probable facts that objectively characterize the possibilities of improving the process of professional training of students when using innovative technologies in the teaching process of English in institutions of higher education.

The implementation of the pedagogical experiment was carried out in three stages: preparatory, main, and final.

At the preparatory stage, the purpose and tasks of the research were determined, the experimental plan was developed, methods of measurement and processing of results were selected, control and experimental groups were selected, and their homogeneity was checked.

At the main stage, an experiment was conducted.

At the final stage, the results of the experiment were analyzed, their reliability was confirmed, and conclusions were drawn about the pedagogical effect of the experiment.

The reliability and validity of the obtained results, and the objectivity of their assessment were ensured by the methodological soundness of the initial positions and the qualitative mechanism for evaluating 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 experimental and control data, statistical processing was performed using MS Excel and SPSS (Statistical Package for Social Science).

## 4. Results and discussion

Nowadays, innovative approaches to education are an important feature of the accumulation and understanding of best experiences, the formation of new approaches to creative self-realization, the teaching process, and the development of teachers and students in the field of education (Kosharna et al., 2022).

The pedagogical innovation technology should meet the following key criteria of technological relevance:

- relying on a certain scientific concept to achieve the intended goals,
- application and construction of various didactic materials and innovative visual aids that make education more effective based on learning outcomes,
- guaranteeing the achievement of a certain educational standard,

- predictability of possible diagnostic goal-setting, design of the educational process, planning, phased monitoring, and variation of methods and means for correction of educational results (Efendiieva, 2017).

Innovations that are used in the field of education are called educational innovations.

We consider educational innovation as the process of spreading, creating, and using innovations for pedagogical problems, as a novelty that significantly changes the results of the education process, and innovativeness as an individual's attitude to new ideas, innovations in education, the susceptibility of subjects to innovations, experience. Studying at a higher education institution requires the mandatory use of active learning techniques, methods, and innovative technologies.

According to the logic of the research and the requirements for the organization of the pedagogical experiment, the purpose of the research and experimental work was to study the effectiveness of using innovative technologies in teaching English in institutions of higher education. The realization of the goal became possible due to its decomposition into partial tasks, namely:

- diagnosis of the levels of readiness of students to use innovative technologies in teaching English in institutions of higher education;
- the approbation of the experimental methodology, which reflected the peculiarities of preparing students for the use of innovative technologies in teaching English in institutions of higher education.

We used qualitative and quantitative methods in the research. Quantitative research methods presuppose the presence of a specific standardized instrument (questionnaire), which, in turn, presupposes the respondent's standardized answers to clearly stated questions. The availability of such a tool is a necessary component of quantitative research since each question represents a certain parameter subject to quantitative measurement. That is why in quantitative studies we paid close attention to the formulation of questions.

Qualitative research methods, which assume a structured, but still free narrative (in the form of a monologue or dialogue, discussion) on the proposed topic, provided us with objective results of subjective activity. Thus, in qualitative research methods, it became possible to implement an expert professional analysis of the products of the respondent's activity.

Taking into account the outlined tasks, the experimental research was carried out in three interconnected stages, each of which was characterized by certain goals and content, appropriate forms, and methods of organization.

At the initial stage – organizational and theoretical – the analysis of the philosophical, pedagogical, psychological, and acmeological discourse on the research problem was carried out, the general theoretical and methodological foundations of the research were determined; ideas for the organization of experimental work were developed; the purpose and tasks of the research were specified; the categorical research apparatus was scientifically justified.

The second stage – experimental – provided for the implementation of the theoretical and procedural development of the pedagogical experiment, the implementation of a complex selection of methods, the implementation of experimental work on the need to use innovative technologies in teaching English in institutions of higher education; systematization and analysis of the obtained results.

At the third stage – the final stage – the analysis of the materials of the experimental work was carried out according to the topic of the study, and the general conclusions of the study were formulated.

We planned to divide the study groups into experimental and control groups. Thus, groups of students of the V-VI years (before the experiment) were considered control (hereinafter – CG), and experimental (hereinafter – EG) those groups that participated in experimental training.

At the beginning of the pedagogical experiment, pilot studies were carried out, which included a questionnaire survey of teachers of higher education institutions and students to reveal their ideas about the use of innovative technologies in teaching English in higher education institutions, the specifics and importance of technologies, about the peculiarities of professional training.

According to the results of the survey, it was found that the majority of teachers (92% of respondents) are aware of the need to use innovative technologies in teaching English in higher education institutions to successfully prepare students for their professional careers and ensure the competitiveness of graduates in the labor market. Such an opinion is characteristic of both experienced teachers who have a sufficiently long experience in scientific and pedagogical activity, and young teachers.

The following trend, which is followed by the results of the questionnaire, indicates a high assessment of the importance of forming readiness for the use of innovative technologies in teaching English in higher education institutions since the vast majority of teachers (75%) consider this problem about the most important aspects of teaching activity, in particular: the formation of special professional skills (82%), the development of students' life competence (analytical, critical thinking, the ability to build a life strategy, etc.) (70%), the development of communicative competence, rhetorical skills (64%), etc.

The essential characteristics of the use of innovative technologies in teaching English in institutions of higher education are revealed by the majority of teachers as a complex phenomenon, in particular: implementation of professional knowledge, abilities, skills based on professional experience and labor market requirements (53.1% of respondents); the individual's ability to design and manage technologies in accordance with the level of professional competence (45.3% of respondents); an integrative combination of personal traits and technologies that allow success in the profession (35% of respondents); the process of internal development of a person, which includes the professional growth of students when using innovative technologies in teaching English in institutions of higher education, accumulation and development of competencies, external movement in the assimilation of the social space of not only one profession or specialization, but also others (provided it is necessary to change profession) (62% of respondents).

Therefore, it is legitimate to state that the majority of teachers consider it necessary to use innovative technologies in teaching English in higher education institutions. However, the majority of teachers at higher education institutions (more than 60%) are aware of the broader meaning of a professional career, which integrates the system of using innovative technologies in teaching English in higher education institutions to obtain important qualities and professional competence.

According to respondents, targeted work on training students using innovative technologies in teaching English in institutions of higher education for strategic management of a professional career should be organized in the process of teaching professional disciplines (92%) and by modernizing the content and tasks of assistant and scientific production practices (73%). The respondents also highly appreciate the potential of introducing special selective educational disciplines (85%).

Among the types of educational activities of students that contribute to the formation of their readiness to work well and are necessary in later life, the respondents assigned the greatest potential to training work, educational project activities, and scientific and industrial practice (72% of respondents).

In summary, we note that based on the results of empirical research, we have identified a trend that proves the awareness of teachers of higher education institutions of the need, in addition to professional education, to humanize the content of professional training, the importance of forming students' readiness to use innovative technologies in teaching English in higher education institutions as a professional of significant quality.

To find out in institutions of higher education the importance of using innovative technologies in teaching English, we investigated the characteristic types of thinking of EG and CG students. For this, testing was carried out, which showed the dominance of the analytical style of thinking among students, both EG and CG. In particular, 17.6% demonstrated a very high level of analytical thinking in the use of innovative technologies in teaching English; 56.5% – high; 16.1% – medium, and 4.8% – low. Characteristically, our empirical studies did not record a very low level of analyticity.

The analysis of the results of the student questionnaire made it possible to conclude: about a third of students do not know the types of use of innovative technologies in teaching and learning English, and they do not have information about the possibilities of career growth through the use of innovative technologies in teaching and learning English; a significant part (about 2/3) claim that they either know or have an idea about them, while only 13.2% of EG students and 12.5% of CG claim to have familiarized themselves with ways of using innovative technologies.

We conducted a study of students to find out the self-assessment of the use of innovative technologies in teaching and learning English. The results showed: that about a third of students have low self-esteem, which leads to insecurity, timidity, excessive self-criticism, lack of initiative, and, therefore, difficulties in realizing their abilities in the process of using innovative technologies in teaching and learning English. 16% of EG students and 9.6% of CG students have a high level of self-esteem, which indicates that these are self-confident people who correctly compare their opportunities and abilities, strive to realistically look at their successes and failures, and set achievable goals for the use of innovative technologies.

The statistical processing of the results of the diagnostic sections based on the defined criteria and indicators made it possible to determine the level of formation of each of the components of readiness for strategic management of a professional career (table 1).

As evidenced by the data of the diagnostic sections, the level of readiness of students to use innovative technologies in teaching and learning English in institutions of higher education of the control and experimental groups is insufficient. A low level of readiness according to the personal-motivational criterion is typical for the majority of students (76.56% and 75.0% of students). The levels of formation of the following criteria – substantive-practical and evaluation-productive – were also low.

**Table 1.**
*Formation of components of readiness to use innovative technologies in teaching and learning English in higher education institutions (in %)*

| Components | Experimental group | | | Control group | | |
|---|---|---|---|---|---|---|
| | Levels of formation | | | | | |
| | L | A | H | L | A | H |
| **Mobilization and axiological** | 76,56 | 21,88 | 1,56 | 75,0 | 21,88 | 3,2 |
| **Strategic and operational** | 77,34 | 19,53 | 3,12 | 77,34 | 19,85 | 3,12 |
| **Reflexive and corrective** | 78,13 | 20,31 | 1,56 | 76,56 | 21,88 | 1,56 |

Note: L – low (passive) level; A – average (conditional) level; H – high (stable) level.
Following the criteria of readiness to use innovative technologies in teaching and learning English in institutions of higher education, the current level of this education was analyzed as a generalized indicator. The results of the analysis are presented in Fig. 1.

The obtained data prove that the percentage indicators of the levels of readiness to use innovative technologies are approximately the same for students of both groups. Thus, 77.34% of EG respondents and 77% of CG respondents are characterized by a low level of readiness. Indicators of the average level of readiness to use innovative technologies also turned out to be insignificant (20.3% and 21.0% of students in the experimental and control groups, respectively; 2% and 2.36% are stable levels).

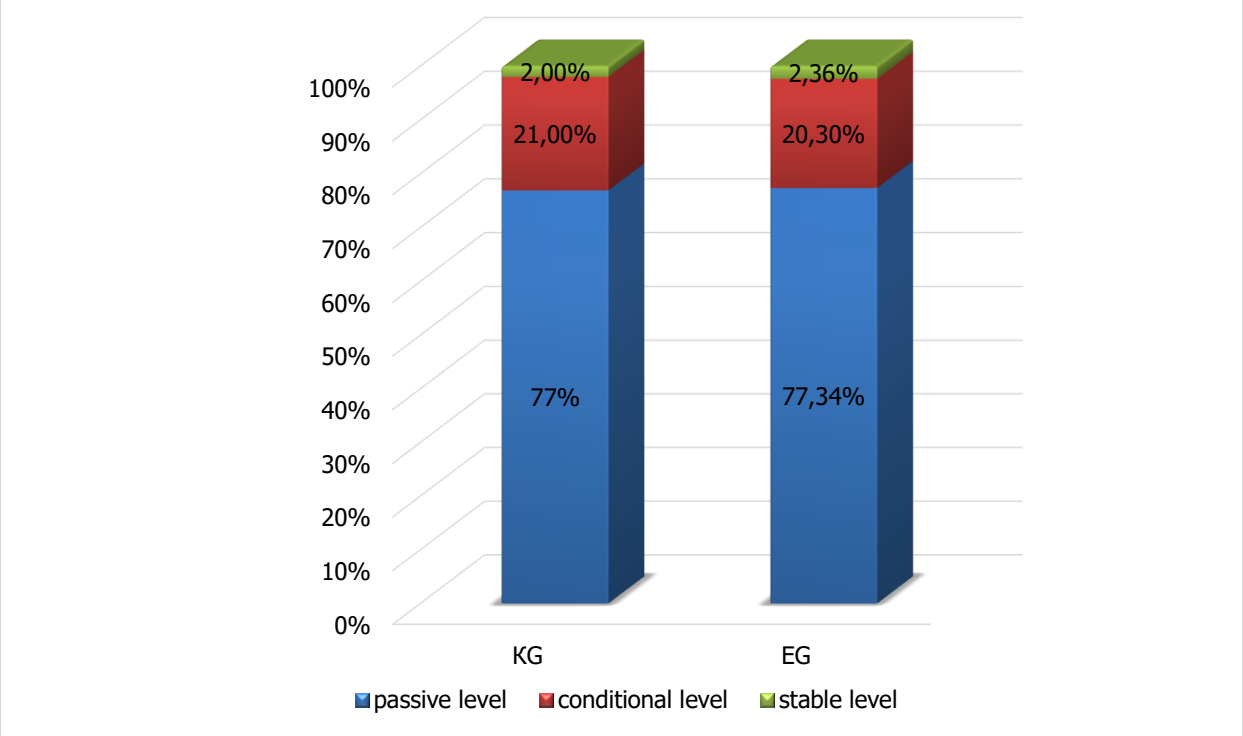


***Figure. 1.*** Levels of students' readiness to use innovative technologies in teaching and learning English in higher education institutions

In general, the results of the study allowed us to conclude that the real state of readiness for using innovative technologies in teaching and learning English in institutions of higher education does not meet the modern requirements of pedagogical practice and society, and therefore requires radical changes.

The experiment included the following methods:

- empirical – application of methods of observation, interviews, surveys, and questionnaires to study the research problem; conducting a pedagogical experiment to collect data on the effectiveness of the developed approach to the problem;
- statistical: registration and processing of experiment results using computer programs, in particular MS Excel and SPSS for statistical processing of the obtained data;
- graphic: visualization of the results of experimental work: diagrams, tables.

According to the results of the research, it was established that the process of professional training of specialists does not take into account the main criteria of technologicalness that pedagogical innovation technology must meet, the main principles by which innovative activities are carried out in institutions of higher education are not identified; approaches containing innovative technologies in teaching English are not disclosed; effective technologies (interactive learning technology, distance learning, multimedia technologies, virtual environment technology, microlearning (bite-sized learning)) and approaches containing innovative technologies in teaching English are not disclosed; the specifics of the use of innovative technologies in teaching English in higher education institutions have not been clarified.

As a result, the level of use of innovative technologies in teaching English in institutions of higher education does not meet modern requirements. In the control groups, at the end of the experiment, the number of students with low and medium levels of professional competence did not change significantly. According to the results of the empirical research, we found a trend that proves the awareness of the teachers of the institution of higher education of the need, in addition to professional education, to humanize the content of professional training, the importance of forming the readiness of students to use innovative technologies in teaching English in institutions of higher education as a professionally significant quality.

In the experimental group, a more significant progress in the formation of professional competence was observed compared to the control group. This became possible thanks to our proposed method of formation of readiness to use innovative technologies in teaching and learning English in institutions of higher education.

During the ascertaining stage of the experiment, the results of the study allowed us to conclude that the real state of readiness for the use of innovative technologies in teaching and learning English in institutions of higher education does not meet the modern requirements of pedagogical practice and society, and therefore requires radical changes.

Therefore, during the formative stage of the experiment, we set the task of clarifying the features of the use of innovative technologies in teaching English in higher education institutions; to show the main criteria of manufacturability that should be met by pedagogical innovation technology; to single out the main principles using which innovative activity is carried out in institutions of higher education; to reveal effective technologies (interactive learning technology, distance learning, multimedia technologies, virtual environment technology, microlearning (bite-sized learning)) and approaches containing innovative technologies in teaching English; show the role of reading, listening, communication, writing and reveal the content of technologies that can be applied to improve and develop the personality in high-quality teaching of the English language.

Based on the results of the experiment, it can be concluded that the proposed technique is effective and can be successfully used in educational institutions.

Therefore, in the article, we set the task of clarifying the features of the use of innovative technologies in teaching English in institutions of higher education; showing the main criteria of manufacturability that should be met by pedagogical innovation technology; identifying the main principles by which innovative activities are carried out in institutions of higher education; to reveal effective technologies (interactive learning technology, distance learning, multimedia technologies, virtual environment technology, microlearning (bite-sized learning)) and approaches containing innovative technologies in teaching English; show the role of reading, listening, communication, writing and reveal the content of technologies that can be applied to improve and develop the personality in high-quality teaching of the English language.

First of all, let's distinguish the main principles by which innovative activities are carried out in higher education institutions:

- the principle of the necessary impact of innovation on the final result of the educational process with a mandatory change of the final result of the educational process;
- the principle of the necessary impact of innovation on the material, intellectual, and time costs of higher education seekers (Shevchenko, 2020).

High-quality language training of university graduates in teaching English is impossible without the use of modern innovative technologies (Suleman et al., 2019).

The most effective innovative technologies in teaching English in institutions of higher education are the use of telecommunications and information technologies, project work in the educational process, use of Internet resources, professionally oriented foreign language learning, multimedia systems (work with educational computer programs for foreign languages), remote technologies in teaching English in institutions of higher education, teaching a foreign language in a computer innovative environment (blogs, forums, e-mail, etc.) (Kapitan, 2021).

Let's name the approaches that contain innovative technologies in teaching English in higher education institutions:

- interactive teaching methods;
- use of multimedia, computer teaching aids, and the Internet (technical teaching aids) for information storage, knowledge control, and use of educational materials (Kudria, 2018).

The use of innovative technologies in teaching English in institutions of higher education determines the constant improvement of educational and pedagogical activities (Vydaichuk et al., 2022). In innovative technologies, developing and educational educational goals, methods, and forms of education, innovative approaches to the organization of educational activities of education seekers are reflected and implemented. The practice of using English language teaching technologies shows the existence of many innovative technologies that help to diversify the educational process (Pudlo, 2018). The teacher has the opportunity to choose innovative technologies for teaching English. It is necessary to take into account the importance of innovative technologies, but also not to forget that no technology can replace a teacher, but is only a means of strengthening and expanding the educational activity of students (Khrystych & Borysova, 2022).

Let's consider effective technologies that deserve attention in teaching English in institutions of higher education (Efendiieva, 2017).

The purpose of interactive learning technology is to create comfortable learning conditions, under which every learner of the educational space feels intellectual ability and increases his success.

The essence of interactive learning is that the educational process takes place with the active interaction of the students of education, and constant cooperation between the students of education and the teacher, who act as equal subjects of the educational process (Kuchai & Demianiuk, 2021).

The use of multimedia technologies in teaching English in institutions of higher education is an example of the use of technologies for the individualization of the educational process; related to the creation of multimedia products: encyclopedias, e-books, memory cards, databases (Juraeva, 2022). These products will combine graphic, text, audio, and video information. Multimedia technologies allowed the audience to attend the lectures of outstanding scientists and practitioners without leaving the house, made the computer a full-fledged interlocutor, allowed participating in dialogues, conferences, and conduct correspondence (Efendiieva, 2017).

Let's highlight the advantages of multimedia tools for learning a foreign language (Herasymenko, 2021):

- the method allows you to choose the pace and level of tasks, has a high degree of interactive learning, improves the accumulation of vocabulary and the speed of assimilation of grammatical constructions;
- makes it possible to effectively implement the principle of visuality, while demonstrating photos, diagrams, and drawings on the topic of language communication;
- makes it possible to use interactive audio clips and video broadcasts when teaching oral communication;
- enables the teacher to present information in an effective and new innovative form, to make it interesting, more complete, and closer to the topic of communication being studied;
- creates conditions for interactive communication (Kudria, 2018).

Taking into account the peculiarities of the use of innovative technologies in teaching English in higher education institutions, microlearning technology attracts attention – it is a strategy of the educational process that serially uses short segments of content in combination with short-term educational activities (Hattie & Yates, 2013). It is also called bite-sized learning because it uses small fragments of educational material or educational activity, that is, it breaks information into manageable fragments, is small in volume, and does not carry out a long continuous educational activity (Alqurashi, 2017). In the name of the bite-sized learning technologies, the meaning of the word "bite" is embedded as a unit of information storage and its measurement; bite, piece, fate (Shuliak et al., 2022). An important factor for this technology is that any educational module is simple, small in size, purposeful, structured, and focused on one linguistic phenomenon, one educational goal. Students have the opportunity to establish their connections between individual modules and decide how one topic is related to another and in what sequence to view them (Kharchenko & Hostishcheva, 2022).

Therefore, educational and innovative processes complement each other and are indivisible. The modern educational space is aimed at the maximum use of innovative technologies in teaching English in institutions of higher education to make the educational process the most effective, convenient, and accessible, and such innovative technologies serve, first of all, as a support for the teacher himself (Efendiieva, 2017).

The aspects of the application of innovative technologies in the teaching of English in higher education institutions analyzed by us make it possible to state that (Herasymenko, 2021):

1. The computer is considered both as an integral part of the educational process of the students of education and the activities of the teacher and as a means by which certain skills are transferred to the students of education.

2. With the development of innovative technologies in the world society, their inclusion in the educational process of learning English has become mandatory.
3. Practical and theoretical learning of the English language can be combined through the use of innovative modern technologies.
4. Institutions of higher education should modernize their technical capabilities by using laboratory equipment to support the educational process of teaching English.
5. In the process of developing the language skills of students, English language teachers should involve their students in the use of innovative technologies (Shevchenko, 2020).

An important factor in learning English at a high level is the desire of students to master a foreign language fluently, by focusing students on the future, raising their level of consciousness through the successful implementation of innovative technologies for foreign language education (Kulichenko & Polyezhayev, 2020). The European approach to learning a foreign language includes a practical professional, interdisciplinary orientation of foreign language classes, where the learner is at the center of attention. The purpose of this approach is to direct the educational process to the development and formation of basic abilities and skills in professional and social communication, and the development of strategies for independent study of foreign languages (Vasiukovych, 2020).

## 5. Conclusions

An important factor in learning English at a high level is the desire of students to master a foreign language fluently, by focusing students on the future, raising their level of consciousness through the successful implementation of innovative technologies for foreign language education.

The peculiarities of using innovative technologies in teaching English in institutions of higher education have been clarified. The meaning of the concepts "innovation" and "educational innovation" is revealed.

The main criteria of manufacturability, which must be met by pedagogical innovation technology, are shown. The main principles by which innovative activities are carried out in institutions of higher education are highlighted. Approaches containing innovative technologies in teaching English are disclosed.

The most effective innovative technologies are grouped and effective technologies for teaching English are considered. that deserve attention in teaching English in institutions of higher education (interactive learning technology, distance learning, multimedia technologies, virtual environment technology).

Taking into account the peculiarities of the use of innovative technologies in teaching English in higher education institutions, microlearning (bite-sized learning) technology attracts attention – it is a strategy of the educational process that serially uses short segments of content in combination with short-term educational activities.

We see the prospects for further research in the detailed disclosure of approaches that contain innovative technologies in teaching English.

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Revista de Tecnología de Información y Comunicación en Educación • Volumen 18, N° 1. Enero-marzo 2024

Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.8

Cómo citar:
Blinovska, R., Kudria, O., Yitong, L., Chalii, L., & Verbivskyi, D. (2024). Innovative approaches in higher education in Ukraine: Trends and prospects. Revista Eduweb, 18(1), 109-123. https://doi.org/10.46502/issn.1856-7576/2024.18.01.8

# Innovative approaches in higher education in Ukraine: Trends and prospects

## Enfoques innovadores en la educación superior en Ucrania: Tendencias y perspectivas

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Recibido: 01/01/24
Aceptado: 02/02/24

**Abstract**

Innovative approaches in higher education in Ukraine are crucial to address changing global education dynamics, technological advancements, and evolving workforce needs. The primary aim is to assess the significance of innovation in shaping the educational experience and teaching methodologies. The research employs a mixed-methods approach, combining surveys and in-depth interviews with educators across various disciplines. The collected data from 125 participants provide insights into their perspectives on the importance of innovation. The results indicate a growing interest in innovative methods among educators and students, highlighting a desire for continuous improvement in the learning process. Challenges related to the implementation of innovative approaches are identified, including technological barriers, limited resources, and resistance from within the academic community. In conclusion, while innovation remains a crucial component for advancing higher education in Ukraine, strategic planning and targeted support are essential for successful implementation. The study underscores the need for enhanced international collaboration, a focus on overcoming identified challenges, and the development of a comprehensive support system for educators. These findings contribute to the ongoing discourse on the evolution of higher education in Ukraine and offer insights for policymakers, administrators, and educators seeking to foster a dynamic and effective learning environment.

**Keywords:** educational transformation, digital learning landscape, digitalization, innovations, technologies.

**Resumen**

Los enfoques innovadores en la educación superior en Ucrania son cruciales para abordar la dinámica educativa global cambiante, los avances tecnológicos y las necesidades cambiantes de la fuerza laboral. El objetivo principal es evaluar la importancia de la innovación en la configuración de la experiencia educativa y las metodologías de enseñanza. La investigación emplea un enfoque de métodos mixtos, combinando encuestas y entrevistas en profundidad con educadores de diversas disciplinas. Los datos recopilados de 125 participantes proporcionan información sobre sus perspectivas sobre la importancia de la innovación. Los resultados indican un creciente interés por los métodos innovadores entre educadores y estudiantes, destacando el deseo de mejora continua en el proceso de aprendizaje. Se identifican los desafíos relacionados con la implementación de enfoques innovadores, incluidas las barreras tecnológicas, los recursos limitados y la resistencia dentro de la comunidad académica. En conclusión, si bien la innovación sigue siendo un componente crucial para el avance de la educación superior en Ucrania, la planificación estratégica y el apoyo específico son esenciales para una implementación exitosa. El estudio subraya la necesidad de mejorar la colaboración internacional, centrarse en superar los desafíos identificados y desarrollar un sistema de apoyo integral para los educadores. Estos hallazgos contribuyen al discurso actual sobre la evolución de la educación superior en Ucrania y ofrecen ideas para los formuladores de políticas, administradores y educadores que buscan fomentar un entorno de aprendizaje dinámico y eficaz.

**Palabras clave:** transformación educativa, panorama del aprendizaje digital, digitalización, innovaciones, tecnologías.

## 1. Introduction

In the contemporary era, marked by constant technological progress, higher education emerges as a fundamental pillar for social development and national success. In Ukraine, a country striving to improve its educational standards, innovation in higher education takes on crucial relevance. Beyond being a mere vehicle for knowledge transfer, higher education plays a vital role in promoting creativity, innovation and training professionals prepared to face the challenges of the future (Behera & Karmakar, 2022; Onischuk, 2021).

This article addresses the need to explore innovations in Ukrainian higher education, examining in detail the approaches, methods and trends that shape the country's educational landscape. Through a comprehensive literature review, a critical gap in research is identified that analyzes specific innovative approaches, their implementation, and their impacts on the educational environment and future prospects. The study aims to answer the following research question: What are the key innovative approaches, methods and trends currently used in the Ukrainian higher education system and how do these strategies contribute to the development of a dynamic, competitive and educational environment? adaptable?

To address this question, previous research by scholars such as Krymets (2022) and Iskakova (2023) is examined, providing a solid foundation for understanding the Ukrainian educational landscape. The existing literature highlights the importance of higher education as a catalyst for societal development and the formation of a skilled workforce (Alvi, 2021). However, the need for more comprehensive research is identified that comprehensively analyzes innovative approaches and their implications.

In this context, this article is structured as follows: the literature review, the methodology, the results and discussion and findings.

## 2. Theoretical framework and literature review

Innovation is the implementation of innovative ideas, technologies, methods, or approaches with the aim of improving and changing existing processes, products, or services. They have become crucial elements

in various spheres of modern society. Innovations in education may involve the integration of electronic technologies, changes in curricula, the development of new teaching and assessment methods (Cheung et al., 2019). The use of innovative approaches in higher education contributes to the creation of flexible, adaptive, and interactive learning environments, fostering the development of students' creativity and critical thinking. Thus, one of the key characteristics of innovation in education is the enhancement of accessibility and flexibility of learning for various student categories (Alvi, 2021). For the other hand, Kang & Lee (2020) described designing technology as important instrument of current education and usage of computational thinking.

Contemporary researchers have demonstrated that the implementation of innovations in the educational process may encompass changes in lecture formats, the use of electronic platforms for learning, and other technological solutions. Innovations in education may also involve the creation of interactive online courses, the use of virtual reality, and other advanced communication tools (Dzhym et al., 2023). Overall, it has been proven that innovative approaches contribute to the development of students' independence, their ability for self-improvement, and independent work on materials. Thus, innovations in education not only enhance the quality of learning but also promote a creative approach to solving challenges and issues in contemporary society.

This article by Alencar, E. S. d., Cunha, A. C. d., Figueiredo, T. D., & Miola, A. F. d. S. (2019) delves into the nexus of teaching and learning with educational technologies. The focus is on the innovative use of technology in educational contexts, particularly in the realm of mathematical education. While the precise details of the content aren't explicitly mentioned, the source appears to provide foundational insights into the incorporation of technology in pedagogical practices. Engel et al., (2016) focused on centrally assisted collaborative telecare as a means of addressing posttraumatic stress disorder (PTSD) and depression among military personnel attending primary care. The research underscores the importance of leveraging telecare and collaborative approaches to address mental health challenges in specific populations, showcasing the potential of technology in healthcare contexts. The work by Guimarães & Leal (2022) explores the role of technologies in innovative pedagogical practices in the teaching of history. The article sheds light on the multifaceted educational aspects impacted by technology, emphasizing its role in transforming history education. It contributes to the broader discourse on integrating technology to enhance pedagogical strategies in specific academic domains. Silva, F. S., Santos, L. C. d. S., Pinto, I. M. B. S., Uchôa, S. B. B., & Balliano, T. L. (2019) investigates educational technologies. The work likely explores future trends and developments in the realm of educational technologies, providing a forward-looking perspective. It contributes to the understanding of how technology might shape the future of education. Swaffield & Thomas (2016) offers a comprehensive overview of educational assessment in Latin America. While the exact connection to technology is not explicitly stated, the broader context suggests a potential exploration of the role of technology in educational assessment practices in the Latin American context.

Accordingly, studying the features of integrating innovations into education is a relevant issue for contemporary scholars. In particular, Iskakova (2023) examined the features of applying electronic technologies to facilitate individualized learning for individuals with special needs. Overall, this work defines how technologies can contribute to the creation of an inclusive educational environment. Boichenko M., Kozlova T., Kulichenko A., Shramko R., & Polyezhayev, Y. (2022) described the features of developing creative activity in Ukrainian higher educational institutions. This work explores the role of creative efforts in academic conditions, providing insights into fostering innovation and creativity. Yuhan (2017) described the use of multimedia technologies in teaching philology. Yuhan (2017) also studied specific pedagogical approaches and strategies to enhance language learning using multimedia. The work of Kozlova & Polyezhayev (2022) is dedicated to cognitive-pragmatic research on phraseology, contributing to interdisciplinary understanding of language and cognition, providing insights into how certain language teaching approaches are used in interdisciplinary discourse. Behera & Karmakar (2022) critically reviewed the development of cultural diversity through global digitalization, with a special focus on its impact on

education. The authors discussed opportunities arising from digital technologies in preserving and supporting cultural diversity. Herrera-Ligero C., Chaler J., & Bermejo-Bosch I. (2022) described the possibilities of digital technologies in the education enhancement system in the field of rehabilitation. Also, Hosseini S., Peluffo D. H., Nganji J., & Arrona-Palacios A. (2022) identified the role of digital technologies in higher education. Meanwhile, Lazko & Tomashevska (2023) identified key trends in music education in the context of higher education and digitalization. Specifically, the authors drew attention to the role of digital technologies in shaping educational reforms in Ukraine. Onischuk (2021) described the main innovations in the education of judges in Ukraine and outlined a strategy for their development. The author also detailed the implementation of new approaches, technologies, and methodologies to improve education in Ukraine. Thus, the problem of using innovative technologies is popular among Ukrainian scientists; however, it is necessary to approach this issue comprehensively and thoroughly characterize the main innovative approaches implemented and used in the higher education system in Ukraine.

## 3. Methodology

*Research Design*

This study employs a mixed-methods approach, incorporating both quantitative and qualitative methods, to ensure a comprehensive understanding of innovative approaches in higher education in Ukraine.

Intersectional Design: The research gathers data at a single point in time to encompass the current landscape of innovative practices.

*Participants and Sampling Procedure*

Sample size: the primary participants of this study are 125 teachers of higher educational institutions of Ukraine. They have different levels of experience in applying innovative methods and approaches in the education system

Inclusion Criteria

1. Participants must be actively employed instructors in higher education institutions in Ukraine.
2. Teachers from different disciplines, including humanities, natural sciences, social sciences, and technology, to ensure diverse representation.
3. Teachers of different ranks (e.g., assistants, associates, and professors), considering that educators at different stages of their careers may bring diverse perspectives.
4. Inclusion is based on voluntary participation in the survey.

Sample Procedure

The study employs a stratified random sampling approach. Stratification is based on the academic ranks of teachers, ensuring proportional representation from each academic rank to avoid bias. Simultaneously, disciplinary stratification is used to ensure representation from various academic disciplines, reflecting the diversity of higher education. Within each stratum, participants are randomly selected to eliminate selection bias. Randomization is implemented using a computer-generated random sequence of numbers to ensure an unbiased selection process.

Recruitment involves reaching out to potential participants through official channels of selected educational institutions. Potential participants receive an email invitation containing information about the research, its purpose, and the voluntary nature of participation. Informed consent is a crucial element, providing detailed information about the research and its goals before participants decide to join. Once informed consent is

obtained, emphasizing voluntary participation and confidentiality guarantees, participants are enrolled in the study.

*Data Collection (Quantitative Data)*

The survey questionnaire has been developed based on a thorough review of relevant literature and consultations with experts in the field. The questions are structured to gather information on teaching methods, technology integration, and attitudes towards innovation.

*Data Collection (Qualitative Data)*

*Literature Content Analysis*

Relevant scientific literature, including scholarly articles, conference papers, and comprehensive monographs, has been thematically analyzed. The content analysis focuses on outlining new trends, challenges, and perspectives of innovative approac The literature was selected based on clear criteria.

1. Relevance. The literature should demonstrate direct relevance to the current state of innovative approaches in higher education in Ukraine, addressing contemporary issues and trends.
2. Alignment with the topic. The literature must specifically address innovative approaches in higher education in Ukraine, providing insights into trends and prospects within this context.
3. Language.The literature should be available in Portuguese, English, or Ukrainian, ensuring accessibility to a wider audience and facilitating comprehension for researchers and practitioners in these languages.
4. Publication date. Preferential consideration should be given to literature published within a relevant timeframe, ensuring the information is current and reflective of recent developments in higher education in Ukraine.
5. Academic rigor. Selected literature should demonstrate academic rigor, employing sound methodologies and scholarly analysis to support its findings and conclusions.
6. Authoritativeness of Sources. The literature should be sourced from reputable academic journals, books, or recognized institutions in the field of higher education, enhancing the credibility of the information presented.

By applying these criteria, we ensured a well-rounded selection of literature that is both relevant to the current discourse on innovative approaches in higher education in Ukraine and accessible to a diverse audience through different languages.

*Data Analysis*

In this study, we employ an integrated approach by combining quantitative and qualitative methods to achieve a comprehensive understanding of the current landscape of innovative approaches in higher education in Ukraine. Our methodology involves a meticulous comparative analysis to discern potential convergences or divergences between teachers' practices (quantitative data) and the overarching educational discourse (qualitative insights).

*Quantitative Analysis*

For the quantitative aspect, data collection revolves around structured surveys and assessments distributed among a representative sample of educators. Tools such as Microsoft Exel are utilized for robust quantitative analysis.

*Qualitative Analysis*

In tandem, a qualitative investigation is conducted through in-depth interviews, focus group discussions, and content analysis of relevant educational documents. Thematic analysis is applied to extract key qualitative insights, providing a nuanced perspective on the broader educational discourse surrounding innovative approaches.

*Integration of Results*

The quantitative and qualitative findings are integrated through a triangulation process, enhancing the validity and reliability of the overall results. The comparative analysis aims to reveal any alignment or disparity between the quantitative data reflecting teachers' practices and the qualitative insights derived from the educational discourse.

*Software and analysis tolos*

To address the concern raised, it is pertinent to note that all quantitative data are meticulously analyzed using Exel. This software ensures accuracy, efficiency, and transparency in the processing and interpretation of quantitative results. Additionally, Exel may be utilized for qualitative data analysis, providing a robust foundation for drawing meaningful conclusions.

In essence, this methodological framework guarantees a thorough examination of innovative approaches in higher education in Ukraine, incorporating both quantitative and qualitative dimensions and employing cutting-edge tools for meticulous analysis.

*Ethical Considerations*

1. Anonymity and Confidentiality: Participants are assured that their responses will remain confidential, and no identifying information will be disclosed. Any collected demographic data is kept anonymous to preserve confidentiality.
2. Voluntary Participation: Participants are informed that their participation is entirely voluntary, and they have the right to withdraw from the study at any stage without consequences.

## 4. Results and discussion

The preparation of specialists in the innovative higher education system of Ukraine operates within the organic unity of the general, specific, and individual domains. In the context of the general, it reflects the regularities of higher education acquisition and is an essential part of the defined system. As the specific, it has its characteristics determined by the specifics of future professional innovative activities. As the individual, it anticipates the dependence of preparation on individual traits, knowledge levels, interests, and inclinations. The core idea revolves around a systematic approach based on the synthesis of continuous professional education and the principles of the individual development of a teacher capable of professional innovative activities. The professional-pedagogical component of pedagogical education aims to unfold the individual characteristics of the student for the purpose of their professional self-development. The diversity of education, freedom in choosing its content and forms, is a crucial condition for its humanization (Krymets, 2022). Thus, the preparation of modern specialists in Ukrainian programs is geared towards developing the capacity for innovative activities, mastering information technologies, and effective communication (interaction with a team and various categories of students), which defines the fundamental innovations (Herrera-Ligero et al., 2022). Therefore, innovative approaches in the higher education system of Ukraine involve the application of creative and advanced methods to enhance teaching, learning, research, and overall institutional effectiveness. These approaches are aimed at adapting education to the changing needs

of students, industry, and society. Modern Ukrainian educators who participated in the survey demonstrated a high level of familiarity with the use of innovative approaches in higher education in Ukraine. In particular, when asked, ¿"How familiar are you with innovative approaches in higher education?" 59.2% (or 74 respondents) indicated that they are "very familiar", while 38.4% (or 48 respondents) acknowledged that they are "somewhat familiar". Only 2.4% or 3 respondents indicated that they are not familiar at all with innovative approaches (See Figure 1).

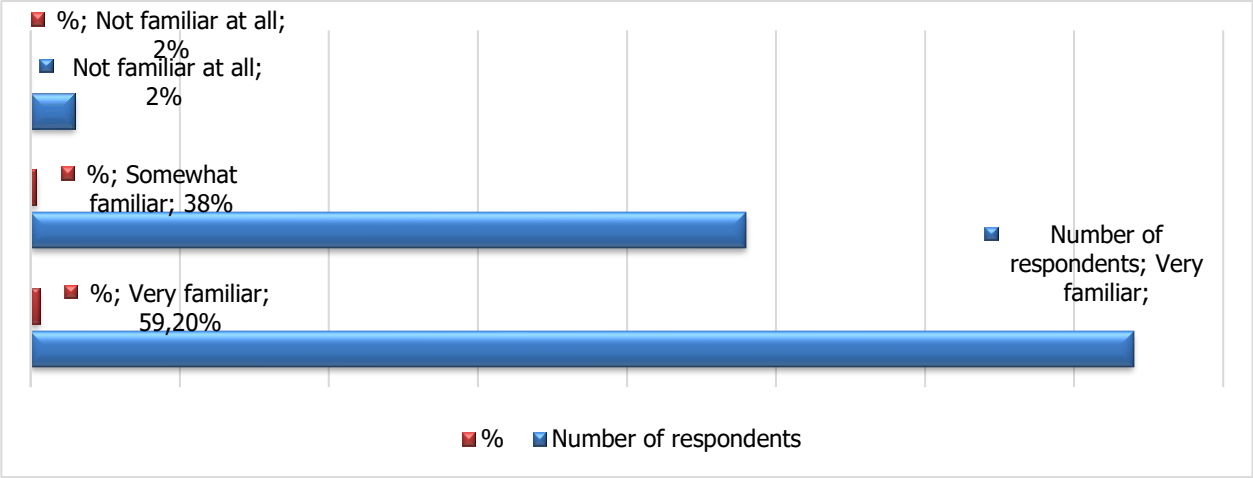


***Figure 1.*** Diagram of familiarization of teachers with innovative approaches.
**Source:** author's development

Based on the survey, Ukrainian teachers employ various innovative approaches in their professional activities. The survey data indicate the level of utilization of different innovative approaches in higher education among the participants. Specifically, technology integration is the most widely used innovative approach, emphasized by 88% of the respondents. This indicates a high level of technological literacy among the survey participants. Project-based learning and competency-based education also have a high level of utilization (79.2% and 62.4%, respectively).

It should be noted that project technologies relieve a certain psychological tension, since the relationship between the student and the teacher (subjective relations) becomes electronic resource (objective relations). Project work is a valuable way of real use of communication skills acquired in the auditorium. Unlike traditional language learning, where all tasks are prepared by the teacher, project the work places responsibility for their own learning on the students themselves. Projects motivate, stimulate, empower and enthuse, which contributes students' confidence, self-respect and independence, as well as improving students' speaking skills, deepening knowledge of the subject and developing cognitive abilities. Project technologies are integrated into skill-oriented is the thematic block introduced as a separate sequence of types of work with a more traditional approach. It requires multi-stage development to achieve success. This suggests that many participants value practical experience and the development of specific skills. Education for sustainable development is also noted for its high level of usage, reflecting a growing attention to sustainability issues in educational programs (79.2%) (See Table 1).

**Table 1.**
*Utilization of innovative approaches in higher education in Ukraine*

| Approach | Number of respondents | % |
|---|---|---|
| Technology integration | 110 | 88% |
| Active learning | 87 | 69.6% |
| Project training | 99 | 79.2% |
| Flexible educational program | 76 | 60.8% |
| Competency-based education | 78 | 62.4% |
| Data analytics and analytical learning | 88 | 70.4% |
| Global and cross-cultural experience | 45 | 36% |
| Education for sustainable development | 99 | 79.2% |
| Gamification | 76 | 60.8% |

**Source:** author's development.

Overall, the data indicates the diversity of approaches in higher education in Ukraine and a certain level of acceptance of innovations in the educational process. Although the flexible approach to educational programs is utilized to a lesser extent, it still receives significant attention, suggesting a demand for flexible learning programs. Global and intercultural experience is less popular among survey participants, indicating a less developed interaction with international aspects of higher education. Nevertheless, a crucial aspect is the effective integration of modern technologies, promoting the development of digital literacy in students and making the learning process more engaging and convenient for education seekers. A detailed description of these innovative approaches is presented in Table 2.

**Table 2.**
*Innovative approaches*

| Approach | Explanation |
|---|---|
| Technology integration | *Online and blended learning*. Using digital platforms to deliver the course, including fully online programs and blended learning models that combine online and traditional face-to-face learning.<br>*Virtual Reality (VR) and Augmented Reality (AR).* Integrating immersive technologies to create engaging learning experiences, simulations and virtual labs. |
| Active Learning | Flipped Classroom. Taking traditional lecture content outside the classroom, allowing classroom time for interactive discussion, problem solving, and concept application.<br>*Problem-based learning*. focusing on real-world problems and encouraging students to solve them together, developing critical thinking and problem-solving skills. |
| Project-based learning | Assignment of projects that require students to apply theoretical knowledge to real-world scenarios, promoting collaboration, creativity and the development of practical skills. |
| Flexible Curriculum | Offering flexible degree pathways that allow students to tailor their academic experience based on their interests, goals and career aspirations. |
| Competency-based education | Assessment of students based on demonstrated mastery of specific skills or competencies. Emphasis on the development of students' practical skills and competencies. |
| Data Analytics and Learning Analytics | Using data-driven information to monitor and improve student performance, identify areas for improvement, and personalize the learning experience. |
| Global and Cross-Cultural Experiences | Fostering international collaborations, exchange programs, and study abroad opportunities to expose students to diverse perspectives and cultures. |
| Sustainable Development Education | Integrating the principles of sustainable development into the curriculum to prepare students to solve global problems and promote environmental stewardship. |
| Gamification | The use of gamification elements in education can stimulate the interest and motivation of students. Rewards, levels, game challenges and competition can make the learning process more exciting. |

**Source:** author's development.

These innovative approaches are not mutually exclusive and, in practical terms, can be combined to create a dynamic and adaptive higher education environment that prepares students for success in a rapidly changing world.

According to the results of the survey on the importance of innovative approaches for improving the experience of teaching and learning in higher education, the majority of respondents (43 people - 34.4%) consider innovative approaches to be important or even extremely important for improving the experience of teaching and learning in higher education. The importance of this issue was also recognized by 70 people (56%). 10 people have a neutral attitude, and only 2 people believe that innovative approaches are not important (See Figure 2).

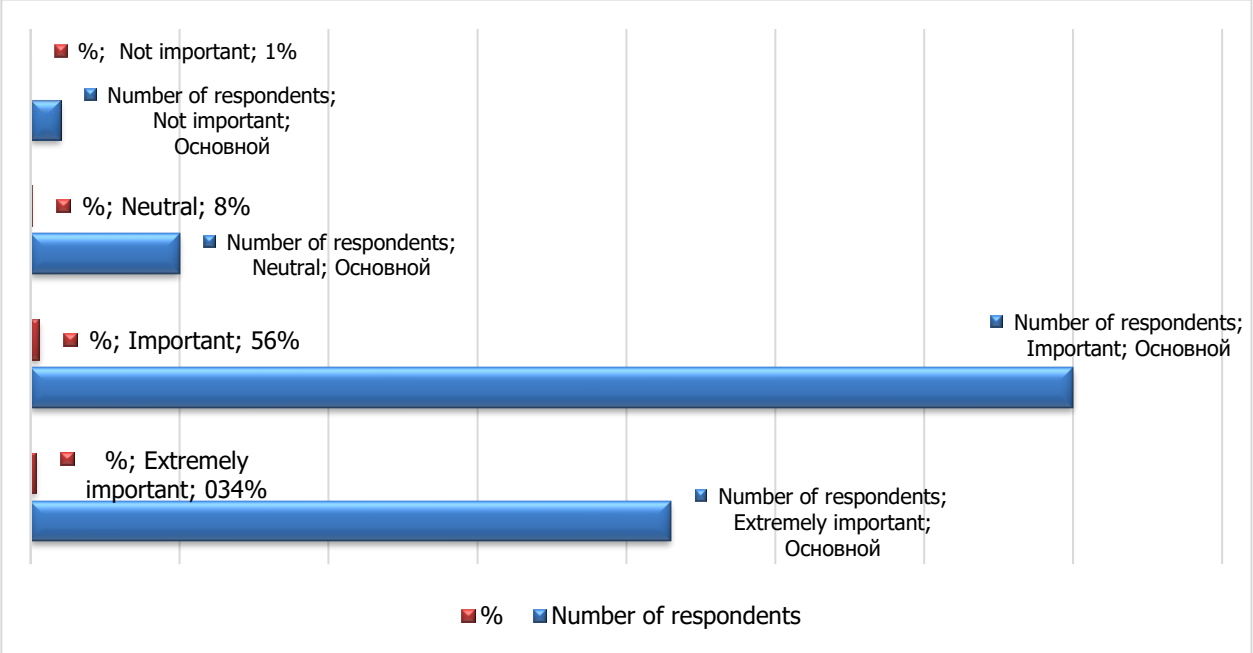


***Figure 2.*** Respondents' attitude to the importance of using innovative technologies
**Source:** author's development.

Based on the survey, it is also determined that the implementation of innovative approaches in higher education can have a positive impact on student engagement and improvement in learning outcomes from several perspectives. Firstly, there is the issue of student engagement. The majority of teachers noted (56%) that innovative approaches allow for the creation of educational content that is interesting and understandable for students. Thus, the use of cutting-edge technologies, from interactive virtual lessons to virtual reality, can make learning more attractive. On the other hand, adaptation to individual needs is crucial. Innovative approaches enable personalized learning processes, considering the individual needs and learning styles of each student (62.4%). Adaptive platforms and programs can provide students the opportunity to learn at their own pace and choose topics of interest. At the same time, 79.2% of respondents pointed out that the use of innovative tools, such as discussion forums, video conferences, and collaborative online learning, stimulates active student participation and develops collaboration skills. Meanwhile, modern researchers argue that the effective use of innovative approaches can influence the improvement of learning outcomes. Contemporary educators identified that they have participated in courses to enhance their digital competencies (33.6%). Additionally, others emphasized the significant role of international internships in the implementation of innovative approaches, contributing to the exchange

of experiences with colleagues, participation in practical-scientific conferences, and professional development courses.

They also contribute to interactivity and practice. In particular, the use of innovative methods, such as virtual laboratories or simulations, can facilitate a deeper understanding of the subject and enhance the practical skills of students. Overall, innovative approaches can not only make learning more interesting but also enhance the effectiveness of the educational process, expanding opportunities for the development of creativity, critical thinking, and practical skills of students.

However, it is essential to consider that integrating innovations into the teaching process can be a challenging task for modern educators. Overall, out of 125 teacher responses, certain difficulties were identified during the integration of innovative approaches into teaching (See Table 3).

**Table 3.**
*Challenges of implementation and utilization of innovations*

| Challenges | Explanation |
|---|---|
| Technological challenges | In 108 responses (86.4%), it is indicated that educators face difficulties in mastering new technologies, especially when they lack sufficient training or support. |
| Lack of access to necessary resources | In 95 responses (76%), the absence of required technical and financial resources is mentioned as complicating the integration of innovations. |
| Resistance from the teaching staff | According to 72 responses (57.6%), there is resistance from other educators who are concerned about potential changes in their work. |
| Lack of time | 89 responses (71.2%) pointed out a perceived lack of time to learn new methods and technologies. |
| Inequality of conditions | 54 responses (43.2%) highlighted differences in working conditions that affect the effectiveness of integration. |
| Lack of support and training | 40 responses (28%) mentioned the absence of support from the administration and insufficient training opportunities. |
| Uncertainty of results | 42 responses (33.6%) indicated uncertainty about the results and effectiveness of innovative methods. |
| Ethical and privacy issues | In 28 responses (22.4%), concerns about ethics and privacy arise when using advanced technologies. |

**Source:** author's development.

These responses underscore the myriad challenges that educators encounter when endeavoring to incorporate innovative practices into their pedagogical methods. Recognizing these difficulties is pivotal, and there is a pressing need to proactively cultivate support systems and resources for teachers, thereby facilitating their seamless adaptation to novel methodologies and technologies. In light of the distinct challenges faced by teachers in implementing innovative approaches in higher education, several promising avenues for their advancement can be identified:

1. *Technological training and education*

Introduce mandatory training courses and seminars focused on enhancing proficiency in utilizing modern technologies in education. Develop online resources and self-study support to ensure educators have continuous access to information and the latest methods.

2. *Provision of financial support*

Establish financing systems that allocate funds for acquiring technical equipment and software. Forge partnerships with companies and foundations to secure grants or subsidies.

*3. Development of support programs*

Form specialized teams or expert groups offering guidance and assistance to teachers. Conduct regular training sessions and webinars on the implementation of new methods, with ongoing monitoring of their success. Establish teacher support centers at each school or district level, providing personalized support and resources.

*4. Stimulation of team cooperation*

Organize weekly or monthly meetings where teachers can share experiences, collaborate on tasks, and form groups for joint implementation of innovations.

*5. Creation of a flexible schedule*

Consider the implementation of flexible working hours for teachers, allowing them to allocate time freely for learning new methods and enhancing their skills.

*6. Facilitation of Communication and Interaction.*

Develop a virtual platform for exchanging ideas, posting materials, and discussing issues related to the integration of innovations in higher education. Support teachers in creating virtual groups to discuss specific topics.

*7. Facilitation of evaluation and results determination*

Implement a reporting system enabling teachers to assess the effectiveness of new methods and gather data for continual improvement of the educational process.

These measures aim to foster a favourable environment for the successful integration of innovative approaches in higher education, tailored to the specific challenges and needs of the teaching staff. Active communication, ongoing professional development, and the exchange of experiences can mitigate resistance, ultimately enhancing the success of integrating innovations into pedagogical practice.

The obtained results confirm the idea that innovation is an essential component of the higher education system's development (Alam, 2021). The growing interest in innovative approaches in education indicates the necessity to adapt to modern challenges and implement advanced methods to enhance student learning and preparation (Sutherland, 2014). It is crucial to provide support and incentivize educators in the implementation of innovations, thereby contributing to the development of a high-quality and competitive higher education system in Ukraine. The results determined that the data obtained from the surveys indicate the diversity of approaches to higher education in Ukraine. The most popular is the integration of various technologies into the system of higher education. This is explained by the digitization trend, which is now actively spreading at all levels of education (Luan et al., 2020). Active learning also plays an important role in training future specialists. In particular, the use of the flipped room moves traditional lecture content out of the classroom, freeing up classroom time for interactive discussions, problem solving, and concept application. The topic of the use of artificial intelligence is particularly important among scholars who investigate various practical, educational and ethical aspects of the use of AI in education (Mohammed & Nell Watson, 2019; Renz et al., 2020).

One can agree with the statement of Lee & Lee (2021) that education for all age groups should prepare society for the future and contribute to individuals' self-realization. Additionally, the idea that education in the era of artificial intelligence (AI) poses both an exciting new challenge and a new opportunity is

supportable (Lee & Lee, 2021). New learning pathways are being developed, such as learning management systems based on digital textbooks, personalized learning through big data analysis, interaction technology with speech recognition and synthesis, and chatbot assistants utilizing natural language processing (NLP).

However, it is possible to disagree with the assertion that most artificial intelligence (AI) technologies have significant applications in education and educational policies, as many of these technologies may not be applicable in all educational domains or may require specific conditions for successful implementation (Lee & Lee, 2021). Questions may also be raised about how effective predictive analysis technologies using AI are in providing proper support to students with problems. For instance, these technologies might not always accurately identify students' needs or offer individualized recommendations, especially in higher education, where an individualized approach is a key element of success. In this context, we agree with Sukhonos, V. V., Harust, Y. V., & Shevtsov, Y. A. (2019) that it is important to consider the ethical aspects of using AI technologies in education and potential limitations in access to these technologies for all students. The obtained results also determined that the implementation of innovative approaches in higher education of Ukraine may face certain challenges and difficulties. This statement is also emphasized by many modern researchers (Rossikhin et al., 2020). However, the results of the study contradict the statement of Rossikhin V., Rossikhina H., Radchenko L., Marenych V., & Bilenko L. (2020) that in Ukraine, the digitization process lags behind the best global educational practices. It is important to take into account that not only in Ukraine, but almost everywhere, a number of circumstances can be found that indicate a narrow approach to understanding the prospects and possibilities of digitization of education. In addition, one should take into account significant problems in higher education, which the traditional system of many countries of the world today does not solve, in particular, limiting and averaging the intellectual development of the most gifted children.

To overcome these difficulties, it is necessary to actively interact with pedagogical teams, develop support and training for teachers, as well as use the experience of famous universities in the world to implement innovative approaches in a coordinated and successful manner in the Ukrainian higher education environment.

The obtained results also emphasized certain prospects for the development of the process of implementation of modern innovative approaches in the system of higher education. Effective technological training of teachers, provision of financial assistance, development of support programs, creation of a flexible schedule are particularly relevant. These aspects are also discussed in detail in modern literature (van Hoof et al., 2015; Serafín & Depešová, 2018).

This study correlates with the results of Serafín & Depešová (2018), which demonstrated that digital literacy is an important driver of the development of modern innovative education. The authors of this study support this statement, however, special attention should also be paid to the development of material and technical support. This aspect is not sufficiently covered in this work, however, this issue is described in more detail in other modern works (Silva & Janes, 2023). In general, this work is notable for its novelty through an in-depth analysis of innovations in higher education, a practical approach to studying and providing recommendations for improving the educational process in Ukraine. It can become a valuable contribution to the understanding of modern challenges and opportunities in higher education in Ukraine. In addition, this study focuses on approaches to studying specific segments of higher education, such as the use of technology in educational programs, the integration of international experience into the educational process, and the development of key skills for successful adaptation in the modern world. Thanks to this deep and multifaceted approach, the work not only identifies trends, but also reveals their practical significance and potential benefits for all participants of the educational process in Ukraine. Such a research approach contributes to the formulation of specific strategies for the further development of innovations in higher education, contributing to the creation of a sustainable, progressive educational environment in Ukraine. The limitations of this study are conducting a survey purely among teachers and considering only

modern literature. This approach somewhat levels the achievements of other scientists, however, it enriches the research with relevant information.

## 5. Conclusions

Innovations play a crucial role in the training system for future professionals. The research results confirm the growing interest of the pedagogical community and students in innovative approaches in higher education. This indicates a commitment to continuous development and improvement of the learning process. It has been identified that global and intercultural experience is less popular among survey participants, casting doubt on the level of interaction with international aspects of higher education. To overcome this challenge, it is essential to activate international partnerships and initiate efforts to ensure a global perspective on educational processes.

At the same time, the research suggests that implementing innovations in higher education in Ukraine may face certain challenges. This requires a systematic approach, active teacher support, financial backing, and the development of necessary resources to overcome these challenges. Thus, innovations are a vital component of higher education development, but their successful implementation demands strategic planning focused on addressing specific challenges and ensuring alignment with international standards. Overall, innovative approaches to higher education in Ukraine have significant potential for enhancing the quality of learning and professional training. However, achieving success requires active collaboration with all stakeholders in the educational process, addressing identified challenges, and providing necessary support for both teachers and students. Only through such an approach can the effective implementation of innovative approaches in higher education be achieved, ensuring continuous improvement of the system.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.9

Cómo citar:
Yefremova, O., Humeniuk, V., Kalinichenko, O., Fomina, L., & Kokhan, D. (2024). The significance of digital technologies in fostering the development of communicative competence among the prospective doctors. Revista Eduweb, 18(1), 124-138. https://doi.org/10.46502/issn.1856-7576/2024.18.01.9

# The significance of digital technologies in fostering the development of communicative competence among the prospective doctors

## La importancia de las tecnologías digitales para fomentar el desarrollo de la competencia comunicativa entre los futuros médicos

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Recibido: 01/01/24
Aceptado: 02/02/24

**Abstract**

Future doctors are expected to possess a high level of professional skills, as reflected by their acquisition of proficient communication competence. The purpose of the article is to determine the role of digital technologies in the formation of communicative competence of prospective doctors. The objective was attained through the use of observation, analysis and weight coefficient, efficiency coefficient, Spearman's correlation coefficient. It was established that the development of communicative competence skills

primarily allows to ensure the relevant orientation to the communication conditions (1.6) as well as informativity (1.53). To cultivate the communication proficiencies of prospective medical professionals, the authors developed corresponding approaches that included the use of digital technologies. The study of theoretical material involved the use of the SlideDog application; conducting practical classes via Medvoice Platform. The formation of professional competence involved the role-playing of relevant situations, based on the materials of the Pediatric Dentistry Academy, CARE-NExT-PG. After determining the level of students' communication skills development in Group 1 (40.2) and Group 2 (40.1), it was established that they attained a high level. The development of communication skills contributed to the formation of students' communication and social skills, as well as skills of abstract thinking and statistical information processing. The practical significance of the study lies in the elaboration of effective approaches to the development of prospective doctors' communication skills drawing on the use of digital technologies. Research perspectives may be linked to the comparison of the level of communicative competence among medical students across various academic levels.

**Keywords:** communicative and competency skills, digital applications, professional terminology, role-playing the professional situation, transfer of content.

## Resumen

Se espera que los futuros médicos posean un alto nivel de habilidades profesionales, como lo refleja la adquisición de una competencia comunicativa competente. El objetivo del artículo es determinar el papel de las tecnologías digitales en la formación de la competencia comunicativa de los futuros médicos. El objetivo se logró mediante el uso de observación, análisis y coeficiente de ponderación, coeficiente de eficiencia, coeficiente de correlación de Spearman. Se estableció que el desarrollo de las habilidades de competencia comunicativa permite principalmente asegurar la orientación adecuada a las condiciones de comunicación (1.6) así como a la informatividad (1.53). Para cultivar las habilidades comunicativas de los futuros profesionales médicos, los autores desarrollaron enfoques correspondientes que incluían el uso de tecnologías digitales. El estudio del material teórico implicó el uso de la aplicación SlideDog; Realización de clases prácticas a través de la Plataforma Medvoice. La formación de la competencia profesional implicó la dramatización de situaciones relevantes, con base en los materiales de la Academia de Odontología Pediátrica, CARE-NExT-PG. Luego de determinar el nivel de desarrollo de las habilidades comunicativas de los estudiantes del Grupo 1 (40.2) y Grupo 2 (40.1), se estableció que alcanzaron un nivel alto. El desarrollo de habilidades comunicativas contribuyó a la formación de habilidades sociales y comunicativas de los estudiantes, así como habilidades de pensamiento abstracto y procesamiento de información estadística. La importancia práctica del estudio radica en la elaboración de enfoques eficaces para el desarrollo de las habilidades comunicativas de los futuros médicos basándose en el uso de tecnologías digitales. Las perspectivas de investigación pueden estar vinculadas a la comparación del nivel de competencia comunicativa entre estudiantes de medicina en varios niveles académicos.

**Palabras clave:** aplicaciones digitales, habilidades comunicativas y competenciales, role-playing de la situación profesional, terminología profesional, transferencia de contenidos.

## 1. Introduction

The utilization of information technologies has a significant impact on the enhancement of the educational process, as evidenced by communication advances, knowledge acquisition, etc.. This is largely attributed to the wider availability of scientific resources and integration of diverse materials into academic curriculum. By implementing digital technologies in a well-structured learning environment, one can effectively foster communicative competence among future medical professionals (Zhao et al., 2019; Silkens et al., 2023). Such competency is instrumental in enabling doctors to accurately diagnose patients and perform

professional responsibilities proficiently. Therefore, probing deeper into this topic remains pertinent for further research endeavors.

The concept of communicative competence is aimed at establishing contacts with people, taling into considering the attained knowledge and expertise to ensure effective communication (Gummesson et al., 2023). The formation of communicative competence is indispensable in ensuring professional success as a result of professional interpersonal contacts. Communication facilitates the assistance provision on any subject matter, as well as enables efficient engagement with colleagues, availability of resources for effective interaction (Chaban et al., 2021; Babinets et al., 2022). High-profile communication can be ensured as a result of high-quality use of language tools, development of communication culture. Moreover, maintaining efficient interaction allows to ensure the formation of professional competence. To that end, one needs to have general communication skills, a developed outlook, as well as specialized expertise in a specific area. During communication, it is important to engage emotionally, thus contributing to people's commitment to establish appropriate contact. The cultivation of effective communication skills in aspiring medical professionals must be closely linked to the refinement of articulate speech, as well as the mastery of language tools (Muller & Konecny, 2023; Kawamura et al., 2023). Furthermore, it necessitates the capacity to reproduce the former communication subjects in order to construct a comprehensive understanding, furnish proficient suggestions, etc. However, professional communication should rely on the appropriate medical terminology that is scientifically substantiated.

The utilization of digital technologies, which serve as instruments for producing and storing data in a digitalized format, enables the attainment of an elevated degree of professional aptitude. Digital technologies are technical means that promote rationality in education and ensure the development of the competitiveness of the future qualified specialist (Lisetska, 2020). One of the digital technologies that can enhance the learning process is electronic coursebooks, study program complexes, tools for online control, etc. The effectiveness of digital technologies in education is related to the formation of independence, logical thinking, the development of new knowledge, interaction with other students (Marler & Ditton, 2021). The successful professional activity of the future doctor should be associated with the formation of ethical values that will contribute to ensuring a holistic practical implementation. Digital technologies promote teamwork, which is reflected in value orientation, formation of professional paradigms and so forth (Sodomora et al., 2021). Given the above, the development of communication skills of future doctors is indispensable for obtaining professional information, ensuring cooperation, forming scientific achievements, etc.

The exploration of the theoretical framework made it possible to identify the overarching significance of communication in fostering future doctors' professional growth, with particular emphasis on leveraging digital technologies. Research gaps pertain to devising tailored training mechanisms for prospective medical professionals using digital tools that allow for the development of their communication skills. The purpose of the current study is to ascertain how digital technologies contribute towards cultivating effective communicative competence among future doctors.

The authors established the following objectives to achieve their goal:

- to ascertain the necessity of cultivating communication proficiencies among prospective doctors by emphasizing the significance of predetermined criteria through the weighting factor;
- to devise the applicable approaches to enhancing the communicative proficiency of prospective dentists and military medical officers with a specialization in "Medical business" through the utilization of digital technologies;
- to determine the level of students' acquired communication skills as a result of using the efficiency factor;

- to determine the development level of additional skills in medical students as a result of orientation towards approaches to the formation of communicative competence of prospective medical professionals.

## 2. Literature review

Digital technologies have become widespread in the education of prospective medical professionals, which contributes to the development of their professional skills. The feasibility of the process is attributed to the use of appropriate tools that are seamlessly incorporated into the training program. Typical strategies pertaining to digital technologies include the advancement of computer systems for data processing and communication purposes. As noted by Esposito et al. (2023), digital technologies promote flexibility in learning that is not limited to specific frameworks. The application of artificial intelligence is important not only for practicing medical professionals., but also for future doctors. To work with artificial intelligence, relevant skills should be developed in the medical education system. The analysis of medical students' questionnaires completed at the University of Lübeck and the University Hospital of Tübingen made it possible to determine their positive attitude towards chatbots. Current research has it that the use of artificial intelligence not only enables the identification of potential risks, but also reflects the provision of structured learning (Moldt et al., 2023). In this light, the development of digital technologies contributes to the systematization of medical care, which allows for remote diagnostics. Ensuring high-quality communication makes it possible to enhance the accuracy of information collection, which will contribute to timely decision-making. This is evidenced by the development of individual and societal competencies stemming from the dynamic delivery of information and prompt decision-making. Therefore, digital competence should be developed in the learning process, which will ensure the formation of professional skills (Salem et al., 2022).

Information technologies contribute to the improvement of medical students' communication skills. Yet, it is expedient to ensure reframing and recalibration of perception, as well as to form experiential learning. In the realm of medical training, it is imperative to prioritize certain objectives that will guarantee the automation of healthcare services and ultimately enhance patient well-being. The incorporation of digital technologies must be closely connected to one's professional duties. This makes it possible to substantiate the relevance of such training, which is reflected in the motivation of students (Garling, 2022). The formation of medical students' communication skills contributes to the development of empathy and professional development, as it provides a more personal approach to each patient. The creation of discussion groups presents an opportunity for the enhancement and refinement of medical students' communication abilities, which provide for the discussion of the read text, a lecture, or a film on a professional topic. Such an approach to education made it possible to ensure the development of reflection among students at a professional level, the use of applicable communication strategies. When conducting research, it is crucial to consider the principle of prioritizing patient needs and preferences, which contributes to the development of mindfulness, self-reflection in students (Leijenaar et al., 2023). The development of communication skills in the framework of interaction between the future doctor and the patient in training is a limited issue. With that in mind, it is necessary to develop a science-based educational training program, which will be focused on the communicative interaction of future doctors. This can be achieved through blended learning – online and offline approaches that promote an effective hands-on interaction with patients (Houwen et al., 2022).

It is worthy of note that it is feasible to enhance the communication skills of prospective doctors through their involvement in general practice, namely during outpatient appointments. This is due to the possibility of providing face-to-face meetings between the doctor and the patient, which is related to obtaining and providing professional information. During the training, the level of medical subjects in the area of humanities should be raised and the number of practical classes should be expanded (Zhao et al., 2023). Evidently, the Chat Generative Pre-Trained Transformer (ChatGPT) can be used in medical education. This

pertains to the development of personalized methodologies in pedagogy, the design of practical classes, the solution of clinical problems, which contributes to more effective learning. However, the use of digital technologies should be moderate, excluding their mindless overuse. Nevertheless, digital technologies can have a positive impact on the development of clinical reasoning skills, independent learning, practical skills, and systemic logical thinking. ChatGPT allows ensuring the development of humanistic skills of students, to improve the accuracy of diagnosis due to the development of communication skills (Qu et al., 2023).

After the analysis of a substantial body of scholarly literature, a number of studies was identified highlighting the significance of cultivating effective communication skills in prospective medical practitioners. However, among the gaps in this field of inquiry, one can distinguish the lack of relevant methodologies for ascertaining communication skills through employment of specialized digital technologies.

## 3. Methods

### 3.1. Research Procedure

The research procedure involved three interrelated stages. At the first stage of the research, the benefits arising from the acquisition of communication skills were investigated. Also, among the highlighted advantages, the research identified the most significant ones that must be taken into account during training. At the second stage of the research, it was envisaged to develop additional approaches to learning that will contribute to the development of communicative competence. The elaborated approaches presented an additional element to the adopted research program, which included an emphasis on the development of communicative competence. Approaches to learning provided for the development of communicative competence for students who studied at the Department of Pediatric Dentistry. The same approach was applicable to the students of the department of emergency medicine and military medicine, specialization "Medical business". The duration of the training with the development of communication technologies comprised 5 months.

At the third stage of the research, the level of communication skills development in students of various specialties was established. Furthermore, this stage provided for the determination of additional skills of students, which were related to the formation of communicative competence of medical professionals.

### 3.2. Formation of the Sample

A total of 115 individuals, who were enrolled in a program to pursue a career as pediatric dentists and were assigned to Group 1, participated in the study. Additionally, there were 108 students specializing in "Medical business" from Lviv National Medical University named after Danylo Halytskyi and Kharkiv National Medical University, who took part in the research as Group 2 and pursued a career of military doctors. For the selection of respondents, the analysis method was utilized, which provided abstraction regarding the sample of respondents, taking into account the relevant and non-relevant criteria. Using the evaluation of individual characteristics, it was possible to determine the preferences of some respondents of the sample over others. The inclusion criteria involved a cohort of second-year students to establish uniformity among all participants. Moreover, as for the sample of research participants, it was envisaged that they would obtain a medical specialization to develop professional communicative competence. Limitations were related to specialization, which involved the selection of particular digital technologies that would contribute to that line of research. The exclusion criteria involved the restrictions on the sample of first-year students in view of the fact that their training program included many general subjects that do not affect the formation of professional competence. Respondents had a conscious choice to participate in the study and were informed about the provision of statistical observation of the learning process by independent researchers.

### 3.3. Methods

Determining the advantages of communicative competence of prospective doctors became possible due to the use of the general theoretical method of observation. The observation method consisted in determining the level of professional communication among first-year, fifth-year students, as well as internship students. As a result of observing students, it was intended to ascertain the factors that influence the establishment of effective communication as well as how is it related to the development of professional skills. It was also planned to determine which of the criteria were more significant in the formation of professional competence using a weighting factor. The authors determined the weighting factor with a particular emphasis on the specific research characteristics.

$$y_{\text{в}} = \frac{a_d \times p_c}{a_h}, \quad (1)$$

$p_c$ – the weight of the selected preference in comparison with other criteria;
$a_h$ – the highest weight of established advantages, which was determined by the authors of the article (equal to 10);
$a_d$ – the complexity of achieving a separate indicator during the development of communication skills.

The elaboration of approaches aimed at the development of communicative competence of future doctors in the basic education system involved the analysis of various sources (Son et al., 2018; Hagiwara et al., 2019; Ortega et al., 2021; Sekar et al., 2021).

In the course of elaborating of the approaches, the criteria that are interrelated with the development of professional competence of future doctors were taken into account. Upon analysis, it was determined that the attainment of a higher level of communication skills is possible due to the use of digital technologies. The utilization of digital technologies was also aimed at motivating the future doctors. The choice of digital technologies primarily involved a focus on professional specialization. Among 74 different digital applications, SlideDog, Medvoice Platform, Pediatric Dentistry Academy, CARE-NExT-PG, Kahoot were selected. Their selection was aimed not only at professional information acquisition, but also at the development of communication skills.

Determining the overall level of communication skills involved the use of the efficiency coefficient formula as follows, which was prepared by the authors. The level of communication skills was determined among students of different groups. The level of communication skills was determined drawing upon the observation of students during the entire study period and during the control exam. At the control exam, the students were given the task of role-playing a specific situation that needed to be addressed by the doctors. Additional skills were also identified that were developed among students during the development of communication skills

$$r_{ef} = c_s + c_e + c_p, \quad (2)$$

$c_s$ – future doctors are awarded points for the development of communication skills during the entire period of study;
$c_e$ – future doctors were awarded points for the development of communication skills on the basis of a control exam;
$c_p$ – the level of professional competence of future doctors.

### 3.4. Data Analysis

To verify the obtained numerical results, additional statistical calculations were performed in the study based on the Spearman rank correlation coefficient (Barabash et al., 2021). A statistical comparison of the obtained numerical results was carried out when determining the importance of the advantages of the communication skills development, ascertaining the level of their formation. A statistical comparison of the skills held by students was also carried out. If the calculated value is within the range of less than 0.3, then a low level of relationship between the presented values is present:

$$p = 1 - \frac{6\sum d^2}{n(n^2-1)}, \quad (3)$$

$n$ – the quantity of research metrics available for comparison purposes;
$\sum d^2$ – the sum of squares between rank indicators.

### 3.5. Ethical Criteria

Adherence to ethical standards was a fundamental prerequisite for the research. In accordance with the ethical criteria of the Guidelines for Research Ethics in Science and Technology (Mikkelsen et. al, 2016), it was planned to ensure correct data collection, which does not contradict the requirements of international communications. The authors confirm the absence of data falsification that is not related to the conducted research.

## 4. Results and discussion

At the initial stage of the study, an evaluation was conducted to identify potential advantages that could result from enhanced communicative competence among prospective doctors. The said research phase entailed identifying the most notable benefits associated with improving communication skills, which require the greatest emphasis during training (Figure 1).

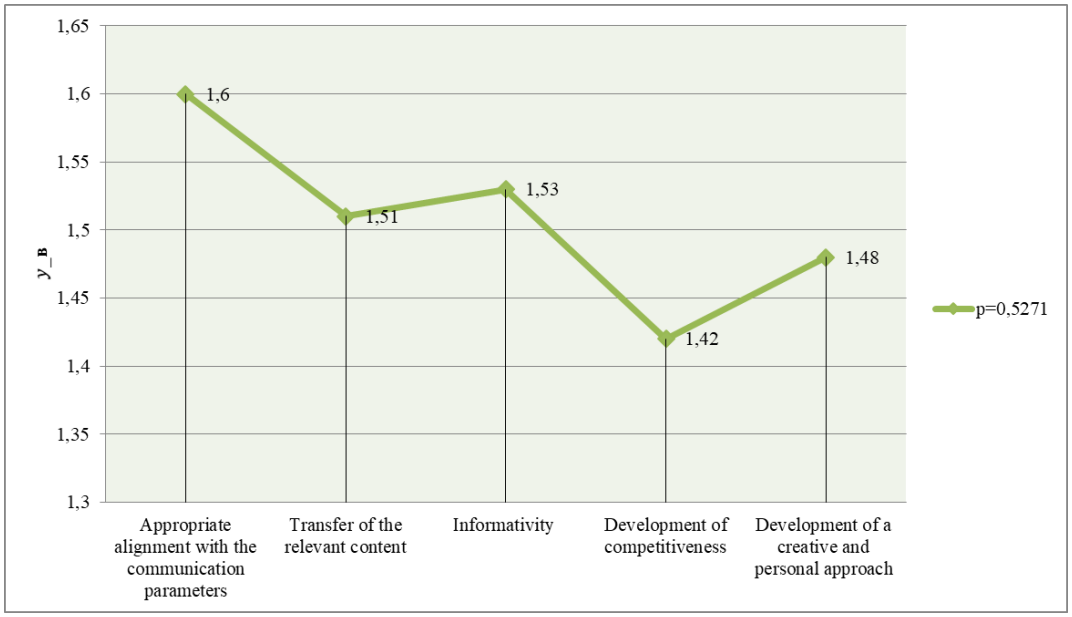


***Figure 1.*** The significance of benefits derived from the development of future doctors' communicative professional skills.

*The development of communicative competence* of future doctors primarily affects the relevant orientation to the conditions of communication. This enables efficient navigation of pertinent subjects, facilitating the preparation of a competent professional conversation. The relevant orientation to the communication conditions also contributes to the determination of the accurate diagnosis, focusing on the patient's complaints, which allows prescribing high-quality treatment. *Informativity* is also important, which affects the quality of the speech process and allows one to master professional vocabulary. From this perspective, it can enable the doctor to regulate the psychological impact on the patient and professionally inform about the diagnosis, which ensures productivity and effectiveness of professional activity. Informativity is reflected in the formation of the doctors' professional culture. *The conveyance of accurate information* is linked to its informativeness and serves as a reflection of the doctor's actions. Such conveyance must be rooted in the physician's awareness and composure, which impact their ability to regulate any sensual aspects. This indicator enables the adjustment of knowledge and appropriate response to patient diagnoses. Additionally, it fosters a positive outlook towards the treatment regimen among patients.

*The development of a creative and personal approach* during communication allows to increase the efficiency of the doctor-patient interaction. Moreover, this approach is reflected in the improvement of the quality of activities in medical practice. A personal approach contributes to obtaining positive dynamics during the interaction with the patient. For a medical practitioner, *cultivating competitiveness* is crucial and this can be demonstrated through effective communication with patients. Utilizing appropriate language facilitates the acquisition of essential knowledge, which affects the professional motivation and improvement of the doctor's qualification level.

Focusing on the established advantages of the future doctors' communicative competence development, the authors identified specific approaches to ensure the students' relevant training. The elaborated learning approaches involved the use of digital technologies as follows (Figure 2).


***Figure 2.*** Approaches to the development of prospective doctors' communicative competence based on the use of digital technologies

I. The study of theoretical material became possible due to the use of the SlideDog application. The application is aimed at conducting classes in the form of presentations, which allows for visual perception of materials. In addition, information can be provided not only with the help of text, but also with charts, drawings, video materials. The study of theoretical concepts necessitated the incorporation of practical applications, including comprehensive comprehension of specialized jargon and medical apparatus. Theoretical classes for dentists involve studying the criteria of intraoral scanning, studying approaches to radiological methods, understanding approaches to digital design of teeth. Furthermore, during the perception of theoretical information, it is necessary to determine the approaches to the rehabilitation of simple and complex cases. For students of the specialization

"Medical business" there is a definition of approaches to the diagnostic function, patient care, preventive, rehabilitation function; ensuring the principles of high-quality emergency care during accidents. Understanding patient diagnostic approaches during training is aimed at predicting possible consequences, carrying out invasive interventions. In order to cultivate effective communication skills, it was envisaged that collaboration within the team would be prioritized. Learning information using the SlideDog application involved discussing it in groups of students. The students were presented with a separate situation that needed to be solved on the basis of the acquired knowledge. The approach allowed not only the development of general erudition, but also the solution of non-standard situations in groups, which contributes to the development of communication skills.

II. Practical classes during the training of future doctors involve an orientation to interactivity within the framework of laboratory classes. Practical classes were conducted in specialized laboratories with the availability of appropriate tools, which contributed to the consolidation of the acquired theoretical knowledge. The use of interactive Medvoice Platform technology provides a visual perception of determining the approaches to the stages of conducting laboratory classes. Dividing students into groups allows to enhance the communication between them, including focusing on the stages of conducting laboratory work using the Medvoice Platform. After performing the laboratory work, the group of students was expected to present its results, which was aimed at the development of professional speaking competence. Facilitating hands-on sessions entails the cultivation of conceptual reasoning and comprehension of professional activity.

III. The formation of professional competence involved conducting a role play among future doctors. This involved the role-playing of a relevant situation from professional medical activity with the distribution of students' roles. The training stage was aimed at mastering professional skills, as well as behavioral reactions and professional communication. The formation of professional competence involved conducting theoretical classes by students and the development of practical skills. During training, students could use the Pediatric Dentistry Academy and CARE-NExT-PG applications. The focus on applications contributed to a better perception of educational information, which made it possible to conduct theoretical classes while fluently possessing professional knowledge. During the staging of the corresponding situation, the applications facilitated orientation to professional materials for determining clinical diagnosis, approaches to treatment, etc. Additionally, at this stage students had to comply with relevant ethical and legal norms. Completing professional documentation was one of the elements of training.

IV. During training, it was also planned to provide digital assessment of the future doctors' knowledge. The training stage was implemented utilizing the Kahoot online service. The service offers the creation of quizzes, discussions in learning conditions that develop teamwork. It also provides for testing knowledge in a test format, which contributes to the facilitation of scientific, methodical, and organizational activities. The knowledge assessment is aimed at determining the level of knowledge regarding the understanding of individual diseases, features of the human body. Moreover, the assessment involves students' understanding of the specifics while determining the patient's condition, including and psychological, which is related to the development of communication skills.

Conducting the research involved determining the general level of development of students' communication skills as a result of orientation to the developed approaches to learning. The results were obtained among future dentists (Group 1) and military doctors (specialization "Medical business") (Group 2) (Figure 3).

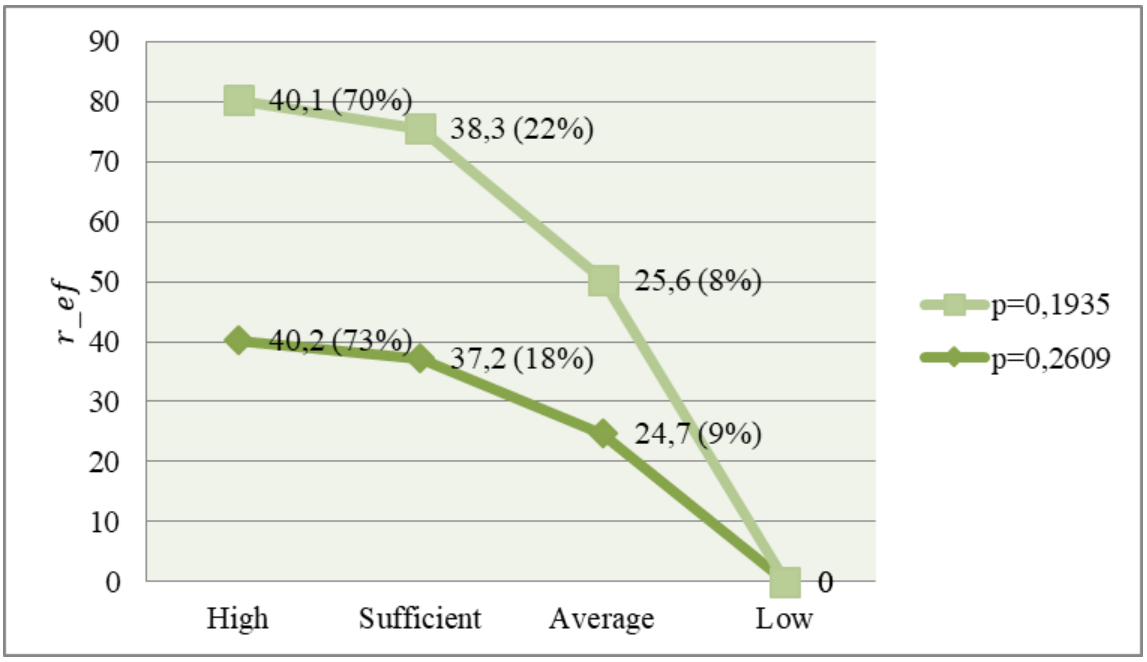


***Figure 3.*** The level of communication skills development among prospective doctors in different groups

During the study, it was determined that a majority of the prospective doctors in both groups demonstrated exceptional communication abilities. This is due to the fact that the students were fluent in professional information, which allowed them to actively solve a particular role-played situation. It should be noted that such results indicated the achievement of a high level of proficiency, as it involves the relevant use of theoretical knowledge to solve practical problems. Students were able to reasonably use professional data, utilize applicable methodologies to delineate an accurate clinical scenario, and execute suitable diagnostic procedures.

A sufficient level of communication skills was also common among students of different groups. The students of Group 1 were able to provide the most qualitative treatment of dental problems, which is draws upon the implementation of specific algorithms. However, additional study was needed to combine the different results regarding the CT scan and the appropriate follow-up. Students of Group 2 mastered the skills of conducting primary diagnostics, which was reflected in high-quality communication. However, additional knowledge was needed to identify approaches to mitigate the onset of further ailments.

A low level of knowledge was not evident among future doctors, while a modest degree of proficiency was noted in a minority of students. Apparently, this is due to the lack of students' active participation in the discussion during the role-playing of individual situations and work in groups.

After the training, the skills that were acquired by the future doctors were also highlighted. The characterization of refined skills was linked to the cultivation of proficient and effective communication skills (Table 1).

**Table 1.**
*The acquired skills of future doctors during the formation of communication*

| Variety of skills | Indicators of Group 1 | Indicators of Group 1 | $p$ |
|---|---|---|---|
| Cognitive skills | 26% | 29% | 0,8602 |
| Social skills | 28% | 27% | 0,9317 |
| Statistical information processing skills | 24% | 23% | 0,9510 |
| Abstract reasoning skills | 22% | 21% | 0,8024 |

The results of the study showed that cognitive skills were well-developed among future doctors, which facilitated the cultivation of critical and logical reasoning in the process of communication. Furthermore, cognitive skills made it possible to develop critical thinking, which was reflected in tackling quickly certain problems. Also, the development of cognitive skills was shown in the creative thinking of future doctors, which affected the ability to analyze a particular situation. This made it possible to identify the problem in the process of communication and solve it on the basis of professional knowledge. The development of social skills guaranteed the quality communication between different students, which made it possible to ensure teamwork. Social skills were aimed at identifying approaches to intercultural understanding. It is worthy of note that social skills are essential to creating a dynamic doctor-patient relationship. The skills of statistical processing of information contribute to the formation of responsibility for solving individual cases related to professional activity. Statistical processing of information allows to ensure high-quality performance of professional tasks, which affects the adequate understanding of the initial data from the patient for diagnosis and methods of treatment. Abstract thinking skills are of the utmost importance for the development of professional competence, as they will allow making accurate and well-grounded decisions. Abstract reasoning was manifested in formulating pertinent judgments for evaluating specific circumstances.

Effective communication between physicians and patients leads to improved treatment outcomes. Ensuring high-quality communication is possible due to the involvement of patients in training. Such an approach allows future doctors to form personal-oriented care for an individual patient (Eijkelboom et al., 2023). High-tech digital technologies contribute to the development of medical skills, including and communication skills. An intelligent environment allows for automation between a person and the medical system. Online visualization facilitates enhanced comprehension of educational information, fostering the acquisition of professional knowledge and promoting opportunities for communication development (Salem et al., 2019). The digital revolution in higher education has made the study of medical students more intricate. Chatbots can help build communication skills in everyday conversations by focusing on validated digital tools. This approach allows reducing the level of stress in communication due to the involvement of digital assistants. Consequently, this impacts the favorable reception of information among fellow students (Moldt et al., 2022). Our article also presents aspects of the digital transformation of medical education. Yet, the emphasis is placed on enabling digital technologies to develop professional communication skills.

To cultivate the communication skills of prospective doctors, it is feasible to administer a thoroughly organized methodical instruction. In this light, communication skills should be manifested in the production of diction, active listening and interview with the patient, empathy, acting technique. The development of future doctors' communication skills should be patient-centered. With that in mind, online stimulators can be used in the professional training of medical students, which can be combined with the Miller system. Miller's system involves the development of communicative competences based on a structured program that promotes science-based learning (Patra, 2022). Involving the gamification approach in the training of future doctors can impact the formation of communication skills even in the most unpredictable situations. Modeling the role of the patient by students allows for the development of individual communication skills. In the course of the training, the development of personal skills, joint training, and the implementation of educational standards were taken into account, which affects the enhancement of future doctors'

competence. The development of a professional identity influences a better interaction with the patient (Erici et al., 2023). In general medicine, numerous physicians encounter difficulties in effectively communicating with their patients during consultations. Therefore, during training the following communication elements should be taken into account, namely: psychosomatic research, development of empathy, adequate perception of the problem and ongoing discussion. In order to achieve this objective, physicians ought to possess a heightened level of cognitive awareness, be ready to evaluate the individual needs of patients and conduct daily practice (Houwen et al., 2021). Effective communication is an important element of medical practice based on professional skills, queries, improvement of listening skills as well as information processing. Communication skills are essential to ensure proper counseling. Their development is possible only as a result of conscious and meaningful training aimed at effective communication of prospective medical professionals (Salam et al., 2022). In our article, in contrast to the presented works, the development of communication skills was an integral part of training. The process involved the creation of student groups to activate thinking and develop communication skills.

The integration of information technologies in education has undeniably enhanced the quality of learning, yet it necessitates an increased level of communication skills. To optimize this approach, a distinct curriculum plan can be developed that can contribute to the optimization of training. The refinement of professional knowledge is indispensable to enhance communication skills; however, their elaboration should also be ensured to facilitate seamless adaptation during unconventional scenarios (Baumgartner et al., 2022).

Having analyzed the relevant scientific literature, it was established that digital technologies are increasingly used to cultivate the future physicians' professional skills. However, the utilization of said technologies for enhancing communication skills was explored superficially. The current study outlines methods for developing professional communication skills among future doctors through the implementation of digital tools. After providing such training, Following such training, significant changes were observed in the formation of communication skills among students pursuing specializations in "Pediatric dentistry" and "Medical business." Additionally, indispensable proficiencies acquired during their studies were identified.

## 5. Conclusions

The conducted research facilitated the achievement of the set goal. Initially, the authors identified potential benefits that could arise from improving future doctors' communicative competence. It was determined that effective communication primarily enables accurate identification of communication contexts (1.6), leading to correct diagnoses and quality treatment outcomes. Additionally, the formed communication skills are essential for conveying informative content (1.53) with precision (1.51), which testifies to a doctor's competence and commitment level. The development of innovative and personalized approaches as well as competitiveness are also pivotal components in enhancing communicative competence, contributing to professional growth among medical practitioners.

To enhance the cultivation of professional competence, the authors elaborated relevant methodologies. Those comprised a thorough examination of theoretical concepts via presentation materials and videos, as well as practical sessions that were conducted in groups of students. To consolidare professional expertise, individual role-played scenarios were addressed. The evaluation of medical students' aptitude was conducted using Kahoot online platform for digital assessment. Overall, training included the creation of separate student groups to foster communication capabilities and proficiency in digital technologies such as SlideDog, Medvoice Platform, Pediatric Dentistry Academy, CARE-NExT-PG, Kahoot.

The of the five-month training showed that a high level of professional communication skills (40.2) was achieved among the students of Group 1 (future dentists). Also, who were studying to be military doctors specializing in "Medical business" (40.1). Mostly, a high and sufficient level of communication skills was

formed as a result of substantiation of professional information, competent solution of the set practical tasks. Cognitive, social skills, statistical information processing skills, and abstract thinking were also developed among the future doctors, which is connected with the achievement of a high level of professionalism of the future doctors.

The end of the five-month training program revealed that Group 1, consisting of aspiring dentists, achieved a remarkable level of professional communication skills (40.2). Similarly, predominantly high results were achieved among the respondents of Group 2 who were pursuing medical studies with specialization in "Medical business" also scored high (40.1) on this metric. The achievement of such impressive results can be attributed to their adept handling of practical tasks and proficient utilization of professional data. This rigorous training has not only fostered cognitive and social skills but has also honed their statistical information processing abilities and abstract thinking capabilities, which are all crucial components for becoming successful physicians in the future.

The practical significance of the study lies in assessing the efficacy of digital technologies in fostering communicative competence future doctors, with a particular emphasis on qualitative approaches to the organization of training. Future research may explore the extent to which interactive and traditional training foster the development of professional communication skills.

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Revista de Tecnología de Información y Comunicación en Educación • Volumen 18, N° 1. Enero-marzo 2024

Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.10

Cómo citar:
Yeshchenko, T., Kushch, N., Yuldasheva, L., Gruba, T., Chernysh, A. (2024). The effectiveness of the project method for the training of philology teachers. Revista Eduweb, 18(1), 139-151. https://doi.org/10.46502/issn.1856-7576/2024.18.01.10

# The effectiveness of the project method for the training of philology teachers

## La eficacia del método de proyectos para la formación de profesores de filología

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Recibido: 01/12/23
Aceptado: 01/03/24

**Abstract**

The evolution of technologies and the current dynamic development of the education system require the search for effective learning tools that will contribute to the acquisition of knowledge using technologies and the ability to use them for future teaching. The aim of the research is to study the impact of using project method for training future philology teachers. The study involved 398 third-year students. Students studied Ukrainian (native) language (n = 132), English (n = 129) and French (n = 137). A total of 15 teachers with a PhD degree and at least 7 years of teaching experience participated in the study to develop project topics used during training. The teachers developed 10 topics for projects that students who study their native (Ukrainian) and foreign languages (English and French) performed during the academic year. A questionnaire survey was used to determine the effectiveness of the project method. Eight hypotheses

were put forward regarding the effectiveness of the project method for language learning and the acquisition of skills for further teaching. The obtained results confirm the advanced hypotheses, thereby proving the effectiveness of the use of project method for teaching students — future (foreign and native) language teachers. Prospects for further research may be comparing the use of project method with other pedagogical practices, determining the influence of different contents of the curriculum using project method for students studying different academic subjects.

**Key words:** language teachers, students, training.

**Resumen**

La evolución de las tecnologías y el desarrollo dinámico actual del sistema educativo requieren la búsqueda de herramientas de aprendizaje efectivas que contribuyan a la adquisición de conocimientos utilizando las tecnologías y la capacidad de utilizarlas para la enseñanza futura. El objetivo de la investigación es estudiar el impacto del uso del método de proyectos en la formación de futuros profesores de filología. En el estudio participaron 398 estudiantes de tercer año. Los estudiantes estudiaron el idioma ucraniano (n = 132), inglés (n = 129) y francés (n = 137). Un total de 15 docentes con título de doctorado y al menos 7 años de experiencia docente participaron en el estudio para desarrollar temas de proyectos utilizados durante la formación. Los profesores desarrollaron 10 temas para los proyectos que los estudiantes que estudian su lengua materna (ucraniano) y extranjera (inglés y francés) realizaron durante el año académico. Se utilizó una encuesta por cuestionario para determinar la eficacia del método del proyecto. Se plantearon ocho hipótesis sobre la eficacia del método de proyectos para el aprendizaje de idiomas y la adquisición de habilidades para la enseñanza posterior. Los resultados obtenidos confirman las hipótesis avanzadas, demostrando así la eficacia del uso del método de proyectos para la enseñanza de los estudiantes, futuros profesores de lenguas (extranjeras y nativas). Las perspectivas para futuras investigaciones pueden ser comparar el uso del método de proyectos con otras prácticas pedagógicas, determinando la influencia de diferentes contenidos del plan de estudios utilizando el método de proyectos para estudiantes que estudian diferentes materias académicas.

**Palabras clave:** estudiantes, formación, profesores de idiomas.

## 1. Introduction

The dynamic system of modern education requires a combination of traditional learning approaches with new technologies. The availability of information on the network necessitates the development of students' critical thinking, information analysis, the ability to create personalized projects, and other skills. It is important for future philology teachers to learn specific skills and abilities, which leads to the rapid development of translation technologies using artificial intelligence (AI), which helps in learning languages, but does not replace the skills and influence of a teacher. Future teachers need to have the skills to navigate the technology-enabled language learning landscape. Philology, as a subject deeply rooted in linguistics, represents a unique field in which these technological innovations can be applied to improve the educational process for teachers and students. One of the directions for improving the pedagogical process of training future philology teachers is the use of project-based learning.

Project-based learning consists of student-cantered learning that is organized on the basis of project implementation. The acquisition of new skills and the content of the educational material occurs through a project that students complete in groups (Guo et al., 2020). In other words, project-based learning is based on joint research, during which students apply their knowledge and skills, working together to solve complex problems (Markula & Aksela, 2022). Along with the influence on the knowledge of the language and the study of its features, professional teaching skills are formed in future philology teachers through the use of project method. This method allows students to actively interact with problems and challenges,

provides opportunities for a creative approach to learning. Future teachers need to develop organizational abilities to use different educational technologies with students of different ages, in schools of different levels. Therefore, the use of project method can transform future teacher training programmes, providing ideas for language learning in the modern world, including the use of information technology (Berkeshchuk et al., 2020; Valyukevych et al., 2021).

Many researchers from different subjects proved the effectiveness of the project method. However, the conducted research in the field of training future philology teachers is insufficient. Taking this into account, *the aim* of the research is to study the impact of using project method for training future philology teachers. It is planned to study the effectiveness of various tools and platforms of project method for philologists who will teach Ukrainian, French and English languages. It is planned to study pedagogical strategies that maximize the impact of using project method.

The following hypotheses were advanced in the study:

1. Project-based learning has a positive effect on student learning outcomes;
2. Project-based learning has a positive impact on the effect of training;
3. Project implementation of has a positive effect on the use of interactive technologies for education;
4. Project implementation has a positive effect on the students' involvement in learning;
5. Project implementation has a positive effect on the students' behaviour during their studies;
6. Joint learning during projects has a positive effect on teaching;
7. Project-based learning has a positive effect on future teachers; confidence in language skills;
8. Project-based learning has a positive effect on language teaching skills (in this study, on teaching preschool and primary school children);
9. Learning outcomes resulting from the use of project method have a positive effect on future teaching skills.

## 2. Literature review

An analysis of recent publications shows an increased interest in the implementation of project method as an effective means of developing the necessary skills in students (Liu et al., 2019). The use of project method allows enriching the educational process, developing students' creative and practical skills. At the same time, the authors emphasize the need to carefully study the impact of the use of project-based learning in each case, taking into account the sample of students, the field of study, and other factors. Previous studies show that the use of project method can contribute to the enhancement of students' learning motivation, the expansion of their worldview, and the development of critical thinking (Shpeizer, 2019). The integration of project method has the potential to increase the effectiveness of educational work in a group, provides an opportunity to gain practical experience that goes beyond the scope of traditional language learning. Project-based learning allows students to gain unique practical experience, to bridge the gap between theory and practice, using the acquired knowledge in real situations and contexts.

Conducted research on the use of project method for language learning shows that a proper selection of project topics, matching the interests of students and the support of teachers contribute to quality language learning, understanding of its aspects and the quality of education in general (Lushchyk et al., 2022). The use of the author's approach to the creation of an educational course, the high-quality rather than chaotic use of technologies for learning contributes to the rapid completion of the tasks set before students, and they better learn to use new interactive tools (Biletska et al., 2021). The impact on the motivational sphere of students' learning through the creation of a pleasant, interactive and interesting environment facilitates the acquisition of knowledge and language skills. In particular, Zhyhadlo (2022) proved the effectiveness of using gamified resources for language learning.

Reshetnyak (2017) recommends using information and communication technologies for project implementation by students in order to optimize the learning process, make it interesting and creative. This encourages the development of students' cognitive abilities, the ability to find ways to solve problems with the help of various types of activities. At the same time, it is necessary to use digital technologies qualitatively so that they contribute to the development of the necessary skills and not hinder it as a distracting factor (Haleem et al., 2022). The use of project method in education also eliminates distractions and promotes focus on active student learning, as students need to develop, plan and execute an extended project (Yuliansyah & Ayu, 2021). The development of technologies and applications, artificial intelligence has affected all aspects of life. Learning in a virtual environment using digital applications significantly optimize the language learning process, encourages dialogue between students and teachers, and promotes the acquisition of new skills and abilities (Biletska et al., 2021). It is necessary to choose appropriate applications and interactive programmes for students for the quality use of technology taking into account their major, the subject for which the technology is used, and other aspects (García-Martínez et al., 2019).

Other specialists point to the use of project-based learning as one of the most influential methods in translation pedagogy, which promotes the development of students' translation skills and provides an opportunity to gain real practical experience. Hastürkoğlu & Bayraktar (2020) proved that the use of project-based learning had a positive effect on the development of students' metacognitive knowledge and skills, necessary for translators who are aware of their cognitive abilities. Zinchenko et al. (2021) also proved the effectiveness of using project method in the training of philology teachers for deepening their understanding of linguistic concepts and translation theory. This approach improves the students' research skills, promotes the development of communication skills in the training of philologists. Ivanova & Vinogradova (2020) proposed the trajectory of the integration of project method into various types of educational activities, as well as proposed the design of project implementation in the educational process of bachelor students' training.

The results of previous studies (Simonson et al., 2022) prove that project method is an effective tool for training philology teachers with the right approach and creation of the educational plan. This will contribute to the acquisition of appropriate teacher training qualifications, which is the task of higher education institutions. At the same time, it is necessary to further study aspects of the use of project method for teaching students of different majors, exclusion of negative effects and high-quality use of technology to improve the effectiveness of student learning. Therefore, the use of project method in the training of philology teachers is a relevant direction of research that needs further improvement and systematization.

## 3. Methods

### Research design

This study was conducted using a quantitative method. The impact of the use of project-based learning in the training of philology teachers in the study of the Ukrainian (native), French and English languages was studied. The research participants will be divided into experimental groups that studied different languages using project method, and control groups that studied using traditional methods.

### Participants

The study involved students of V.I. Vernadsky Taurida National University, Academician Stepan Demianchuk International University of Economics and Humanities, and Sumy State University. The study involved a total of 398 third-year students. Students who studied Ukrainian (native) language — n = 132, English — n = 129, French — n = 137. A total of 15 teachers with a PhD degree and teaching experience of more than 7 years were involved to develop the topics of the projects used during training.

### Experimental factor

The experimental groups studied during one semester using project method, which consisted in the joint use of language learning applications, execution of joint online projects, participation in online conferences, offline meetings and project discussions. The project topics are presented in more detail in the results. The control groups studied using traditional teaching methods.

### Research methods

To check the effectiveness of the use of project method in the training of philology teachers, a questionnaire was used to assess the effectiveness of the use of learning technologies, adapted from the one proposed by Lai et al. (2022). The questionnaire contained 28 items rated on a five-point Likert scale from 1 - completely disagree to 5 - completely agree. The questionnaire is used to evaluate 8 dimensions of the impact of the use of a certain technology on the educational process. A subsection called Further Teaching Skills was also added to the adapted questionnaire, the questions of which make it possible to assess the impact of the use of project method on the development of relevant students' skills. All questions were presented randomly to prevent biased answers. The survey was conducted using the Qualtrics online platform.

### Data processing

The data were processed using SPSS Statistics. The statistical values of the average indicators of the evaluation of the quality of the use of project method for students - future philology teachers, the relationships between aspects of learning were calculated, and the Cronbach's alpha consistency coefficient was calculated to assess the validity of the questionnaire.

### Ethics

The research was conducted in compliance with ethical standards, ensuring informed consent for participation in the experiment, confidentiality of survey data and publication of survey results with observance of data anonymity. Ethical approval from the Institutional Supervisory Board was obtained to conduct the experiment.

The limitations are the choice of specific topics for the creation of projects, the selection of participants from one country (Ukraine), the evaluation of the impact of the use of project method on the study of three languages — native Ukrainian, foreign French and English. Further research could examine the longer-term impact of using project-based learning for other languages, over a longer or shorter period of time, and take into account additional variables such as students' learning motivation.

## 4. Results and discussion

The discussion between teachers regarding the choice of topics for project implementation, the specifics of the use of technologies for their implementation, the deadlines and the number of participants in the groups, gave grounds to determine the following project topics:

1. Literary project "Creating an overview of literary works". Students choose certain literary works, reread and make a short review from this work (minimum 1 - maximum 2 pages of A4 format, single-spaced, 12 font).
2. Linguistic project "Etymology and modern language"

Students are tasked with researching the origins and development of words to understand linguistic aspects. Each student studies the etymology of selected words, researches their use in modern language, developing a team presentation or publication.

3. Theatrical evening "Classical works on stage".

The students choose an episode from a classic work written in the language they are studying and create a theatrical scene with actors. Results are presented to teachers and other students.

4. Research "The influence of speech features on the perception of the speaker". The students analyse language-specific presentations on the TED platform, including native and non-native (accented) speakers, studying specific pronunciation features and audience impact. The research results are presented in the form of an analytical article.
5. Creation of a digital textbook for preschool and primary school students. Students jointly create a digital textbook for preschool and primary school children taking into account the specifics of children's development at this age, the specifics of presenting educational material, using game exercises, video lessons, songs for listening, drawing in the textbook for teaching writing, transcription of words and others features.
6. Literary club

Students choose a certain work in the language they are studying, choose different chapters and read them, then discuss together and complement each other according to the chapters they read.

7. Speech trainer of a philology teacher. Students prepare short lessons for use in preschool and elementary school aimed at learning the basics of language (alphabet, basic words, phrases, and sentences). Lessons should include elements of game, activation of attention and memorization. Lessons are presented with other groups of students.
8. Grammar guide. Students choose a grammar topic (such as tenses or constructions with prepositions) and create a step-by-step guide to explain that topic with exercises and practical examples. Then a group of students presents their designed guides to other groups.
9. Film review. Students watch a film or series in the language they are studying and write a short review identifying new interesting constructions and grammatical concepts.
10. Grammatical challenge. Groups of students develop tasks to learn the grammar of the language through a game, which is then played in another group of students. The tasks of the game can be to create more sentences using different tenses within a certain time limit, or to find the largest number of synonyms for a certain word (pre-selected words with a large number of synonyms).

Descriptive statistics

After two academic semesters with the use of project method, that is, the implementation of 10 projects, students evaluated the impact of the use of projects on various aspects of language learning, and on the development of teaching skills. The results of the survey allow us to state that the vast majority of students who completed a language learning course using project-based learning highly rated the positive impact on various aspects of learning, in particular, on the results of language learning (Figure 1):

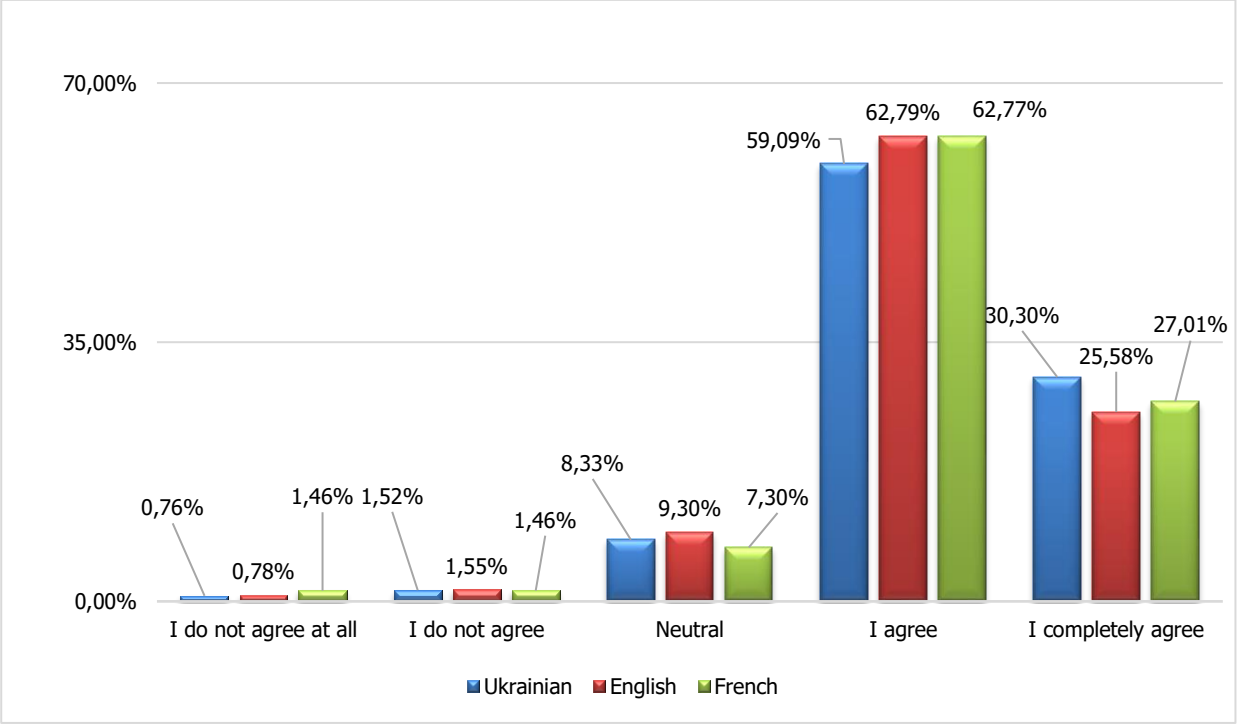


***Figure 1.*** Results of a survey of the impact of project-based learning on students' learning outcomes.

Similar results were obtained from the analysis of the assessment of other scales that characterized aspects of language learning. In particular, the impact of project implementation on the learning effect, active learning of students, the design of the educational process, and the use of information and communication technologies were highly rated (Figure 2).

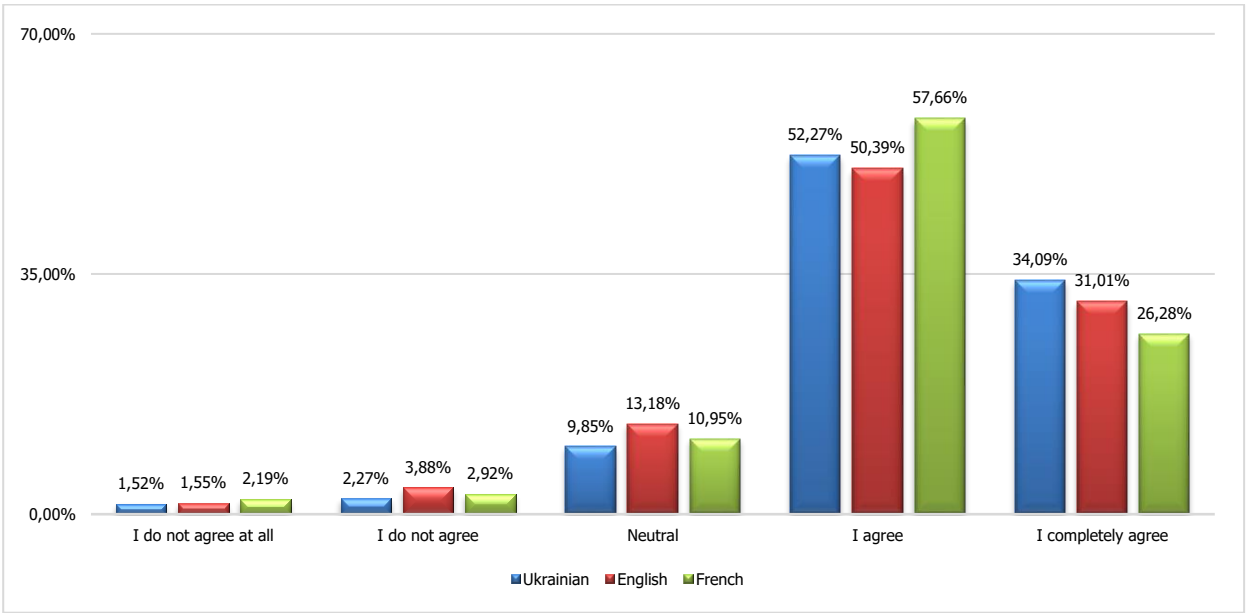


***Figure 2.*** Results of a survey of the impact of project-based learning on the ability to use information and communication technologies for language learning.

Students also positively assessed the impact of project implementation on such aspects as the quality of teaching during study, their own involvement and participation in joint learning, and what is especially important for future language teachers – on Further Teaching Skills.

A corresponding check was carried out to confirm the invalidity of the questionnaire after the introduction of the author's sub-scale Further Teaching Skills. The results are presented in Table 1.

**Table 1.**
*Checking the reliability of the model*

| Dimensions | Average obtained variance | Reliability of the composite | Cronbach's alpha |
|---|---|---|---|
| Learning outcomes | .601 | .912 | .875 |
| Learning effect | .632 | .922 | .869 |
| Behaviour | .611 | .921 | .893 |
| Design | .638 | .911 | .901 |
| Technology | .641 | .899 | .826 |
| Teaching/pedagogy | .642 | .932 | .873 |
| Presence/community | .652 | .903 | .903 |
| Skills for future teaching | .676 | .935 | .887 |

The Cronbach's alpha exceeds 0.700, meaning that the developed questionnaire for evaluating the effectiveness of the project method for training future philology teachers is a reliable and valid tool.

The advanced hypotheses regarding the positive impact of the use of project method on students' learning outcomes were tested. The obtained results are presented in Table 2.

**Table 2.**
*Testing of the advanced hypotheses*

| Independent dimensions | Dependent | Rate | SE | t value | p | Result |
|---|---|---|---|---|---|---|
| Project-based learning | Learning outcomes | .325 | .029 | 8.232 | <.0.05 | Confirmed |
| | Learning effect | .426 | .032 | 6.589 | <.0.05 | Confirmed |
| | Behaviour | .361 | 036 | 7.365 | <.0.05 | Confirmed |
| | Technology | .415 | .034 | 6.586 | <.0.05 | Confirmed |
| | Teaching/pedagogy | .358 | .325 | 7.235 | <.0.05 | Confirmed |
| | Presence/community | .326 | .360 | 6.965 | <.0.05 | Confirmed |
| | Further teaching skills | .422 | .312 | 7.326 | <.0.05 | Confirmed |
| Learning outcomes | Further teaching skills | .431 | .320 | 6.325 | <.0.05 | Confirmed |

Table 2 shows that the obtained results demonstrate a significant relationship between the use of project method and learning outcomes (β=.325, t=8.232, p<.0.05), which confirms a strong and significant correlation for the proposed first research hypothesis. In other words, all respondents who took part in the implementation of projects assessed its positive impact on the results of language learning as a whole. The next result, the impact of project-based learning on efficiency, also shows a positive and significant correlation (β=.426, t=6.589, p<.0.05). This means that project-based learning has a positive effect on the effectiveness of foreign (French, English) and native language learning.

The next hypothesis was also confirmed: the positive impact of project method on student behaviour during studies (β=.361, t=7.365, p<.0.05). Design technology has a positive effect on the study of the features of using technologies for language learning (β=.415, t=6.586, p<.0.05). Students highly rated the impact of using project method during language learning on the overall teaching process (β=.358, t=7.235,

p<.0.05), involvement in learning, and cooperation in the community (β=.326, t=6.965, p< .0.05). And a special effect of using project method in the training of future philology teachers is that, in addition to learning the language, they believe that it helped them to better understand and improve their ability to teach language to children in future pedagogical activities (β=.422, t =7.326, p<.0.05). A positive significant correlation was also found between how students evaluated their language learning and acquired skills for teaching children using project method (β=.431, t=6.325, p<.0.05).

The obtained results give grounds to assert that the use of project method has a positive effect on the results of language learning by students, provides them with valuable practical experience of spoken language and the analysis of its various aspects (dialects, origins and different meanings of words, etc.). The use of project method has a positive effect on relations with teachers and students, because students are active participants in learning, searching for the necessary information, and not just simply learning it from the teacher. The results show that the implementation of projects makes the educational process more dynamic, interactive, and interesting for students.

A positive impact on students' learning motivation is caused by the opportunity to freely express their opinion and study certain phenomena. Participants expressed increased enthusiasm during learning, the use of interactive technologies and active participation in learning contributes to a better understanding of linguistic aspects.

The conducted research shows an unambiguously positive effect of the use of project method for the formation of the necessary skills for future language teachers. The significance of the use of project method is in the improvement of students' language training, as well as in the acquisition of the necessary skills for teaching in the future. Project method is one of the optimal approaches to the preparation of highly qualified philology teachers. Training of teachers with appropriate qualifications is currently one of the main tasks of higher educational institutions. Educators must know digital applications at a high level, and teach to use them not as a substitute for language knowledge, but as a supplement and optimization of language learning. Future teachers should develop this skills both to improve their own skills and those of their future students. The main goal of this research is to study the impact of using project method for training future philology teachers. For this purpose, the impact of the use of project method on various aspects of education was investigated, in particular, the impact on improving joint learning and collaboration, improving digital skills, information literacy, and future teaching skills. It is expected that students highly rated the impact of project implementation on the development of relevant skills.

The proposed approach — namely the developed topics of the projects and the conditions for their implementation, helped to enhance philology students' learning motivation, and to confirm the relationships between the hypotheses advanced in the research. So, the implementation of projects contributes to increasing involvement in learning, deepening the study of the subject, excluding the superficiality of learning. This is one of the indicators of the effectiveness of the proposed methods in the educational process, which, according to the results obtained by Granado-Alcon et al. (2020), positively correlates with students' educational performance. The project-based learning promotes involvement in learning, thereby contributing to a tendency to improve one's academic performance.

Knowledge of the features of certain methods, language and the ability to use these technologies is one of the predictors of success in future professional activities (Fallucchi et al., 2020). Mobile technologies for education need to be rationally used to engage students and enhance their learning opportunities (Bernacki et al., 2020). The main focus of this research is to study the impact of the proposed approach of project-based learning in the development of various aspects of learning, which increases student engagement in learning (Granado-Alcon et al., 2020). According to the obtained results, project-based learning helps students to navigate the challenges and complex situations of the daily work of future teachers, which

corresponds to the goal set in the work. Al-Busaidi & Al-Seyabi, (2021), Puspitasari (2020) drew conclusions about the same consequences of using project method in education.

The obtained results show that implementation of the projects contributes to the improvement of teachers' understanding, and has a potentially positive effect on the relationship between students and teachers. So, teachers can use project-based learning to improve educational content and promote learning by increasing active learning, independent information search, its systematization and generalization. The approach of project-oriented learning has a positive effect on the cooperation between the participants of the educational process, the training of digital skills, and increases the information literacy of philology students. This emphasizes the positive results associated with an organizational approach to the training of students — future language teachers — based on the implementation of project-based learning, which was previously noted by experts (Rodríguez-Peñarroja, 2022), and also contributes to the acquisition of skills necessary for future work (Musa et al., 2011; Konotop et al., 2022). Therefore, this study continues the previously obtained positive results of using project-based learning in school Chen & Yang (2019) to further use this technology with appropriate educational content and cognitive load on students. According to Žerovnik & Nančovska Šerbec (2021) for the successful implementation of project-based learning, teachers must adhere to the basic elements of project design – description of the problem or issue, allocating time to search for information, critique and revision through student-to-student feedback and teachers, and the publication of the results of the project implementation. By using these approaches, students benefit from a project-based learning by sharing information and thereby increasing their general awareness and proficiency in the language and related skills.

Moreover, the obtained results emphasize the integral role of project-based learning for students and teachers in the current conditions. This approach improves the learning environment and provides effective learning management. The interactive nature of the implementation of projects on different topics allows for the achievement of many academic goals and the improvement of relations between students (Belwal et al., 2020). According to the data obtained in the research, the implementation of the projects contributed to the improvement of the attitude of students — future language teachers — to pedagogical activities. Students better understand the sequence of presentation of educational material for themselves and for future students, understand the nuances of the necessary instructions for studying certain topics related to language knowledge. Furthermore, it contributes to the expansion of their abilities and skills for future pedagogical activities, the search for rational approaches to students with different levels of performance, and the explanation of educational topics of different complexity.

Students are highly encouraged to find innovative solutions, perform authentic tasks and projects, which promotes knowledge sharing, collaboration, and increasing the socio-emotional aspect of learning and acquiring a quality learning experience (Ghosheh et al., 2021; Venn-Wycherley et al., 2023). At the same time, further research into the long-term rather than one-time use of innovations in the education of philology teachers is needed (Potvin et al., 2021).

The conducted study found no reliable differences between the indicators of the impact assessment of the use of project method for the study and future teaching of the native (Ukrainian) and foreign languages — French and English. So, the implementation of the projects caused an increased effectiveness of learning native and foreign languages, and a deepening of the ability to teach these languages to preschool and primary school children in the future. All the advanced hypotheses of this study were confirmed with the help of statistical analysis, which proves the numerous advantages of using project method for learning native and foreign languages, acquiring relevant competencies with its use (Tseng & Yeh, 2019). The obtained results show the importance of using project method for educational institutions that prepare future philologists, using the previous high-quality training of teachers, developing the curriculum in accordance with the students' level of knowledge and skills. The use of project method during the study of native and foreign languages plays an important supporting role in acquiring the necessary competencies

for future language teachers, and teachers should use project-based learning, recognizing its effectiveness for enhancing learning motivation.

### Prospects for further research

Further studies of the effectiveness of project method for language learning and the acquisition of professional competence skills for future philology teachers may focus on different project plans on learning outcomes, the features of communication with students during the implementation of projects, including online communication and traditional communication in the classroom, a comparison of the use of project technologies with other pedagogical approaches.

## 5. Conclusion

The use of project technology in the training of future philology teachers has great potential for acquiring a high level of language proficiency and forming the necessary skills for teaching in the future. The use of student-cantered learning and the use of digital tools allows for the creation of an interactive and interesting learning environment that enables students to actively participate in language learning. The use of project technology effectively complements the curriculum of future philology teachers, as it provides an opportunity to develop critical and analytical thinking when creating projects, improve communication and collaboration skills between students, and improves communication between students and teachers.

The results of the analysis and testing of hypotheses indicate that the impact of the application of project method has a statistically significant impact on such aspects of learning as Learning Outcomes, Learning Effect, Behaviour, Technology, Teaching/Pedagogy, Presence/Community, and what is especially important — on the development further teaching skills. The majority of students who took part in the study fully agree with the statements that indicate the effectiveness of projects on these aspects of learning. Students showed greater interest in learning using project method, increased their activity and independence in the implementation of projects, and were active participants in the creation of projects.

Future research can be aimed at studying the use of project method by senior students, the implementation of projects that are even more aimed at the development of teaching skills in future philology teachers (creating educational materials or exercises for schoolchildren of different ages, studying certain aspects of educational material).

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.11

Cómo citar:
Lopatynska, I., Bratanych, O., Biletska, I., Cherednychenko, V., & Pustovoichenko, D. (2024). Evaluating the efficacy of Kahoot as a computer-assisted language learning tool in higher education. Revista Eduweb, 18(1), 152-163. https://doi.org/10.46502/issn.1856-7576/2024.18.01.11

# Evaluating the efficacy of Kahoot as a computer-assisted language learning tool in higher education

## Evaluar la eficacia de Kahoot como herramienta de aprendizaje de idiomas asistida por ordenador en la educación superior

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Recibido: 16/12/23
Aceptado: 02/03/24

**Abstract**

This study aimed to analyse the effectiveness of using the computer tool Kahoot for foreign language learning in higher education, as well as to address the problem of students' lack of motivation in learning English. This study hypothesised that using the Kahoot app in foreign language classes would improve students' motivation through its engaging approach. To test this hypothesis, a survey was conducted among students who had studied English using this tool. The results showed that students who used the Kahoot app in the classroom were significantly more motivated to learn English. This was made possible by the app's ability to vary the learning tool depending on the needs of the students, which encouraged their active participation in the learning process. The effectiveness of Kahoot as a tool in higher education for learning foreign languages is promising. Its engaging and interactive format, instant feedback, and collaborative learning opportunities make it a valuable tool for enhancing language learning. However, it is important for teachers to be aware of its limitations and complement it with other activities to ensure comprehensive language development. Overall, Kahoot can be a valuable addition to the language learning toolkit in higher education.

**Keywords:** assessment, computer tools, distance learning, institutional efficiency, teacher training.

**Resumen**

Este estudio pretendía analizar la eficacia de la herramienta informática Kahoot para aprendizaje de lenguas extranjeras en la enseñanza superior, así como abordar el problema de la falta de motivación de estudiantes para aprender inglés. La hipótesis de este estudio era que el uso la aplicación Kahoot en las clases de lenguas extranjeras mejoraría la motivación de los estudiantes gracias a su enfoque atractivo. Los resultados del estudio mostraron que los estudiantes que utilizaban la aplicación Kahoot en clase estaban mucho más motivados para aprender inglés. Esto fue posible gracias a la capacidad de la aplicación de variar la herramienta de aprendizaje en función de las necesidades de los estudiantes, lo que fomentó su participación activa en el proceso de aprendizaje. La eficacia de Kahoot como herramienta en la enseñanza superior para el aprendizaje de lenguas extranjeras es prometedora. Su formato atractivo interactivo, la retroalimentación instantánea y las oportunidades de aprendizaje colaborativo lo convierten en una herramienta valiosa para mejorar el aprendizaje de idiomas. Sin embargo, es importante que profesores sean conscientes de sus limitaciones y complementen con otras actividades para garantizar un desarrollo lingüístico integral. En general, Kahoot puede un valioso complemento para aprendizaje de idiomas en enseñanza superior.

**Palabras clave:** eficacia institucional, evaluación, formación a distancia, formación del profesorado, herramientas informáticas.

## 1. Introduction

The transformation of higher education in Ukraine that took place during the Covid-19 pandemic and subsequently in light of the full-scale war is the main reason for the development of a comprehensive and inclusive assessment of all learning resources (Yuzyk et al., 2019). The forced transition to distance learning requires "quality of education". The Ministry of Education of Ukraine emphasises that "quality refers to all functions and activities of higher education: teaching and curriculum, research, students, computer tools, equipment". In addition, in the context of distance learning, assessment is necessary to improve its quality (Ivaniuk & Ovcharuk, 2020). Thus, to talk about the evaluation of higher education is to improve its quality through internal assessment and external review by independent experts (Ovcharuk et al., 2022). In addition, talking about quality also means talking about the evaluation of learning aids, which, according to Zhorova, Kokhanovska, Khudenko, Osypova & Kuzminska (2022), is considered to be an intentional and socially organised act leading to the development of a value judgement. Ovcharuk (2020) explains that assessment is also a way of positioning ourselves, it allows us to measure the reality of acquisitions for both teachers and students.

Today, digital technologies are an integral part of our environment (Martynenko et al., 2023).

However, the use of digital technologies in educational institutions is still quite marginal (Tao & Zou, 2023). Thus, the purpose of this paper is to analyse the effectiveness of Kahoot as a computer-based tool for learning foreign languages in higher education and to address the problem of students' lack of motivation in learning English.

The opportunity provided by the Kahoot app to vary the learning tool during English classes improves students' motivation in the context of English language learning (Tsekhmister, Kotyk, Matviienko, Rudenko & Ilchuk, 2021). From this perspective, it was hypothesised that using the Kahoot app in foreign language classes would improve students' motivation due to its engaging approach.

## 2. Literature review

According to research in the field of education, the term 'routine' is often used to refer to a set of organised, defined, and stable means that form the basis for repetitive actions in response to a recurring problem

(Cárdenas-Moncada, Veliz-Campos & Veliz, 2020). Devices are tools created to respond to a problem. A distance learning system is typically characterised by the separation or physical distancing of the teacher and student during teaching (Kasap, 2023).

Orhani (2023) emphasizes the significant shift towards integrating technology to meet contemporary educational demands. Kahoot is situated within a broader trend of innovative educational practices. This context enriches the discussion around Kahoot, underlining its role as a bridge between traditional and modern learning paradigms. It supports its potential to enhance language learning through engaging and interactive methods.

However, the term 'distance learning' is much more difficult to define (DeMatthews, Reyes, Solis Rodriguez & Knight, 2023). According to research, the term distance learning is being used less and less and is gradually being replaced by the term e-learning (Lin et al., 2023). The latter term reflects the desire to consider both distance and e-learning in order to explore the process and devices that are related to it (Vasylyuk-Zaitseva, Kosenyuk, Tanasiichuk & Boyko, 2023). However, since in our study, we are interested in the impact of Kahoot's effectiveness in improving foreign language skills, regardless of how the user uses the device (in person or at a distance), we will use the term "distance learning".

The research by Iskakova (2023) on using electronic technologies for individualized education aligns with evaluating Kahoot's efficacy as a language learning tool. Iskakova (2023) findings emphasize the importance of digital tools in accommodating diverse learning needs, mirroring the potential of Kahoot to enhance language education through interactive and accessible methods. This connection underscores the broader educational value of implementing versatile technologies like Kahoot in higher education, especially for students with special needs, advocating for adaptive learning environments.

Measuring the effectiveness of a particular learning tool can be difficult, as many people have different ideas about the meaning of the measurement (Ovcharuk, 2020). However, we believe that in a broad sense, it is possible to formulate a hypothesis that the distance learning system is more effective than the traditional system due to new technological capabilities and tools (Zhorova et al., 2022). In our opinion, since the assessment of efficiency depends on the personal perception of the person measuring it, this efficiency can be very diverse. Often, the evaluation is limited to the ease of measurement and achievement of the goal for each instrument (Yolida & Marpaung, 2023). In fact, evaluating effectiveness means examining the extent to which the goals of a "process" are achieved.

Alharthi (2020) distinguishes between two types of Kahoot effectiveness: institutional effectiveness and individual effectiveness. Individual efficacy implies that the user is in the centre of attention and becomes an active agent in achieving their goal. The study of individual efficacy involves analysing the impact of various factors, such as available information about the device, learning strategies, optimal use, and satisfaction, on the user's achievement of their own goals (Mgonja & Kambuga, 2023).

The research conducted by Martynenko et al. (2023) provides a foundational understanding of the broader applications and implications of digital technologies, offering valuable perspectives for the incorporation of tools like Kahoot in higher education. It underscores the need for a comprehensive strategy that embraces current and future digital tools to improve engagement and learning efficacy, reflecting a shared trajectory between marketing and education towards greater digitalization and personalization.

The findings from Rakhimov & Mukhamediev (2022) reinforce the value of investigating and implementing digital solutions like Kahoot within higher education to leverage technology's full potential in enriching educational experiences.

On the other hand, the institutional effectiveness of a system is the effectiveness that is of interest to

designers, policy makers, or system owners in order to achieve their defined goal (Kiyançiçek & Levent, 2022). It assesses the extent to which learning objectives are achieved. The peculiarity of institutional effectiveness is that it concerns the impact of the learning mechanism itself on the goals set by the educational institution. It also decides whether these goals are achieved by the device rather than the user. Institutional effectiveness is determined based on five indicators, which include:

1. Internal effectiveness, which is traditionally measured by success rates or knowledge assessment results.
2. External effectiveness, which reflects the relationship between the diploma and the possibility of successful integration into the labour market.
3. Equity, as measured by the access and performance of students from different social and economic groups compared to the general population.
4. Efficiency, which compares financial efforts, such as tuition costs per student, with expected outcomes, such as the ratio of successfully completed courses to all courses.
5. Quality of learning and teaching, which is assessed based on the satisfaction of users such as students and alumni (Tsekhmister et al., 2022).

In related work, von Lautz-Cauzanet (2018) evaluates IFADEM to measure its impact on the evolution of English language skills. Thus, the author refers to institutional effectiveness as the organisational interest in the impact of learning on skills, with internal effectiveness as an indicator. Indeed, when we study the contribution of a pedagogical device to improving learning, knowledge, or skills evolution, we measure its internal efficiency. This indicator is usually assessed based on testing (Zhorova et al., 2022) and evaluated "in terms of improving students' academic performance" (Ovcharuk et al., 2022).

In terms of effective devices, Kahoot is an online application for creating interactive quizzes. It is free (but there are paid versions with more options) and requires the teacher to create an account (Bakhmat & Smorgun, 2022). Quizzes are in the form of MCQs, with questions and answers. Answers are created by the teacher. To make full use of this app in the classroom, the classroom should be equipped with a computer with a projector and an internet connection, as the quizzes are projected onto the board by the teacher from the classroom computer. While students can answer questions using a tablet, smartphone, or computer. Teachers can set different parameters depending on their learning objectives (Alharthi, 2020).

In addition to offering a fun way to learn in real-time, the app also allows teachers to assess each student's level of learning by using an end-of-class quiz that displays each student's performance. Using the Kahoot app at the end of a class allows the teacher to conduct formative assessment (Wang & Tahir, 2020). It also gives students the opportunity to evaluate themselves by seeing live how well they and their peers did on the task.

## 3. Methodology

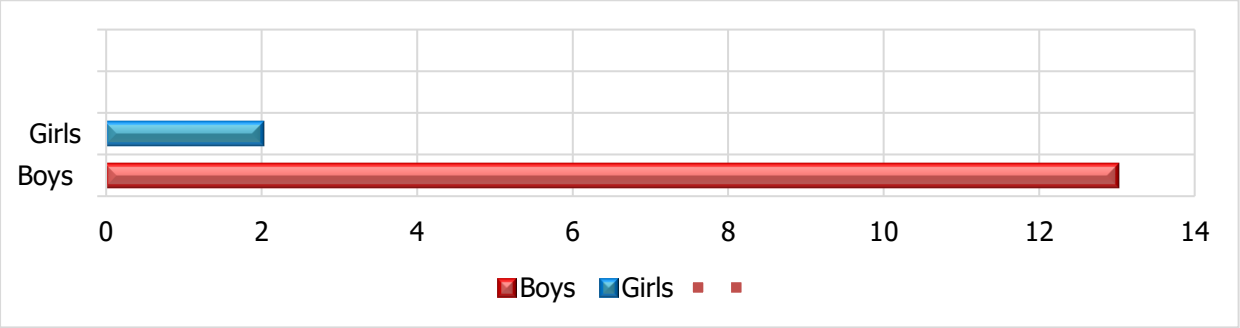
An experiment was conducted by questionnaire among 140 students studying at different higher education institutions of Ukraine and in different specialties (among students of law and law enforcement, among future specialists for police units, and Germanic philologists). However, since the purpose of the experiment was to prove the effectiveness of Kahoot for learning foreign languages, namely to prove its impact on motivation, the paper describes only the experiment conducted among students of future police officers.

*Data Collection*

Statistical methods such as chi-square tests were used to analyze the relationship between different variables, such as gender, age, mobile phone ownership, and motivation to use digital tools. These tests helped to determine if there were significant differences between groups in terms of their motivation levels.

The responses from the questionnaire were coded and entered into a statistical software program for analysis. Each response was given a numerical value for ease of analysis. The binary responses (yes/no) were coded as 1 for yes and 0 for no. The open-ended questions where students had to justify their choices were categorized and analyzed qualitatively to gain a deeper understanding of their motivations. The experimental group consisted of 15 first-year students. The group consisted of 2 girls and 13 boys with an average age of 16.5 years. All students in this group had smartphones. Their general level of English at the time of the experiment was A2 (fig. 1):

**Figure 1.**
*Participants age-sex data*




Source: author's development.

Validity and reliability of the data collection instrument were ensured through several means. The questionnaire used was designed based on the research objectives and was pilot tested to ensure clarity and relevance of the questions. The questions were also reviewed by experts in the field of language learning and motivation to ensure their validity. The anonymity of the survey ensured that participants were comfortable providing their honest opinions without fear of judgment. The reliability of the study was also enhanced through the use of standardized procedures for data collection and analysis. The experimental group was predominantly male, with only 2 female students. The majority of students in the group had smartphones, which may have influenced their familiarity with technology. Additionally, their English level was at an A2, indicating a basic understanding of the language.

*Study Instrument*

Although a foreign language is considered a professional subject in their curriculum, they are often reluctant to learn it. And, as a result, it is quite difficult to interest and motivate these students to study this subject, which is why it was important to conduct a field study with a not the strongest group. To answer the research question, we observed students' behaviour during Kahoot quizzes.

To obtain observable and concrete signs of motivation among students, a questionnaire was conducted. The questionnaire was designed to gather the opinions of all students about the effectiveness of Kahoot and to analyse the factors that influence their motivation. The questionnaire was in the form of statements to which the student had to tick "yes" or "no" and then justify their choice by indicating why they ticked the box. Students had to explain why they chose that particular answer. The survey was anonymous so that students felt free to answer and did not fear being judged. This type of questionnaire seemed appropriate because it made it easier to process the results because of the binary responses.

*Statistical Management*

The study design was an experimental study that focused on the impact of Kahoot on motivation among

students studying to become future police officers. The variables measured included gender, age, mobile phone ownership, motivation to use digital tools, and attitudes towards using Kahoot in class. Analyses were performed to determine the relationships between these variables and the impact of Kahoot on student motivation. The statements in the proposed questionnaire were chosen for a specific purpose. The first four statements were related to gender, age, parental occupation, and mobile phone ownership. Their purpose is to shed light on whether there are differences in students' personal contexts that could explain differences in their motivation to use digital tools. Statement 5 "Using my personal phone in English motivates me" and statement 6 "I need help to use my mobile phone when doing digital tests in class" are analysed in parallel. The statements are aimed at finding out whether it is the use of the digital tool, i.e. the phone itself, that affects motivation. This influence can be both a driving force and a hindrance to student motivation.

Statement 5, "I prefer a more traditional class without the use of the Kahoot platform, such as an oral survey," should be analysed in relation to statements 7, 8, and 9 ("I feel more motivated to work in a class with Kahoot," "I enjoy the class with Kahoot," "Time passes faster in a class with Kahoot"). This time, the goal was to find out whether the use of the Kahoot app affects student motivation. With statements 12 "I am afraid that my mistakes will be visible on the screen when I use Kahoot in class" and 13 "When I use Kahoot in class, the fact that my grade is projected in front of everyone motivates me", we tried to find out whether this can affect students' motivation, whether in the form of fear or pride.

To collect responses, a questionnaire was distributed to students after an English class.

To avoid bias, including imitation due to novelty, as well as frustration due to lack of proficiency, the questionnaire was distributed after two months of Kahoot sessions with students.

*Ethical Considerations*

The study followed rigorous research methodology to ensure the validity and reliability of the findings. The data analysis techniques used were appropriate for the research questions, and the study design allowed for replicability in future research. The ethical considerations taken into account also ensured that the rights and well-being of the participants were protected throughout the study. The researcher followed all the necessary ethical considerations for this study. Ethical approval was granted after obtaining permission from the management of the higher education institution. In addition, the study participants were informed that there were no risks associated with participating in this study. Participation in the study was also anonymous. A full explanation was provided to all participants before completing the questionnaire and they were asked to give their voluntary consent before filling in the questionnaire.

## 4. Results and discussion

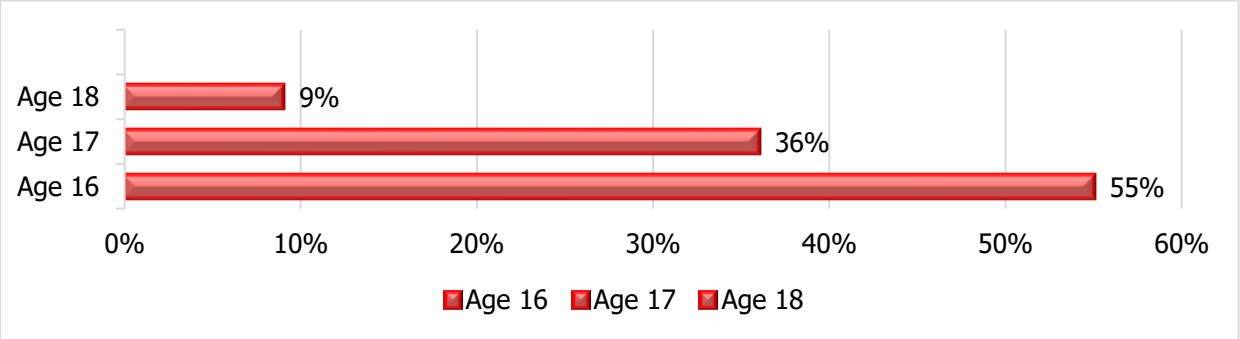
Before presenting the results, it is important to note that some students did not take the questionnaire seriously, as they did not try to answer all the questions or justify their answers as suggested in the questionnaire. The results are presented in percentages for ease of reading (the number of students who took part in the survey was 11 (as 4 of them were ill at the time of the survey), so it is easy to convert the percentage to the number of students if necessary, i.e. 9% equals one student). The first four statements were general information that helped us to get to know the students who answered the questionnaire to facilitate the analysis of the results.

The aim of this study was to highlight differences in students' personal contexts that might explain differences in their motivation to use digital tools. The first statement was used to identify the gender of the participating students.

100% of the students who responded were male, due to the absence of 4 students. Therefore, in this study, we are not able to make a comparison with the female gender to see if any gender-specific factors may affect motivation. The second statement concerned their age.

It turns out that 55% of students are 16 years old, 36% are 17 years old and 9% are 18 years old. The average age is 16.5 years. The students are quite close in age, which is normal as they study in the same group. Again, this study did not allow for comparisons with students of different ages to see if motivational factors change depending on the maturity of the students (fig. 2):

**Figure 2.**
*Data with percentage distribution of age among students*




Source: author's own development.

The third statement was an open-ended question about the parents' occupation to determine the social background of the students who answered the questionnaire. All students who answered the questionnaire came from modest social backgrounds. Thus, it is possible to compare them with more affluent families to see whether the family's standard of living affects motivation.

The fourth statement was about having a mobile phone. "If so, do you use it for work at home? Please specify what activities" and "If yes, do you use it for work during English classes? Please specify the activities you do". The aim here is to find out whether the acquisition of Kahoot skills is related to previous, traditional experiences, which could lead to bias in the study.

All students who answered the question have mobile phones 100%. However, all the questionnaires show that mobile phones are used only in English classes.

Thus, the use of mobile phones in the classroom still seems to be rather marginal. The survey also showed that 10 out of 11 students use their mobile phones to work at home, including 8 to search for information on the Internet and 3 to watch videos of classes. We can see that almost all of them use their phones as a working tool when they are at home.

The following statements were no longer relevant to the students' personal context, but they all related to the use of Kahoot in the foreign language classroom. Statement 5 "Using my mobile phone in class motivates me" and statement 6 "I need help to use my mobile phone when we do digital quizzes in class" were to be analysed in parallel. The aim was to find out whether the use of a digital tool influences students' motivation.

The results show that almost three-quarters of students are motivated to use their phones and 9% are not motivated to use their phones, with no answer. Most of the students who answered yes did not give a reason for their answer, with the exception of one student who said it was because she could help herself

and another because "it improves the atmosphere". Thus, it can be said that in general, it is the use of the digital tool Kahoot, whether on a computer or on a mobile phone, that motivates students. This may also be due to the fact that they feel freer to use an object that helps them, but also because the foreign language class takes on a less traditional aspect.

The sixth statement aimed to find out whether students had difficulties using their phones that could interfere with their learning.

It turns out that more than half of the students do not need help, 27% did not answer the question and 18% need help. None of the students gave a reason for answering "no". As for the "yes" answer, one student said it was because he was "not sure of the answer". So, we can say that overall, the use of Kahoot during the class was very positive.

For statements 7, 8, and 9 ("I feel more motivated to work during class using Kahoot", "I have more fun during class using Kahoot", "Time passes faster during class using Kahoot"), the aim was to find out whether the Kahoot app itself influences students' motivation in learning English.

Students unanimously preferred using the Kahoot platform in class to more traditional learning tools by 100%. This can be attributed to the motivation associated with using their phone, as well as what they gain from using the Kahoot app itself. This is exactly what the hypothesis of the paper highlights.

The results show that all students answered "yes" to this question. The reasons given by students were: "it motivates me" (3), "it's a change from the usual classes" (2), "it's fun" (1), "time passes faster" (1), "it's interesting" (1), "we can see our knowledge and our mistakes better" (1), "it's a good way to have fun" (2), "it makes me want to answer and understand more" (2). Students' willingness to learn a foreign language is clearly increasing thanks to the use of Kahoot. It allows students who are intimidated by traditional teaching methods to have fun and discover a desire to be more engaged in their learning.

With the help of statements 10, 11, and 13 ("I am more interested in English during classes using Kahoot", "I understand grammar better during classes using Kahoot digital tests" and "When I use Kahoot in class, even if I have difficulties or if I cannot answer a question, I continue"), we tried to demonstrate the impact of the Kahoot app on students' motivation to learn foreign languages.

All students answered "yes" to 10 statements. The reasons given by students were not related to the subject. Their interest was reinforced by the impression that "it's easier" (1), that "it helps to remember new words" (1), as well as the desire to be a leader in the group (1) and enjoyment of the tool (1). It can be assumed that by using a game-based learning method such as the one offered by this app, students will be able to overcome their aversion to the subject.

To summarise the results of this survey, for the majority of students, the use of mobile phones and the Kahoot app has improved their motivation in biology class. They seem to appreciate the fact that the digital skills they demonstrate in their everyday use of their mobile phones are useful to them at university. All the students clearly prefer using the Kahoot app to more traditional learning because it takes a more unconventional and interesting turn for them. The fun aspect of Kahoot's digital quizzes makes the activity less boring in their eyes, despite their rejection of the subject matter being taught. In fact, they have more fun during the quiz: it takes less time and encourages them to work harder. Kahoot quizzes are an educational approach that is both fun and modern. Kahoot is the only tool that can identify what is preventing a student from understanding the material.

The entertainment aspect of Kahoot means it can be used to encourage competition between students and the motivational factor of pride. The motivating factor is the sense of pride a student feels as a result of

being admired by others.

After analysing the results of the survey, it is worth returning to the central question of the study, whether the use of the Kahoot app in foreign language classes is effective. In this aspect, the answer is definitely positive, as Kahoot primarily improves students' motivation to learn. According to Nguyen & Yukawa (2019), by using Kahoot, teachers can make classes more interactive and challenging. Students are more motivated to participate and learn because they are actively involved in the learning process. In addition, Kahoot can be used in different subjects and at different levels, making it a versatile tool. The opposite opinion is expressed by Lin, Tsai & Hsu (2023) in their work. According to the scientist, Kahoot has some disadvantages. He believes that using Kahoot can be time-consuming, as it takes time to create tests and questions. In addition, some students may feel excluded or depressed if they answer questions incorrectly. In contrast, Ivaniuk & Ovcharuk (2020) conclude that Kahoot is an interactive platform that offers many benefits for learning. It allows teachers to make classes more engaging and students to enjoy learning (Yuzyk et al., 2019). However, it is important to consider potential drawbacks and manage them appropriately to ensure a positive learning experience for all students. It is also worth noting that Kahoot can be used in other contexts, such as corporate training or interactive events (Tsekhmister, Malatsai, Nechitailo, Emelianova, Korol & Statsenko, 2022). Its ease of use and ability to make presentations more interactive make it a popular tool in various fields (Garvasiuk et al., 2023). However, Namestiuk (2022) recommends not to overuse Kahoot and to incorporate it into classroom activities in a balanced way. Ensuring that questions are relevant and aligned with learning objectives can help to maximise the use of this platform, minimising distractions and promoting a positive learning experience for all students.

Despite the scientific controversy, the results of the presented work show that all the answers to the questionnaire clearly demonstrate that using Kahoot in English classes is a way to improve students' motivation. Using the indicators of motivation proposed by Dobrovolska, Moroz, Shpak, Tsekhmister & Vovchenko (2021), it is clear that motivation increases when:

- students prefer to invest themselves in a Kahoot quiz as opposed to more traditional activities;
- students' cognitive activity seems to be better balanced in this activity, as most of them have a better understanding of grammar thanks to Kahoot;
- students persevere with tasks despite setbacks or difficulties.

Increased motivation is associated with the implementation of certain regulatory factors that generate extrinsically motivated behaviour (Chernova, Nemesh & Togachynska, 2023). Firstly, it is related to the understanding by most students of the importance of the subject for their professional future. But the entertainment aspect of Kahoot means that it can support another regulatory factor, as activities that are perceived as a game make it possible to make students want to succeed, or to outdo themselves, or to be recognised by others (Tsoli, 2023). Thus, it can be argued that the hypothesis of the paper is relevant and validated in this limited context.

However, there are still some limitations to this study. First, this study presented a sample of only 11 students from one group. To obtain more conclusive results, a much larger sample from different higher education institutions would be needed. In addition, all participants were boys, but it would be interesting to see what the results would be for girls. Since adolescence is a time of great upheaval, it would also be wise to look at the results of second and fifth-year students to see if developing maturity might have a different effect on motivation. Second, the environment in which this study is conducted also has its limitations. The educational institution needs equipment to be able to use Kahoot. The quizzes were administered at the end of the session as a formative assessment for the students. It is possible that the results could have been different if the ways in which Kahoot was used were changed. Third, the survey instrument used also had its limitations. When filling out the questionnaire, many students found the questions too long. Therefore, there was a bias in the actual comprehension of the sentences. Interviews

might have shed more light on the research questions.

Despite the limitations of this study, the results of the research have shown that the use of Kahoot is an effective tool for learning foreign languages in higher education institutions.

## 5. Conclusions

The generation of students currently enrolled in higher education institutions has grown up with digital technologies as an integral part of their daily lives. However, despite the adaptation of the education system to this tool, not all educational institutions use it to its full potential due to financial constraints and sometimes a lack of experience on the part of teachers. Therefore, the purpose of this study was to analyse the effectiveness of Kahoot as a computer-based tool for learning foreign languages in higher education and to address the problem of students' lack of motivation in learning English.

The results of the study showed that the opportunity provided by the Kahoot app to vary the learning tool during English classes improves students' motivation in the context of English language learning. To this end, it was hypothesised that the use of the Kahoot app in foreign language classes would improve students' motivation due to its engaging approach.

The results of the study showed that students who used the Kahoot app in their English classes were significantly more motivated to learn. The app provided an opportunity to vary the learning tool depending on the needs of the students, which stimulated their active participation in the learning process.

Using Kahoot added interest and fun to English classes as students were able to play various interactive games, answer questions, compete with their classmates, and get instant results. This approach to learning made the classes more engaging and brought out more energy and enthusiasm from the students to learn English.

Thus, the hypothesis that using the Kahoot app in a foreign language classroom would improve students' motivation was confirmed. The app not only provided students with entertainment and a fun approach to learning but also stimulated their desire to explore more English and improve their skills.

Thus, the results of the study showed that the opportunity provided by the Kahoot app to vary the learning tool during English classes improves students' motivation in the context of English language learning. Using the Kahoot app in foreign language classes definitely improves students' motivation due to its interesting approach.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.12

Cómo citar:
Rozhnova, T., Sholokh, O., Kapinus, O., Makhynia, T., & Prykhodkina, N. (2024). Training of scientific and pedagogical staff in higher education institutions: quality and requirements. Revista Eduweb, 18(1), 164-179. https://doi.org/10.46502/issn.1856-7576/2024.18.01.12

# Training of scientific and pedagogical staff in higher education institutions: quality and requirements

## Formación del personal científico y pedagógico en instituciones de educación superior: calidad y requisitos

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Recibido: 26/12/23
Aceptado: 18/02/24

**Abstract**

This research addresses the crucial aspect of preparing scientific and pedagogical professionals in higher education institutions, focusing on their professional development and alignment with contemporary requirements. In the rapidly evolving landscape of education, understanding the current state and adapting to emerging needs are paramount. The primary aim of this study is to explore and analyze the current trends and modern requirements for scientific and pedagogical workers in higher education institutions. This qualitative research relies on evaluative judgments presented in contemporary scientific literature. The work uses content analysis, thematic and comparison. The results reveal the significance and diversity of approaches in preparing scientific and pedagogical professionals in higher education. The analysis emphasizes the need for adaptation to the requirements of the modern educational landscape in the context

of modern Master's training. system. In the conclusion, the research underscores the importance of ongoing professional development for scientific and pedagogical professionals to meet the challenges of the dynamic educational environment. While acknowledging the role of technology, the study challenges the notion that it is the sole driver of educational development. It also highlights the continued relevance of traditional pedagogical methods and the importance of professionalism in the evolving values of educational practitioners.

**Keywords:** higher education institution, pedagogy of higher education, training of research and teaching staff, masters of educational and pedagogical sciences, educational innovations, professional development of lecturers.

## Resumen

Esta investigación aborda el aspecto crucial de la preparación de profesionales científicos y pedagógicos en instituciones de educación superior, enfocándose en su desarrollo profesional y alineación con las exigencias contemporáneas. En el panorama educativo en rápida evolución, comprender el estado actual y adaptarse a las necesidades emergentes es fundamental. El objetivo principal de este estudio es explorar y analizar las tendencias actuales y los requisitos modernos para los trabajadores científicos y pedagógicos en las instituciones de educación superior. Esta investigación cualitativa se basa en juicios evaluativos presentados en la literatura científica contemporánea. El trabajo utiliza análisis de contenido, temático y comparativo. Los resultados revelan la importancia y diversidad de enfoques en la preparación de profesionales científicos y pedagógicos en la educación superior. El análisis enfatiza la necesidad de adaptación a los requisitos del panorama educativo moderno en el contexto de la formación de maestría moderna. sistema. En conclusión, la investigación subraya la importancia del desarrollo profesional continuo para que los profesionales científicos y pedagógicos enfrenten los desafíos del entorno educativo dinámico. Si bien reconoce el papel de la tecnología, el estudio cuestiona la noción de que es el único motor del desarrollo educativo. También destaca la continua relevancia de los métodos pedagógicos tradicionales y la importancia del profesionalismo en la evolución de los valores de los profesionales de la educación.

**Palabras clave:** institución de educación superior, pedagogía de la educación superior, formación de personal investigador y docente, maestrías en ciencias de la educación y pedagógicas, innovaciones educativas, desarrollo profesional de docentes.

## 1. Introduction

The training of scientific and pedagogical workers in institutions of higher education stands as a pivotal aspect in shaping the future of academia and intellectual progress. As the demand for well-prepared professionals in various fields continues to grow, the quality of training provided to individuals pursuing careers in scientific and pedagogical roles becomes increasingly crucial. This topic is particularly relevant in the context of evolving educational landscapes, where the expectations and requirements for these professionals are continually adapting to meet the challenges of contemporary society. Numerous studies have delved into the requirements of this training, aiming to understand the dynamics that contribute to the overall effectiveness of educational programs (Baranovska et al., 2020; Lottermann et al., 2017). A notable investigation conducted by Bondarenko, Zaytseva and Rukin (2021) explored the correlation between the quality of training programs and the subsequent impact on the academic and research output of graduates. Another study by Ferreira and Cravino (2022) delved into the specific requirements perceived by both educators and researchers, shedding light on the intricacies of aligning training programs with the evolving demands of the academic landscape.

Despite the acknowledged importance of training scientific and pedagogical workers, there exists a pressing research problem concerning the effectiveness and quality of the training programs offered in institutions

of higher education. The gap between traditional teaching methodologies and the dynamic needs of modern society raises questions about whether the current training approaches adequately equip individuals with the skills and knowledge required for success in their respective fields.

The primary aim of this study is to critically examine the quality of training for scientific and pedagogical workers in institutions of higher education. By assessing the existing practices and identifying potential areas for improvement, the study aims to contribute valuable insights that can enhance the overall effectiveness of these training programs.

To achieve the aforementioned aim, the following tasks will be undertaken:

1. Conduct a comprehensive literature review to understand the historical context and current trends in the training of scientific and pedagogical workers.
2. Describe the state of preparation of scientific and pedagogical workers
3. Determine the main modern requirements for the training of scientific and pedagogical staff.

## 2. Literature review

The evolving landscape of education is intricately intertwined with various dimensions, as evidenced by a multitude of studies exploring diverse perspectives. The evolving landscape of education was intricately intertwined with various dimensions, as evidenced by a multitude of studies that explored diverse perspectives. Borysova, Zadorina, Kotiash and Bukoros (2023) delved into the future of Ukrainian education, particularly focusing on the integration of digital competencies. Their work shed light on teaching and assessment methodologies, emphasizing the importance of preparing learners for a digitally-oriented world. In a parallel vein, Iskakova (2023) navigated the realm of electronic technologies, specifically addressing the individualized learning needs of education seekers with special needs. This research underscored the intersection of technology and inclusivity, recognizing the potential of electronic tools in catering to the diverse learning requirements of students with special needs. Philosophical futurism took centre stage in Maciej (2023) work, where an analysis of personality consciousness, information and communication technologies (ICT), and forward-thinking pedagogical strategies unravelled the intricate relationship between philosophy and educational evolution. The study probed the transformative impact of philosophical perspectives on the future landscape of education. Shifting gears to the healthcare sector, Kaminskyy and Viesova (2022) investigated innovative activities within future healthcare institutions. Their exploration provided valuable insights into models designed to overcome dilemmas in healthcare, signaling the importance of innovation in addressing challenges within this critical domain. The role of sports in higher education across various disciplines was explored by Dzhym, Saienko, Pozdniakova, Zhadlenko and Kondratenko (2023), who advocated for the intensification of sports activities in the training process. Their work highlighted the potential of sports in fostering holistic development and its integration into diverse academic specialties.

On a linguistic front, Yuhan (2017) exploration of multimedia technologies in teaching language to foreign students underscored the globalized nature of education. This study acknowledged the significance of multimedia tools in language education, offering an innovative approach to teaching and learning. Frumkina, Diachenko, Polyezhayev, Savina and Hadi (2020) contributed to the discourse by assessing the readiness of future teachers for integrated teaching in a foreign language. This study recognized the growing importance of linguistic diversity in educational settings and the corresponding need for educators to be equipped for integrated language instruction. Moreover, Tsekhmister, Vizniuk, Humeniuk, Dolynnyi and Polishchuk (2022). delved into the formation of professional skills for future physicians. This work provided valuable insights into the training process, focusing on the development of skills essential for medical practitioners, thereby contributing to the ongoing discourse on medical education.

Dehtiarova study (2022) delved into the challenging aspects related to the working hours of scientific and pedagogical workers in higher education institutions operating under specific training conditions. This research was crucial in understanding the potential stressors and constraints that impacted the efficiency and well-being of academic staff in specialized educational settings. Dekarchuk, Honcharuk, Yovenko and Parakhnenko (2023) contributed by establishing the methodological foundations for training students in higher pedagogical institutions, emphasizing the organization and conduct of scientific and pedagogical research. The focus on providing students with a strong methodological framework reflected a commitment to nurturing research skills and fostering a culture of inquiry among future educators.

In the context of Ukrainian higher education, Halchenko, Snyatkova, Semencha, Bilozerska, Tryfonova and Ahiliar Tukler (2023) presented a conceptual framework for shaping the foundations of the future teacher's professional culture. This work underscored the importance of cultivating a robust professional culture among aspiring educators, offering insights into the unique context of Ukrainian higher education.

Kouchur investigation (2020) into pedagogical conditions for ensuring the quality of distance education in higher education institutions was particularly timely, given the growing prominence of online learning. The study addressed challenges and requirements essential for maintaining educational standards in the dynamic landscape of distance education. The work by Kozubtsov, Kariaka, Kozubtsova and Dotsenko (2022) explored pedagogical design as a contemporary phenomenon, focusing on the individual skills of scientific and pedagogical workers in higher education institutions. This study added to the discourse by highlighting the evolving nature of pedagogical skills in the modern educational landscape. Hurska and Parshyn (2023) investigated the role of modern humanitarian textbooks in the process of training and teaching education seekers.

Finally, Kropocheva (2021) shed light on new opportunities for scientific libraries through repositories in higher pedagogical education institutions. This perspective expanded the horizon, emphasizing the role of libraries as repositories and their potential contributions to academic research and knowledge dissemination.

In summary, the amalgamation of these studies enriched understanding of critical issues such as working conditions, methodological foundations, professional culture and pedagogical design in higher education institutions. Together, they contributed to a holistic perspective on the complexities and opportunities within the contemporary landscape of higher education. However, the issue of training scientific and pedagogical workers is not sufficiently studied. For this reason, it is worth characterizing the basic conditions of their training in the modern educational space.

## 3. Materials and methods

General background

This research aims to elucidate the rationale behind conducting a study on the preparation of scientific and pedagogical staff in higher education institutions, as well as to define its objectives and requirements.

This study is qualitative as it is based on evaluative judgments presented in contemporary scientific literature.

Data collection

A meticulous search was conducted, and articles published in reputable academic databases such as Google Scholar, Scopus, and WoS were included in the sample. Keywords like "preparation of scientific and pedagogical staff", "higher education", "digital technologies", "digitization", "modern pedagogical trends",

"requirements for educators", etc., were employed during the search. The research focused on contemporary and relevant literature, spanning from 2009 to 2024. Additionally, the regional scope of the study is confined to the European region.

Data Analysis

In this research on the training of scientific and pedagogical workers in higher education institutions, employed the following methods for data analysis.

1. Categorical analysis. The collected data, including literature insights and expert judgments, were categorized based on key themes and topics. This method allowed us to identify recurring patterns and prevalent issues in the training of scientific and pedagogical staff.
2. Content analysis. The textual content of selected articles and literature was systematically analyzed. This involved identifying recurrent themes, evaluating the depth of discussion on specific aspects, and extracting relevant information pertaining to the current state and requirements in the field of training.
3. Thematic analysis. The data underwent thematic categorization to identify overarching themes and sub-themes. This approach allowed for a nuanced understanding of the diverse aspects influencing the training of scientific and pedagogical workers.
4. Comparative analysis. Selected literature and expert opinions were compared to identify similarities, differences, and evolving trends over the examined period. This method provided insights into the changing landscape of training practices.
5. Synthesis of findings. The results of the analysis were synthesized to construct a comprehensive narrative. This synthesis involved integrating key findings, drawing connections between different aspects, and presenting a holistic view of the state and requirements in the training of scientific and pedagogical workers.

## 4. Results and discussion

The contemporary higher education system aligns with the international Bologna system, a unified framework embraced by numerous European nations. This system aims to standardize higher education structures, qualification documents, and the qualifications of professionals and researchers across different countries. Introduced in 1999, the Bologna system aims to create a common European educational space that promotes the exchange of knowledge, the understanding of qualifications and ensuring the mobility of students and scientists (Çekerol & Öztürk, 2012). One of the key components of the Bologna system is the development of a single qualification standard that ensures the level and content of education in all European countries. This facilitates comparison and obtaining qualifications, which is the place of the aspect of training of scientific and pedagogical workers. Establishing a unified system allows to standardize the quality of education and increase the high qualification of diplomas and degrees (Mykytenko, 2021).

At the same time, the Bologna system promotes changes in approaches to the training of scientific and pedagogical workers. It is designed to provide greater flexibility and integration of science and education so that graduates are ready for the challenges of the modern labour market (Mykytenko, 2021). This includes the development of research skills, pedagogical effectiveness and the ability to learn independently. In the context of the training of scientific and pedagogical workers, the Bologna system considers structural changes in the educational process (Çekerol & Öztürk, 2012). This may include creating innovative programs aimed at producing better scientists and teachers (See Table 1).

**Table 1.**
*Elements of the Bologna System and their role in the preparation of scientific and pedagogical workers*

| Elements | Description |
|---|---|
| Standardization of qualifications | Ensuring a unified qualification standard for ease of comparison and recognition. |
| International recognition of diplomas | Increasing international recognition of diplomas and degrees. |
| Flexibility in education | Providing greater flexibility and integration of science and education. |
| Development of research skills | Fostering the development of research skills and the ability for independent learning. |
| Structural changes in education | Creating innovative programs and university postgraduate schools for the preparation of scientific and pedagogical personnel. |

***Source***: author's development

The ongoing reform in the training of scientific and pedagogical workers within Europe is directed towards instituting structural changes conducive to a unified European research space. A key facet of the ongoing reform in Germany and France involves the establishment and recognition of university graduate colleges as effective entities for postgraduate students, particularly those pursuing doctoral degrees. These graduate colleges, financed through the federal budget, operate as targeted research groups where students benefit from structured programs. Participants receive grants, enabling them to concentrate fully on their dissertation research under the mentorship of one or more faculty members, who are actively, involved in funded research projects (Yakovenko, 2022).. These colleges not only provide financial support but also facilitate an immersive research environment for doctoral candidates. The structured programs offered by graduate colleges encompass general and specialized courses, typically ranging from 4 to 6 hours per week (Yakovenko, 2022). The emphasis lies in creating an environment that encourages in-depth research while simultaneously providing comprehensive academic support. The collaborative nature of graduate colleges fosters a symbiotic relationship between students and faculty, contributing to the overall quality and depth of research endeavors. Furthermore, graduate schools are considered potential models for addressing existing shortcomings in Europe's current approach to the organization of researcher and teacher training in higher education (Zoriy & Bohatyrets, 2018). By offering a focused, well-funded, and collaborative platform, these institutions have the potential to overcome the challenges faced by traditional educational structures, ultimately contributing to the advancement of research and teaching in higher education across the continent (Simonics, 2021).

Thus, the preparation of scientific and pedagogical workers today reflects a dynamic and multifaceted landscape shaped by contemporary educational trends. The main trends in the preparation of the scientific and pedagogical staff, taking into account current realities, are presented in Figure 1.

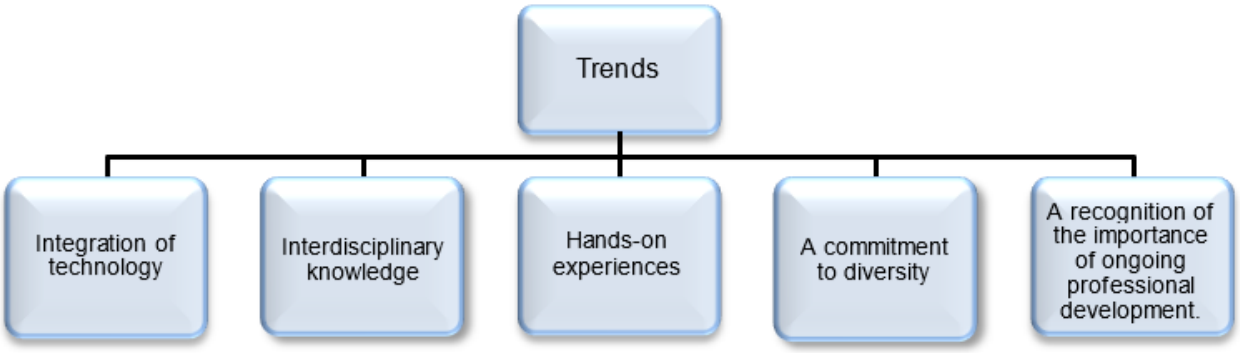


***Figure 1.*** Main trends in the preparation of the scientific and pedagogical workers.
**Source:** author's development.

In response to the demands of an ever-evolving society, the emphasis is on cultivating a diverse skill set that extends beyond traditional disciplinary boundaries. As shown in Figure 1 one prominent trend is the integration of technology in the preparation process. Modern scientific and pedagogical workers are expected to be proficient in leveraging digital tools for research, teaching, and communication. This includes incorporating online resources, interactive learning platforms, and digital collaboration tools into their practices to enhance the overall learning experience (Turchyn et al., 2023). Interdisciplinary knowledge has become a cornerstone of the preparation of scientific and pedagogical professionals. Recognizing the interconnectedness of various fields, there is an increased emphasis on fostering a holistic understanding that goes beyond specialized domains. This trend encourages collaboration across disciplines, enabling professionals to address complex challenges with comprehensive and innovative solutions. Moreover, as shown in Figure 1 there is a growing awareness of the importance of practical experiences in the preparation of scientific and pedagogical workers (Tsekhmister et al., 2022). Practical, hands-on training, often facilitated through internships, research projects, or teaching practices, is considered essential for translating theoretical knowledge into real-world applications. This trend aims to bridge the gap between academic learning and practical skills demanded in professional settings. A commitment to diversity, equity, and inclusion is another prominent aspect of contemporary preparation trends. The recognition of diverse perspectives and the need for inclusive teaching practices are integral to preparing scientific and pedagogical workers for the globalized and multicultural educational environments they may encounter (Maciej, 2023).

Professional development and lifelong learning have become integral components of the preparation journey. The ever-changing nature of knowledge and technology requires continuous adaptation. Thus, the state of preparation emphasizes a mindset of continuous learning, encouraging professionals to stay abreast of emerging trends, methodologies, and research findings throughout their careers (Litynska et al., 2023). Therefore, the preparation of scientific and pedagogical workers in the modern context is characterized by the integration of technology, interdisciplinary knowledge, hands-on experiences, a commitment to diversity, and the recognition of the importance of ongoing professional development. These trends collectively contribute to a workforce that is not only well-equipped with theoretical knowledge but is also adaptable, innovative, and capable of meeting the diverse challenges of contemporary education and research landscapes (Frumkina et al., 2020).

Therefore, taking into account the current trends in the formation of scientists and educators, it is worth outlining the main requirements for their training. According to modern scientists, in the contemporary landscape of academic preparation, the training of scientific and pedagogical staff demands a multifaceted approach to meet the dynamic challenges of modern education and research (Olifira & Synenko, 2020). Consequently, modern requirements should focus on the development of the main required competencies (Borysova et al., 2023). Table 2 below describes the basic requirements important for the training of scientific and pedagogical workers.

**Table 2.**
*Main requirement of the training of scientific and pedagogical workers*

| Number | Name of requirement | Description |
|---|---|---|
| **1** | Interdisciplinary mastery | Proficiency in multiple academic disciplines beyond one's specialization is imperative. This involves a comprehensive understanding of the interconnectedness of various fields, enabling effective collaboration and contribution across disciplines for comprehensive research and teaching. |
| **2** | Digital competence | Adept use of a wide range of digital tools and technologies is crucial. This includes proficiency in data analysis software, online learning platforms, and communication tools, ensuring effective utilization of technology for research, teaching, and academic communication. |
| **3** | Innovative pedagogy | The ability to design and implement inventive teaching methods is paramount. This includes engaging students, encouraging critical thinking, and fostering the practical application of knowledge through active learning strategies, project-based assessments, and technology-enhanced teaching approaches. |
| **4** | Research excellence | A strong foundation in research methodologies, both quantitative and qualitative, is essential. Demonstrated proficiency in designing and conducting rigorous research studies, critically analyzing existing literature, and contributing to the advancement of knowledge in their field is a key requirement. |
| **5** | Applied experience | Integration of practical experiences, such as internships, teaching practicums, or research projects, is critical. This hands-on approach ensures that theoretical knowledge is reinforced with real-world applications, enhancing the overall learning experience. |
| **6** | Diversity and inclusion competence | The ability to create and maintain inclusive learning environments is foundational. This involves respecting and celebrating diversity, adapting teaching strategies to accommodate diverse learning styles and backgrounds, and fostering an atmosphere of equity and inclusion. |
| **7** | Commitment to professional growth | A proactive commitment to continuous professional development is necessary. This involves participation in conferences, workshops, and training programs, staying updated on advancements within the field, exploring emerging trends, and actively seeking opportunities for career growth. |
| **8** | Adaptability | An adaptable mindset is essential to navigate changing educational landscapes, technological advancements, and societal demands. This includes a willingness to embrace new teaching methodologies, integrate emerging technologies, and adapt research approaches based on evolving circumstances. |
| **9** | Effective Communication | Strong communication skills, encompassing clear and articulate written and verbal expression, are fundamental. This involves the ability to convey complex concepts comprehensibly, engage effectively with students and colleagues, and disseminate research findings to diverse audiences, both within and outside academia. |

**Source:** author's development

Hence, as can be seen from Table 2, an important role in the system of training scientists and educators is played by the development of digital competence, interdisciplinary knowledge, the use of innovative methods in professional activities, and adaptability to changes. However, a particularly important

requirement is professional development, which must take place constantly. The continuous professional development of scientific and pedagogical workers in higher and educational institutions is an ongoing process aimed at acquiring new skills and enhancing previously acquired competencies necessary for their professional activities. This development involves a commitment to constant self-education and various forms of professional growth, which can occur through formal and informal education, internships, engaging in professional activities, and more. Legislation outlines specific requirements regarding the frequency and extent of professional development for scientific and pedagogical workers across different levels of education. For those working in institutions of higher and postgraduate education, it is mandatory to enhance their qualifications at least once every five years (Yakovenko, 2022; Tsekhmister et al., 2009). During this period, the respective institution ensures the provision of advanced training while maintaining the average salary of the professional. The duration of professional development for scientific and pedagogical workers is quantified in credits based on the European Credit Transfer and Accumulation System (ECTS), where one credit corresponds to 30 hours (Daghbouche, 2011). Over a five-year cycle, the cumulative professional development for these individuals cannot be less than six ECTS credits. The main focal areas of professional development encompass diverse aspects (See Figure 2).

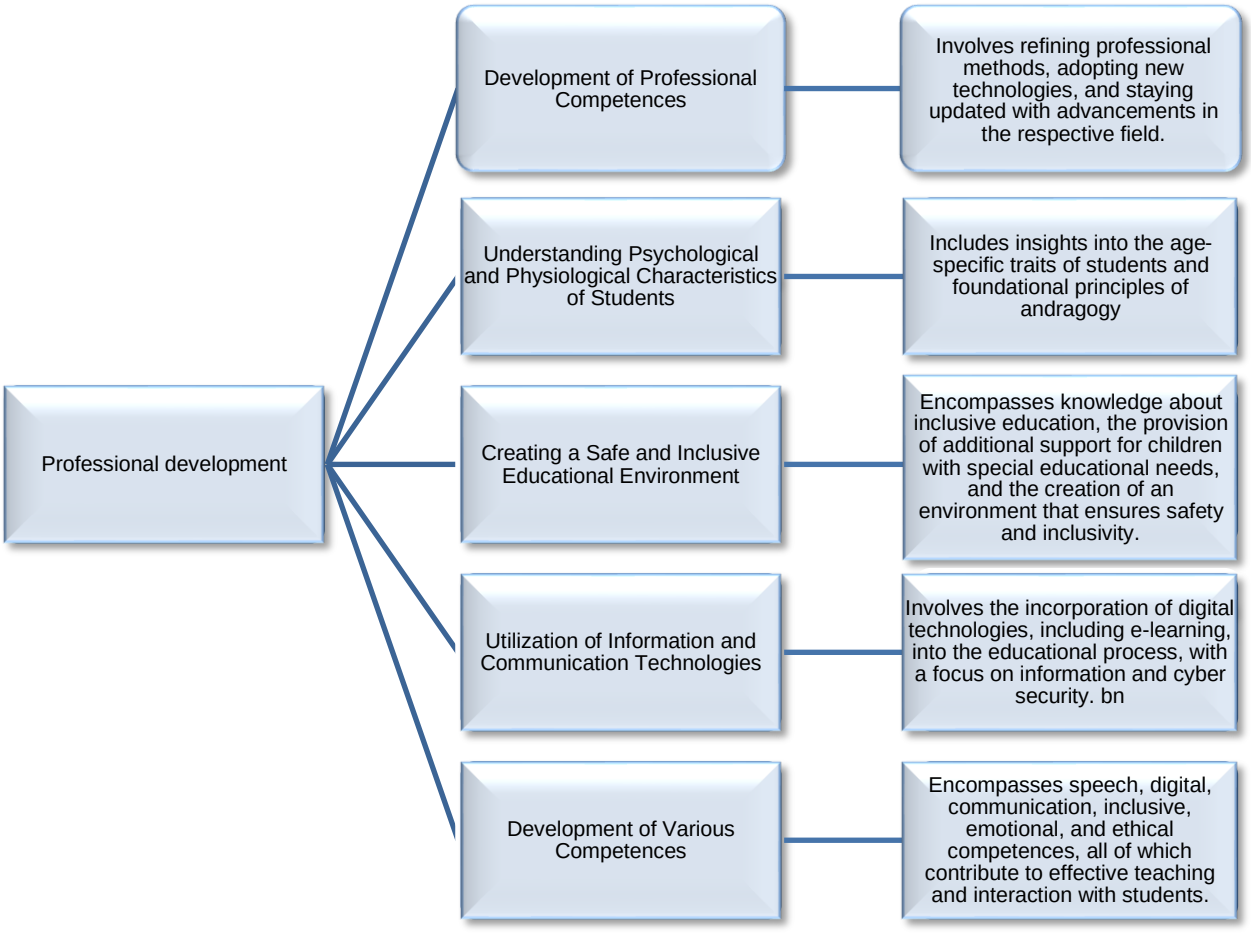


**Figure 2.** *Main aspects of professional development of modern pedagogical staff*
***Source***: author's development

These targeted areas of professional development collectively contribute to the continuous improvement of scientific and pedagogical workers, ensuring that they remain well-equipped and effective in their roles

within the ever-evolving landscape of higher and postgraduate education (Vîşcu, Cădariu & Watkins, 2023). The main forms of professional development for scientists and educators encompass various strategies and mechanisms aimed at enhancing their knowledge, skills, and competencies. This not only contributes to the personal growth of professionals but is also crucial for maintaining high standards in education and research (Iskakova, 2023). Through active participation in these forms of professional development, scientists and educators can effectively integrate new technologies, refine teaching methods, and respond to contemporary challenges in their respective fields. This purposeful approach fosters the creation of a resilient and innovative educational environment that meets the needs of modern society. Several key forms of professional development include internship, formal education, scientific conferences, mentorship and self education (See Table 3).

**Table 3.**
*Forms of professional development of pedagogical and scientific staff*

| Forms | Description |
|---|---|
| Preparation for the master's degree in the specialty 011 "Educational and pedagogical sciences" | The process of training in the master's degree is focused on the development of students as highly qualified specialists in the field of education and science. The main goal is to provide them with comprehensive knowledge, skills and experience necessary for teaching, scientific and research work in higher educational institutions. Students get in-depth knowledge in various aspects of pedagogy, teaching methods, educational psychology, education theory, etc. The educational and professional program "Pedagogy of the higher school" promotes the development of research skills through participation in projects, writing scientific papers, publications and participation in conferences. The master's degree in the field of "Educational and Pedagogical Sciences" provides students with in-depth knowledge and practical experience, which allows them to confidently work in the field of higher education and research. |
| Internship | Active participation in internship programs where professionals can gain practical experience in their field. This may involve working on real projects, collaborating with other highly skilled specialists, and exchanging experiences. |
| Formal Education | Participation in formal education programs such as courses, workshops, seminars, and training sessions. These programs may cover new technologies, current teaching methodologies, or in-depth analysis of scientific trends in the respective field. |
| Scientific Conferences | Participation in scientific conferences, symposiums, and meetings where scientists and educators can exchange their research findings, share impressions of conducted projects, and discover new trends in their field. |
| Mentorship | Participation in mentorship programs where experienced scientists or educators provide support and advice to less experienced colleagues. This may include individual consultations, collaborative projects, and the exchange of best practices. |
| Self-Education | Active self-learning of new topics, reading scientific literature, or acquiring new skills through online resources and independent research. Self-education is crucial for continuous improvement and refining one's professional skills. |
| Membership in Professional Associations | Joining scientific or educational associations where active information exchange, learning about new trends in the field, and collaboration with colleagues are possible. |

**Source:** author's development

These diverse forms of professional development enable scientists and educators not only to enrich their professional knowledge but also to maintain the relevance of their activities in the rapidly changing environment of higher education and science. In addition, Table 3 illustrates the significance of training scientific and pedagogical professionals within the framework of a master's degree program in the field of

educational and pedagogical sciences, specifically in the educational and professional program "Pedagogy of the Higher School." This training proves crucial for the comprehensive professional development of both educators and researchers. This master's program, with its specialization in "Pedagogy of the Higher School" under the discipline of educational and pedagogical sciences (specialty 011), is designed to address key objectives essential for the holistic development of professionals in the education sector. The multifaceted nature of the program aims to achieve several crucial goals (See Table 4).

**Table 4.**
*Tasks of Master's training*

| Tasks | Description |
|---|---|
| **Formation of Professional Competences** | The program focuses on systematically shaping and enhancing the professional competences of master's students. This involves a deep exploration of theoretical knowledge combined with practical applications, ensuring a well-rounded skill set. |
| **Teaching Experience through Scientific and Practical Training** | An integral aspect is providing master's students with teaching experience through a blend of scientific and practical training. This hands-on approach allows for the application of theoretical insights in real-world educational settings. |
| **Development of Professionally Significant Qualities and Abilities** | Master's training emphasizes the development of qualities and abilities that are highly significant in the professional landscape. This includes fostering a profound professional orientation, instilling motivation, nurturing the importance of self-education, and fostering a drive for continuous self-development and improvement. |
| **High Level of Self-Organization** | Recognizing the dynamic nature of the professional reality in the field of education, the program aims to cultivate a high level of self-organization among master's students. This ensures their readiness to perform professional tasks and functions effectively in rapidly changing environments. |
| **Formation of a Creative Approach** | The program places a strong emphasis on instilling a creative approach to the execution of professional tasks. This involves encouraging innovative thinking, problem-solving skills, and the ability to adapt to diverse challenges within the educational sphere. |
| **Development of Communication Skills and Teamwork** | Recognizing the collaborative nature of the educational environment, the master's program actively promotes the development of effective communication skills and the ability to work seamlessly within a team. This collaborative aspect enhances the overall professional readiness of graduates. |

**Source**: author's development

Hence, master's training stands as a cornerstone for the multifaceted professional development of educators and scientists, addressing diverse aspects that contribute to their success and effectiveness in the dynamic field of educational and pedagogical sciences. Hence, the professional development of educators and researchers within the framework of preparing academic professionals in the conditions of the master's program in the specialty 011 "Educational, Pedagogical Sciences," particularly in the educational-professional program "Higher Education Pedagogy," is a crucial stage in the qualification enhancement and formation of professional competence. Below are key aspects of this process:

1. Theoretical and practical training. Master's students choosing the specialization 011 "Educational, Pedagogical Sciences" acquire in-depth knowledge in the field of education and pedagogy. This includes studying theoretical aspects of pedagogical science and practical methodologies aimed at higher education.

2. Scientific activity. Students actively engage in scientific activities, allowing them to explore current issues in higher education, conduct research, and develop critical thinking. Participation in conferences, article publications, and involvement in research groups contributes to their scientific development.
3. Pedagogical practice. Master's training includes pedagogical practice in higher education institutions. Students have the opportunity to apply theoretical knowledge in real teaching conditions, developing skills in planning and conducting educational sessions.
4. Innovative Approaches. Master's training encourages the use of innovative pedagogical methods and technologies in the teaching process. Students learn to implement modern approaches to higher education, fostering their professional growth.
5. Mentorship and Supervision. Students receive guidance from experienced mentors and academic advisors, contributing to their professional and academic development.
6. Innovative Approaches. The program of master's training stimulates the use of innovative pedagogical methods and technologies in the teaching process. Students learn to implement modern approaches to higher education, fostering their professional growth.
7. Assessment and Reflection. The program involves systematic assessment and reflection on pedagogical and scientific activities, enhancing students' skills and competencies.

Hence, master's program "Higher Education Pedagogy" provides students with not only theoretical knowledge but also practical experience and a scientific approach, which are essential components of the professional development of educators and researchers in the field of higher education in Ukraine.

During the pursuit of a master's degree, prospective educators are tasked with mastering not only the foundational professional skills but also the intricacies of teaching within higher education. This involves a comprehensive understanding of the methodology for preparing and conducting educational sessions across diverse institutional settings. The mastery of these skills is contingent upon incorporating insights from pedagogical and psychological sciences, adhering to didactic principles, and aligning with personal scientific interests.

In navigating the dynamic and often unpredictable professional realities of today's higher education landscape, a contemporary specialist must possess a versatile skill set. This includes the ability to navigate non-standard situations, engage in critical thinking, effectively utilize various information sources, and employ adaptive strategies in competitive environments. Moreover, a modern higher education professional is expected to exhibit a commitment to continuous self-education, self-improvement, and the ongoing development of professional qualifications.

Furthermore, the evolving nature of the educational and professional landscape calls for the adeptness in searching for and implementing innovative forms of organizing professional education and activities. This necessitates a proactive approach to staying abreast of emerging trends and a readiness to embrace novel, effective methodologies.

In light of these evolving demands, the imperative of self-organization emerges as a constant in the integral process of organizing professional education and professional activities. It serves as a vital aspect, ensuring that education subjects are well-equipped to navigate the complexities of their roles, foster adaptability, and continually contribute to the advancements in professional education and practice. The cultivation of self-organization skills becomes an inherent component in preparing future educators for the multifaceted challenges and opportunities inherent in the field of higher education. Additionally, engaging in various forms of professional development empowers scientists and educators to stay abreast of emerging methodologies, technological advancements, and innovative pedagogical approaches. This proactive approach ensures that they remain dynamic contributors to the evolving landscape of higher education, fostering a continuous cycle of improvement and adaptability in response to the ever-changing demands of their respective fields.

The obtained results indicate the significance and diversity of approaches in the preparation of scientific and pedagogical workers in higher education institutions. The theoretical analysis also underscores the importance of adapting the training of scientific and pedagogical staff to contemporary requirements, particularly in the context of the Bologna system. This international higher education system establishes unified standards and criteria, creating a favorable foundation for the standardization and improvement of the quality of researchers and educators' training (Çekerol & Öztürk, 2012; Mykytenko, 2021). Training trends also reflect the necessity of integrating modern technologies, innovative teaching methods, and interdisciplinary competencies development. The application of these trends allows scientific and pedagogical staff to effectively respond to the challenges of the modern educational environment and ensure students receive a high level of preparation. Many contemporary researchers emphasize these aspects. For instance, Yuhan (2017) highlights the importance of utilizing innovative multimedia technologies in the training of modern researchers, defining the future pedagogical landscape and playing a vital role in the education system. Iskakova (2023) aligns with this perspective, describing essential electronic technologies for ensuring an individualized approach in higher education. Recent studies also confirm the significance of adapting modern educators and researchers to the dynamic information environment (Litynska et al., 2023; Skyba & Hanna, 2019). However, the obtained results challenge the assertion by Masoumi & Lindström (2014) that educational technologies are primary for educational development. While technologies play a crucial role, other factors such as pedagogical methods, curriculum development, and teacher-student interaction are integral components of educational development. This study acknowledges the importance of professional development in preparing researchers and educators but disagrees with Nestoruk's (2021) notion that the trajectory of values orientation among scientific and pedagogical workers has changed. Professionalism should still take precedence over certain personal qualities of a teacher. This, this research contends that, despite Nestoruk's (2021) perspective, professionalism remains a cornerstone in the field, overshadowing certain personal qualities. The study advocates for a nuanced understanding, acknowledging the importance of personal attributes but emphasizing that professionalism should remain the guiding principle. In essence, the changing dynamics in the educational landscape require educators to possess a blend of professional expertise and essential personal qualities.

The findings also contradict Santos Júnior & Macedo's (2023) claim that "knowledge obtained through specialized training for teaching is essential," assuming that only specialized training provides necessary knowledge for teaching (p 5). In reality, experiential learning, continuous professional development, and on-the-job experience also make a significant contribution. Thus, these findings underscore the need for a more holistic perspective on teacher preparation, recognizing the importance of diverse learning experiences beyond specialized training programs.

The results also indicate that active participation in internship and mentorship programs, along with involvement in high-quality educational programs, ensures practical experience and the development of necessary skills. Participation in scientific conferences promotes the exchange of expertise and the discovery of new trends in higher education and science. These aspects are well-explored, particularly in the works of Simonics (2021) and Olifira & Synenko (2020). Furthermore, the findings underscore the significance of ongoing professional development, emphasizing its pivotal role in keeping abreast of evolving educational landscapes. The effectiveness of internship and mentorship programs in bridging the gap between theoretical knowledge and practical application is highlighted in numerous studies, contributing to the comprehensive understanding of pedagogical and research practices. Additionally, the research by Simonics (2021) and Olifira & Synenko (2020) delves into the intricate dynamics of these developmental strategies, shedding light on their nuanced impact on the enhancement of scientific and pedagogical competencies.

Thus, the novelty of this research lies in the comprehensive examination of the current state and evolving demands within the context of higher education. Specifically, the study delves into contemporary trends

associated with the preparation of scientific and pedagogical staff, incorporating a deep analysis of recent changes, innovations in educational methodologies, and approaches. Considering the rapidly evolving nature of education, the research describes how higher education institutions adapt to the dynamic educational landscape. A new aspect includes an interdisciplinary perspective, considering how the training of scientific and pedagogical staff intersects with other fields of scientific knowledge. Consequently, this interdisciplinary approach can provide a more complete understanding of the educational landscape.

However, like any research, this work has several limitations. In particular, the study was oriented towards the global context, primarily focusing on EU practices. Therefore, the orientation towards practices in the European Union defines the limitations of the research in other regions of the world. The results may be less relevant for countries with different higher education systems and cultural contexts. Additionally, the study is based solely on contemporary literature. The choice of current literature from 2009 may lead to the exclusion of earlier works that could be essential for understanding the dynamics of changes in the preparation of scientific and pedagogical staff. These mentioned limitations should be considered when interpreting the results.

Nevertheless, despite these aspects, the research contributes to the scholarly dialogue on the preparation of scientific and pedagogical staff, offering ideas that could form the basis for educational policy, institutional practices, and future research directions in higher education.

## 5. Conclusions

Hence, the training of scientific and pedagogical workers in institutions of higher education is a multifaceted process that plays a pivotal role in shaping the future of education and research. The quality of this training is critical, not only for the individual professional growth of educators and researchers but also for the overall advancement of higher education institutions. Embracing diverse forms of professional development, including internships, formal education, scientific conferences, mentorship, self-education, and participation in professional associations, proves to be instrumental in enriching knowledge and maintaining relevance in a rapidly changing academic landscape.

Meeting the requirements for effective training involves aligning educational programs with contemporary standards, fostering interdisciplinary collaboration, and integrating cutting-edge technologies. Institutions must prioritize the creation of a supportive environment that encourages continuous learning, innovation, and adaptation to emerging trends. Furthermore, the emphasis should extend beyond theoretical knowledge, encompassing practical skills, research competencies, and a commitment to pedagogical excellence.

By addressing these facets, higher education institutions contribute not only to the professional development of their scientific and pedagogical workforce but also to the overall enhancement of the educational experience for students. Ultimately, a well-trained and adaptable cadre of educators and researchers is essential for advancing knowledge, fostering critical thinking, and preparing the next generation for the challenges of the ever-evolving academic landscape.

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DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.13

Cómo citar:
Boiko, A., Shevtsova, N., Yashanov, S., Tymoshchuk, O., & Parzhnytskyi, V. (2024). The impact of the integration of artificial intelligence on changes in the education process of Ukraine: prospects and challenges. Revista Eduweb, 18(1), 180-189. https://doi.org/10.46502/issn.1856-7576/2024.18.01.13

# The impact of the integration of artificial intelligence on changes in the education process of Ukraine: prospects and challenges

## El impacto de la integración de la inteligencia artificial en los cambios en el proceso educativo de Ucrania: perspectivas y desafíos

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Recibido: 02/12/23
Aceptado: 27/01/24

**Abstract**

The purpose of the article is to analyse the status of artificial intelligence in the development of Ukrainian education in the context of socio-cultural instability. The positioning of innovative elements of modern education depends on the level of use of their potential by participants in the educational process. The research methodology is focused on the analysis of scientific discourse and the use of synergistic approaches to assess the scale and intensity of artificial intelligence in the Ukrainian educational space. The results of the study indicate a reorientation of the status of artificial intelligence from an exclusive element of educational activity to the level of an auxiliary component of the educational process. The demand for and feasibility of using artificial intelligence in Ukrainian education are key concepts that require a thorough scientific study. Thus, artificial intelligence has acquired the potential to transform the Ukrainian educational space.

**Keywords:** artificial intelligence, educational innovations, technologization, Ukrainian education, digitalization.

**Resumen**

El objetivo del artículo es analizar el estado de la inteligencia artificial en el desarrollo de la educación ucraniana

en el contexto de la inestabilidad sociocultural. El posicionamiento de los elementos innovadores de la educación moderna depende del nivel de uso de su potencial por parte de los participantes en el proceso educativo. La metodología de investigación se centra en el análisis del discurso científico y el uso de enfoques sinérgicos para evaluar la escala y la intensidad de la inteligencia artificial en el espacio educativo ucraniano. Los resultados del estudio indican una reorientación del estatus de la inteligencia artificial desde un elemento exclusivo de la actividad educativa al nivel de un componente auxiliar del proceso educativo. La demanda y la viabilidad del uso de la inteligencia artificial en la educación ucraniana son conceptos clave que requieren un estudio científico exhaustivo. Así, la inteligencia artificial ha adquirido el potencial de transformar el espacio educativo ucraniano.

**Palabras clave:** inteligencia artificial, innovaciones educativas, tecnificación, educación ucraniana, digitalización.

## 1. Introduction

Education in Ukraine is currently undergoing a double transformation. Firstly, the educational system is changing its internal foundations both in terms of function and purpose. Secondly, education is being strongly influenced by external factors (pandemic, war, economic turmoil). Under such conditions, the education sector needs progress drivers that can demonstrate high efficiency in a short time and ensure the sustainable development of the education system in difficult times. Usually, such a factor was human potential, when the efforts (quantitative or qualitative) of the participants in the educational process helped to balance the development of education. However, the current realities in Ukraine, associated with the massive migration outflow of teachers and students, highlight the need for other mechanisms. This potential is undoubtedly possessed by innovative information and digital technologies that can provide organisational, pedagogical, educational, methodological, scientific, and cognitive clusters of educational activity. Artificial intelligence is one of the tools of an innovative format that will ensure educational development in the difficult conditions of Ukrainian realities.

Digitalisation, having demonstrated its effectiveness in other areas of social and domestic activity, is gradually being integrated into the educational space (Nehrey et al., 2020). At the international level, scenarios for human-artificial intelligence interaction in the educational environment are currently being developed (Zinchenko et al., 2021). These strategies are based on the paradigm of sustainable educational development. The Ukrainian experience is unique, as it allows us to analyse the activity of artificial intelligence in education in times of instability and crisis.

The educational system in Ukraine is evolving in a dynamic socio-cultural environment. The COVID-19 pandemic, full-scale hostilities on the territory of Ukraine - these events have led to dramatic transformations in the design of education. First of all, the format of the educational process has changed, moving from traditional academic dimensions to the online space. Under such conditions, the need to use information and digital technologies to create an alternative learning environment has become more urgent. At the same time, innovative design using such elements as artificial intelligence also shapes the new content of education. That is, artificial intelligence, designed to improve the educational process, transforms it, which is a cause for concern among the scientific community. For Ukrainian education, which has suffered the devastating impact of socio-cultural force majeure factors, artificial intelligence can be a lifeline (in the context of learning organisation and design). However, artificial intelligence may cause a larger (semantic) destruction of the purpose of education.

The spread of artificial intelligence in educational activities has become an urgent issue in the modern scientific and pedagogical discourse. The use of artificial intelligence in the Ukrainian education system has not yet become widespread, but the first attempts to adapt innovative digital technologies to educational activities have been made, and their results require a thorough analysis, given the socio-cultural realities

in which they were carried out. Artificial intelligence is intended to become a driving force for Ukraine's socio-economic recovery.

*The purpose of the research is to* analyse the potential of artificial intelligence in the context of sustainable educational development and in the context of the instability of the educational system. The objectives of the article are to identify scenarios for the introduction of artificial intelligence in Ukrainian education in the short and long term.

## 2. Literature review

The scientific and educational discourse on the innovativeness of the educational process is developing rapidly, adding more and more new elements of educational activity. The artificial element has become one of the key factors in the use of technological and digital arsenal in the educational system. The intensity of the introduction of artificial intelligence in educational activities has raised many discussions about the feasibility of using such a resource (Zinchenko et al., 2021). Scientists are raising the issue of both the organisational and technological nature of the functioning of artificial intelligence in education (Mintii et al., 2021) and the humanitarian and ideological aspects of its use (Yakovleva et al., 2021). In general, artificial intelligence is gradually gaining ground in national educational systems, forming a unique innovative design of the learning environment (Krasheninnik et al., 2022).

The current study's literature review focuses on analyzing the works of Ukrainian scientists and educators who work directly with artificial intelligence tools in the educational process. This is how we form a vision of the practical results of applying innovative technologies in education. Among the key issues being studied in the segment of artificial intelligence in Ukrainian education are the following:

- training of pedagogical specialists (digital literacy) in the context of the development of digitalisation of education (Byrko et al., 2022);
- the role of artificial intelligence in enhancing the cognitive activity of students (Kharkivska et al., 2022);
- interdisciplinary principles of artificial intelligence in education and science (Tsekhmister, Chalyi & Chalyy, 2009);
- the communicative potential of artificial intelligence in the interaction of participants in the educational process (Kulichenko & Polyezhayev, 2020);
- standardisation and quality of education under the control of artificial intelligence parameters (Tsekhmister, Konovalova & Tsekhmister, 2022);
- creative aspects of using innovative technologies (Dobrolyubska et al., 2024);
- artificial intelligence as a factor in the formation of professional competences (Tsekhmister et al., 2022).

"The use of e-technologies in education is no longer an innovation, but becomes a vital necessity for the functioning of the educational system and the activities of educational institutions" (Sych, Khrykov & Ptakhina, 2021). Such positioning of artificial intelligence and other innovative technologies in Ukrainian education is fully consistent with the socio-cultural challenges faced by participants in the educational process. The use of artificial intelligence tools in the scientific and educational spheres will facilitate the introduction of innovations and inventions that will accelerate the modernisation of the national economy (Dovgyi et al., 2020).

The use of such a topical phenomenon as artificial intelligence has practical application specifics and is positioned in the global educational dimension (Kornytska et al., 2023) and in the national context of educational development (Nehrey et al., 2020).

The dichotomy in the use of artificial intelligence in the education system is relevant in the context of the balance of academicism (Bobrytska et al., 2020) and creative innovation (Kyrychenko, 2020). Hanaba,

Mysechko & Bloshchynskyi (2020) propose a synergistic approach to addressing the proportionality of tradition and innovation by directing the potential of artificial intelligence to interact with classical teaching and learning elements.

## 3. Methodology

The study of innovative elements in an educational system under the influence of force majeure involves the use of different methodological approaches. The current study focuses on the synergistic approach, which aims to unify the existing results of the introduction of artificial intelligence in scientific works and identify the features of the functioning of artificial intelligence in the educational process.

The article offers a qualitative review study with an analysis of scientific literature on the problem of the status of artificial intelligence in Ukrainian education. The scientometric databases of Google Scholar, Springer, Taylor & Francis, and ResearchGate were used to search for scientific research. The keywords that were relevant in the selection of scientific sources were: artificial intelligence, Ukrainian education, innovative development. In developed countries, the active introduction of artificial intelligence resources in education has been taking place over the past few years, while in Ukraine this process has been actualised even later. Therefore, the literature analysis is based on studies of recent years, some of which only identified the prospects for implementation and potential applicability in Ukrainian education, but did not describe the results of use.

The combination of general scientific (analysis, systematisation), scientific and pedagogical (pedagogical observation, pedagogical generalisation), and philosophical and scientific methods (synergistic approaches) helps to achieve the goals of scientific research. The use of synergistic methodological principles has made it possible to reconcile the positions of traditional education with innovative contexts, one of which is artificial intelligence. The methodological focus on interaction rather than confrontation provides a holistic characterisation of the phenomenon of artificial intelligence in education and its prospects in this area.

The basis of the methodological study was a comparative analysis, which characterises the features of the content and format of educational design that uses artificial intelligence. The methodological basis of the research was an analysis of the literature that examines the conditions for integrating artificial intelligence into the Ukrainian education system and the first results of the introduction of artificial intelligence in Ukrainian education.

Special scientific and pedagogical methods are based on the results of pedagogical activity that captures trends in educational development caused by the use of artificial intelligence. Pedagogical observation and generalisation make it possible to analyse such elements of artificial intelligence in education as the scale of use, the intensity of involvement, effectiveness, etc.

## 4. Results and discussion

Under any circumstances, education responds to global civilisational features of development (Kornytska et al., 2023). The processes that are characteristic of modern society require tools for working with information, technology, and digital elements. Artificial intelligence skilfully combines all innovative characteristics. For Ukraine, in its current civilisational position, it is of existential importance to become a country that is able to attract advanced innovative resources in all spheres of public life. Education is one of the key markers of a community's readiness for transformation and engagement in the sustainable development paradigm. Therefore, the use of artificial intelligence is inevitable in educational activities. The sooner the emphasis is placed on the positive and negative aspects of artificial intelligence in education, the sooner the integration of Ukrainian education and public life in general into the highly developed Western model of civilisational progress will take place.

Artificial intelligence has become a hot topic in the educational environment, as its potential is gradually filling the educational activity of all its participants (teachers, students, administration, stakeholders). When the problem is concentrated in the context of Ukrainian education, which has been subjected to negative external influences, artificial intelligence is of great interest to researchers in terms of the level of vulnerability of the educational environment. On the one hand, researchers are aware that innovative elements such as artificial intelligence are vital for the functioning of the educational system in Ukraine as a whole. On the other hand, even in sustainable social organisations that are guided by the principles of sustainable development, artificial intelligence poses obvious threats. When the use of such an ambiguous element as artificial intelligence is applied in the unstable Ukrainian educational environment, the threats increase significantly. Given the vulnerability of the educational system, artificial intelligence, whose potential and impact (especially negative) are not studied and understood, can become a threat not only in the human dimension (deterioration of the quality of the educational process for its participants) but also in the existential dimension (loss of the purpose and value of the educational system).

Therefore, the Ukrainian educational space has become an interesting platform for researching scenarios for the introduction of artificial intelligence in the educational system. It is proposed to consider the use of artificial intelligence in key elements of educational activity in the context of sustainable development (educational systems in developed countries) and in the context of the crisis impact of external factors (Ukrainian educational space) (see Table 1).

**Table 1.**
*Comparative analysis of the use of artificial intelligence in the educational paradigm of sustainable development and in the crisis educational system*

| Education cluster | Education system sustainable development highly developed countries | The Ukrainian educational system in constant change |
|---|---|---|
| Learning environment | Artificial intelligence performs a heuristic function, providing a strategy for progress and development | Artificial intelligence is focused on ensuring the stabilisation function of education, accompanying learning activities in difficult force majeure conditions |
| Methodological arsenal | The methodological arsenal of artificial intelligence is focused on an innovative educational ecosystem based on technology and digital space | The methodological principles are designed to ensure the functioning of a practical innovative learning environment |
| Pedagogical excellence | Artificial intelligence and pedagogical skills form a synergy to create effective strategies for educational development | Artificial intelligence is used in a pragmatic context to meet the current needs of the teacher in supporting the digitalisation of the educational process |
| The activity of the student | Artificial intelligence as a manifestation of the educational ecosystem determines the overall strategy of the educational and cognitive activity of the student | Artificial intelligence becomes a source and translator of information or conclusions on specific educational issues |

**Source:** authors' own development

Artificial intelligence is significantly changing the design of learning. The introduction of adaptive learning principles is a direct consequence of the use of innovative technologies that use computer algorithms and tools in a bulk process. It is noted that such an educational landscape is used differently for different scientific models (Krasheninnik et al., 2022). While the use of computer algorithms is appropriate and

effective for technical or natural sciences, this methodology is no longer in demand in the humanities or creative sciences cluster.

Given the need to organise the educational process in Ukraine in an online and distance learning format (Mintii et al., 2021), there is a growing need for tools that will help speed up the processing, analysis, and dissemination of educational information (Kvitka et al., 2020).

One of the main achievements of artificial intelligence in education is to increase the level of personalisation of education and opportunities for the development of an individual learning process (Yuskovych-Zhukovska et al., 2022). In this aspect, artificial intelligence resources act as a kind of intermediary between the teacher and the student to create a favourable individualised learning environment. The traditional format of education does not allow for individualised learning due to a lack of time and opportunities, systematising and unifying education standards for all. Artificial intelligence provides opportunities for autonomy in the educational process, in which the role of the teacher is transformed into a coordinating activity.

Total digitalisation and the use of information technology tools such as artificial intelligence require an appropriate level of digital literacy among participants in the educational process (Kraus et al., 2021). Digitalisation in education is gradually turning from a popular trend into a familiar format of learning activity. Information and digital competence is becoming a requirement for pedagogical professionals to achieve better learning outcomes (Chernenko, 2021). Such realities require advanced training of teachers in the possibility of professional activity in the digital space. For the Ukrainian educational environment, such professional development is relevant, as it is implemented through self-organisation and does not require significant organisational, logistical, and financial efforts. The process of using artificial intelligence does not cause resistance or lack of skills to use this resource on the part of students. The functionality of artificial intelligence allows for the rapid use of such tools as machine learning, deep learning, cloud technologies, Data Science, Big Data, and neural networks (Valko et al., 2022).

The active use of information and technology potential carries certain risks for creative dimensions based on concepts such as "talent", "creativity", etc. There are threats of artificial intelligence absorbing these elements of human potential. At the same time, the creation and updating of educational content and the use of technological learning methods are fully consistent with the principles of creative forms of educational activity (Berbets et al., 2021). A solution to this contradiction is proposed by Bobrytska, Reva, Protska, & Chkhalo (2020), who define artificial intelligence as a tool that will help students achieve academic achievement.

Artificial intelligence in the educational paradigm is also used in the organisational and administrative cluster. In particular, in the financial and business sectors (Osetskyi et al., 2021). Artificial intelligence in education is making a real revolution in the organisational and administrative segment. Artificial intelligence is becoming the basis for intelligent management in education (Karpenko et al., 2019). For Ukrainian education during martial law and post-war reconstruction, this aspect will be especially relevant, as migration processes will lead to the loss of intellectual resources. There will be a question of alternatives and replacement of problematic areas of the educational sector. The speed of the recovery of Ukrainian society will depend on how prompt and complete this replacement is. Therefore, a separate niche will be created for artificial intelligence with clearly defined organisational and administrative issues in education. Learning Management System using artificial intelligence plays a special role in the integration of educational trends of today. Innovative technologies take into account the expectations of students regardless of the country (Smyrnova-Trybulska et al., 2022). That is, if there is an effective educational experience in a particular country, pupils or students from another country can use this experience in their learning and acquisition of knowledge and skills with the help of artificial intelligence. A specific feature of artificial intelligence is the interdisciplinary functionality of its resources. Artificial intelligence can translate materials, adapt them for a specific consumer, concretise and abstract individual elements, etc.

Controversies over the use of artificial intelligence in the education system also arise in the legal field (Stefanchuk et al., 2021). As Ukraine seeks to join the values of Western society, which primarily values the rule of human rights and freedoms, all legal norms must be fully observed. The Legal Tech methodology (Palkova & Agapova, 2021), which is designed to provide legal support for the use of artificial intelligence in education, can serve as a model for harmonising technological and legal norms of artificial intelligence.

The scientific and pedagogical discourse has not yet been divided into the classic two camps of support and opposition to the use of artificial intelligence in education, as the level of practical implementation of artificial intelligence resources in Ukrainian education has not yet reached the appropriate scale. Therefore, discussions about artificial intelligence are situational in nature as the level of application in certain segments of educational activity increases. At the same time, if we consider the prospects of artificial intelligence in the educational system, the potential consequences of this process are full of various forecasts.

The current study analyses two strategies for positioning artificial intelligence in the Ukrainian educational system. On the one hand, Kovaliuk & Kobets (2021) insist on the formation of an innovative educational ecosystem in Ukrainian education that will regulate the standards for the use of artificial intelligence and other technological and digital resources. A different opinion is held by (Skoromnyi et al., 2021), who emphasise the need to preserve traditional educational design based on substantial experience and to use innovative trends to strengthen the existing educational paradigm. A distinction should be made between the concepts of "informatisation and technologisation of education" and "informatised and technologized education" (Romanchenko et al., 2021). Kharlamova, Stavytskyy & Komendant (2022) provide additional arguments for preserving the traditional format of educational activity, but with the active use of artificial intelligence, noting that the Ukrainian education system is not ready in terms of material and technical resources for a complete transition to an innovative format and the creation of a new digital ecosystem. In general, artificial intelligence will be protected from being banned until the risks it poses become critical. At the moment, the benefits of artificial intelligence resources are clearly greater than the real (not potential or hypothetical) negative effects (Yakovleva et al., 2021).

The problem of using artificial intelligence resources in education is associated with a certain substitution of concepts. Artificial intelligence is being actively implemented in everyday life and is gradually becoming associated with a tool for improving and optimising life. However, educational goals are not limited to indicators of usefulness or convenience, having much broader target characteristics. Therefore, the integration of artificial intelligence into the educational sphere cannot be implemented according to the principles of its integration into the socio-cultural everyday space. However, the use of artificial intelligence has certain specific educational goals that focus on improving the processing of educational information, the accuracy of answers, and the visualisation of learning (Fiialka et al., 2023). In particular, Kovalchuk, Maslich & Movchan (2023) suggest that artificial intelligence should be considered solely as a tool for improving professionalism through digital literacy. For Ukrainian education, these characteristics are important in the short term, as post-war reconstruction will require quick and effective solutions.

The results of the current study correlate with the statement that the national education system (when considered in an autonomous dimension with the actualisation of exclusively internal potential) can be competitive only if the human and technological potential is synergised (Hanaba et al., 2020). If we consider the benefits of artificial intelligence exclusively through the prism of the educational sector, it is obvious that Ukrainian education has acquired the principles of flexibility (Barvinok & Pudło, 2023) and mobility, which is the best response to the challenges of the times. Only the integration of the efforts of the educational community, government institutions, and civil society (Kovaliuk & Kobets, 2020) will create an environment in which artificial intelligence will have positive dimensions and development prospects in the education system. As the practice of using artificial intelligence in other areas of social activity (engineering, financial sector, medicine) shows, its effectiveness is possible only when using interdisciplinary approaches.

It is inappropriate to apply consumer practice of everyday use of artificial intelligence in education, as this format does not ensure the achievement of educational goals.

## 5. Conclusion

Thus, artificial intelligence has become a relevant tool in the Ukrainian educational system and requires an analysis of its current status and forecasting of its future application. In short-term educational strategies, artificial intelligence performs a practice-oriented operational function of supporting the educational process and preventing the loss of the principle of continuity and accessibility of education. For the long-term perspective, there is a need for a more holistic description of the use of artificial intelligence in Ukrainian education. Given that Ukraine continues to actively integrate into the principles of sustainable educational development, which is typical for Western societies, the correlation of norms for the use of artificial intelligence resources must meet all the requirements of a developed democratic society. This means that artificial intelligence will perform pragmatic functions in education to ensure a high level of quality and will comply with the norms of civil society (without violating the legal and moral and ethical principles of educational development). Therefore, it is important for Ukrainian education to maintain the dynamics of practical implementation of innovative elements and plan strategies to reconcile the principles of artificial intelligence with the fundamental principles of the purpose of education.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.14

Cómo citar:
Myroshnychenko, V., Kamensky, D., Lysenko, T., Makarenko, T., & Petiahina, I. (2024). "Defense of Ukraine" degree program for future school teachers: a new element of ukrainian higher education. Revista Eduweb, 18(1), 190-203. https://doi.org/10.46502/issn.1856-7576/2024.18.01.14

# "Defense of Ukraine" degree program for future school teachers: a new element of ukrainian higher education

## Programa de grado "defensa de Ucrania" para futuros docentes escolares: un nuevo elemento de la educación superior ucraniana

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Recibido: 02/12/23
Aceptado: 27/01/24

**Abstract**

The article examines various aspects of professional training of future teachers of the "Defense of Ukraine" course for effective legal education among students. The key aspects in this process are the formation of practical skills, legal culture, socio-psychological and methodological readiness of teachers. Emphasis is placed on the use of modern technologies and interactive methods in pedagogical universities to develop

legal thinking and patriotic values. Several theoretical methods have been used in the course of research. In particular, the article extensively refers to empirical research methods, such as observation, comparison, and monitoring. Modern challenges in the field of national security of Ukraine require active participation of teachers in the formation of legal awareness of students. It is emphasised that successful teacher training requires not only knowledge of law, but also taking into account of individual characteristics and application of innovative pedagogical approaches. In general, the article points out the importance of providing teachers with the necessary competencies to educate Ukrainian citizens who consciously observe their duties and execrise their rights (freedoms).

**Keywords:** professional training, teachers, defense of Ukraine, legal education, legal culture, pedagogical technologies.

**Resumen**

El artículo examina varios aspectos de la formación profesional de los futuros profesores del curso "Defensa de Ucrania" para una educación jurídica eficaz entre los estudiantes. Los aspectos clave en este proceso son la formación de habilidades prácticas, cultura jurídica, preparación sociopsicológica y metodológica de los docentes. Se hace hincapié en el uso de tecnologías modernas y métodos interactivos en las universidades pedagógicas para desarrollar el pensamiento jurídico y los valores patrióticos. En el curso de la investigación se han utilizado varios métodos teóricos. En particular, el artículo se refiere ampliamente a métodos de investigación empíricos, como la observación, la comparación y el seguimiento. Los desafíos modernos en el campo de la seguridad nacional de Ucrania requieren la participación activa de los profesores en la formación de la conciencia jurídica de los estudiantes. Se destaca que una formación docente exitosa requiere no sólo conocimientos de derecho, sino también tener en cuenta las características individuales y la aplicación de enfoques pedagógicos innovadores. En general, el artículo señala la importancia de dotar a los profesores de las competencias necesarias para educar a los ciudadanos ucranianos que cumplan conscientemente con sus deberes y ejerzan sus derechos (libertades).

**Palabras clave:** formación profesional, docentes, defensa de Ucrania, educación jurídica, cultura jurídica, tecnologías pedagógicas.

## 1. Introduction

National security has always been one of the key issues in the development of a nation, society. A social group which is not able to ensure its own national security is always on the verge of existential risks.

In the current context of changes in the geopolitical environment associated with the Russia's large-scale war against Ukraine, the emphasis on national security and defense of Ukraine makes the issue of comprehensive training of teachers of the course "Defense of Ukraine" ever more relevant. The academic attention to this issue is explained by the need to create a high level of legal awareness and readiness to work with high school students in general education institutions. Thus, formation of a high-level legal culture among future teachers becomes a guarantee of high-quality education for young Ukrainian citizens as members of a democratic state based on the rule of law principles.

When explaining the public need for a national defense academic program, one should keep in mind the key constitutional requirements, which serve as official background for the whole framework of national defense studies.

The Constitution of Ukraine defines protection of the Motherland as the primary duty of Ukrainian citizens, it being the most important function of the state. Human safety, life and health are recognized as the

highest social value in Ukraine. As defined in the main Law of the Land (Articles 17, 65), protection of the sovereignty and territorial integrity of Ukraine are the most important functions of the state, the top priority for Ukrainian people.

It is important to note here that the readiness of the Armed Forces of Ukraine to perform its functions largely depends on its personnel, in particular, the readiness of the youth for military service. Staffing by professional and motivated servicemen should be carried out in a single system which will cover initial preparation for national resistance in general secondary education institutions, training in the military education system and management of a serviceman's career, care for the preservation of life and health of personnel, proper social security of servicemen, their family members and persons released from military service in reserve and retirement, training of the military-trained reserve.

With national security being a top priority component of Ukrainian statehood at the moment, the reform of secondary and higher education models in this country involves modernization of the content of education, which should be based on competence-based and person-oriented approaches to learning, and most importantly, focus on the acquisition by students of such abilities and skills, which are necessary for a young person to successfully prove him- or herself in professional activities and in public life in general.

Considering the above-mentioned provisions, the purpose of this article is to illustrate some key principles and elements of preparing future teachers of the "Defense of Ukraine" degree program within Ukrainian system of education, in particular, formation of legal culture and improvement of teaching methods in order to achieve significant academic results and future professional success.

## 2. Methodology

Several theoretical methods have been used in the course of our research, including: general scientific analysis, synthesis, induction, and deduction. The modelling method was also used in the course of writing this article. A scientific model is a mentally represented or materially implemented system that adequately reflects the subject of pedagogical research and is capable of replacing it to the extent that studying the model allows obtaining new information about the object. The main advantage of such modelling is the integrity of information presentation.

In particular, the widely recognized method of comparative analyses has been used to demonstrate approaches toward introduction of patriotic/defense programs in schools and universities of various jurisdictions (Kamensky et al., 2023; Movchan et al, 2023).

The article extensively employs empirical research methods, such as observation, comparison, and monitoring. Based on the experience of the Berdyansk State Pedagogical University, the educational and professional program "Secondary Education (Defense of Ukraine)" of the master degree level has been examined and all such methods have been implemented. The purpose of this educational programme is to build professional competences of future teachers of the Defense of Ukraine in the institution of general secondary, vocational and technical higher education; preparing a teacher with in-depth fundamental knowledge of the Defense of Ukraine theory and skills, a competitive specialist who is able to build his/her activity on the basis of design, a creative approach, a high level of civic consciousness. The program has the following features: focus on the formation of educational, military-tactical, security-legal, and medical-tactical professional competencies in applicants; preparing future pedagogs to teach the subject "Defense of Ukraine" in the context of a deep understanding of the fundamentals of the normative and legal support for the protection of Ukraine, the legislation of Ukraine on military service, civil-military cooperation of Ukraine, legal-educational and national-patriotic work at an educational institution.

## 3. Literature review

The theoretical section of the paper is shaped by a systematic review of current literature and a synthesis of some of the researchers' experiences. Hrynevych, Linnik, Herczyński (2023) have elaborated on the state of education in Ukraine after the start of Russia's full-scale invasion of Ukraine in 2022. They describe obstacles and risks such as degradation of education, lack of security in schools, lack of funding for school development and textbook printing. They also wrote about the measures being taken in Ukraine to advance the education reform. A number of challenges remain, such as rebuilding destroyed schools, optimizing the school network in line with demographic changes, and organizing shelters in schools. Additional challenges include the promotion of digital technologies in schools, strengthening military and patriotic education within the subject "Defense of Ukraine", addressing learning gaps and providing psychological support at school (Hrynevych et al., 2023).

Several Ukrainian authors have previously underlined the need for the competitiveness of the higher education system in Ukraine and the prospects for further development of university education against the backdrop of the ongoing war with Russia. However, higher education institutions in Ukrainian cities have not lost their potential. In addition, universities have retained their intellectual potential, which can be supplemented by cooperation with the Western institutions (Kozinchuk et al., 2022).

The analysis of scientific research has demonstrated that the work of the teacher of the subject "Defense of Ukraine" with the component of legal education is poorly covered in modern pedagogical and legal literature. Several Ukrainian authors have developed only certain aspects of this topic. Thus, a more comprehensive approach in this field of academic research is required.

In particular, as V. Makhnovets makes a point, the issue of preparing a future teacher for the organization of legal educational work is extremely relevant in both theory and practice of professional education in the context of legal component of professional and pedagogical activity (Makhnovets, 2022). Thus, an argument can be made that legal courses should be a part of the national defense academic program, albeit in minimized format.

I. Knysh and her co-authors have examined the interconnected nature of the innovative activity of the teacher, which contribute to the improvement of higher education in generak. The authors have considered innovative educational technologies as a means of improving higher education and have proved their impact on the training of a modern professional in a highly competitive job market (Knysh et al., 2023). Indeed, innovative methods of learning also remain a big part of the "Defense of Ukraine" program, due to new security challenges that Ukraine currently faces.

Also, when talking about issues of the new academic program, such as "Defense of Ukraine", it is also relevant to cover apsects of the Doctrine of civil-military cooperation (CIMIC) in Ukraine. A group of Ukrainian researchers have recently studied, with reference to the comparative legal analyses, models of civil-military cooperation in Ukraine, NATO member countries and some other jurisdictions. Based on the results of their study, they have argued that Ukrainian CIMIC doctrine of the Central Command as a program document in a certain direction should focus on such areas as: development of a culture of mutual respect, trust and support between all involved military and non-military actors;promotion of patriotic education in Ukrainian society, protection of the rights and freedoms of members of the Central Election Commission; use of CIMIC units as a platform for civil-military contact and cooperation in eastern Ukraine, especially in the area of the Joint Forces Operation; promotion of legal guarantees of gender equality and equal opportunities for men and women in the Armed Forces of Ukraine (Lutsenko et al., 2021).

Based on the academic literature overview, we will argue that despite various attempts by Ukrainian authors to analyze challenges that the Ukrainian system of higher education currently faces, the "Defense of

Ukraine" academic program is not explained enough in Ukrainian scholarship; its importance for the new generation of Ukrainian teachers is not revealed sufficiently. Instead, this program should be viewed as not just an academic tool, but should rather be put in a broader context of national defense as the priotity function of the modern Ukrainian state.

## 4. Research results

### National defense as an academic discipline: international approach

The modern world trend is that social institutions, government agencies, educational institutions as well as human rights organizations are increasingly required to take active steps in terms of the theory and practice of legal education, which, in turn, is an incentive to implement the rule of law and respect for human rights. However, without teachers' readiness to absorb elements of legal education, this demand will not be met. All teachers of general education institutions should be able to successfully deliver legal education, but, as practice reveals, this is mostly done in history, law and the basics of national security and civil protection (in Ukraine, such school course is called "Defense of Ukraine", while in the USA – "The Junior Reserve Officer Training Corps (JROTC)", in Poland – "Military Training Units").

In particular, in Israel, a country, which has recently found itself in a similar to Ukrainian position of the "victim of military aggression", the educational "Boundaries of Consent" Initiative originated from scholarship on the impact of mandatory service on Israeli society. Tailored for high school students, the Initiative underscores the significance of meaningful service in the Israely Defense Forces (IDF), emphasizing its Zionist, security-oriented, and societal dimensions. It is based on the understanding that the IDF serves not only as a defense force but also as a prominent social mechanism, thus reducing societal disparities and fostering solidarity. This program is officially sanctioned by the Israel's Ministry of Education. In addition, the Israel Defense and Security Forum (IDSF), which includes over 22,000 reserve officers and operatives from all branches of the Israeli security forces, dedicates significant efforts to engage the younger generation in adopting Zionist and security-focused perspectives aligned with the national security needs of the State of Israel and the Jewish people. This Forum's educational program extends its influence to various audiences and institutions, including:

1) Pre-army preparatory programs: such initiatives aim to train the upcoming generation of Israeli leaders. Experienced IDSF members, well-versed in policy, security, and military matters, deliver lectures and share insights on various security related topics;
2) Academic institutions: IDSF student groups are active across Israeli universities and colleges, while conducting outreach and educational activities focused on national security;
3) High Schools and Youth Movements: IDSF has been developing activities tailored for high schools and youth groups, fostering an understanding of national security issues among the younger population (Israel Defense and Security Forum, 2023).

Based on such progressive academic experience in other nations, we can safely assume that Ukraine is hardly the pioneer on the national security educational 'front' and also that it is on the right track with creating its own academic curriculum in this vital field of state development.

In France and the United Kingdom, the components of the national system of military-patriotic education in general secondary education institutions are: initial military training; military training at training camps; training in the form of military games, hikes, etc. In addition, all British universities, as well as many polytechnic institutes and colleges, provide military training for junior officers for the Armed Forces of the country and military-patriotic education in state and public organizations (associations, clubs, circles, sports sections, etc.) (Ostapenko et al., 2022).

American commentators R. Curren and C. Dorn elaborate in their well written book on the key thesis that throughout history there have been numerous and varied endeavors to instill patriotism in American public schools. Those efforts have been grounded in diverse interpretations of patriotism, citizenship, and learning. The exploration of the history of patriotic education in schools yields both cautionary tales and positive insights. The authors argue that focus should be placed on cultivating civic virtue in schools, organized around three key components: civic intelligence, civic friendship, and civic competence. The book wraps up with an advocacy for global civic education, while also emphasizing the promotion of global civic friendship and cooperation (Curren & Dorn, 2018).

Though the above-mentioned treatise does not contain analyses of connection between patriotic upbriniging and various national defense (quazi-military) courses within educational curriculum, we agree with the authors' point that national patriotic education is a good resource not only within any specific country but for the global community at large. History teaches that "healthy" patriotism, unlike twisted forms of ultranationalism, bring much more mutual understanding, peace and prosperaity than the lack of such national virtue.

Reference to the national patriotic (national defense) courses in several world jurisdictions underlines the importance of both sharing new theoretical knowledge and expertise in the pedagogical field and also the importance of comparative research method. Indeed, as pointed out by many Ukraine authors, critical comparision allows to better understand exactly which principles and provisions work better in any given field of academic knowledge (Lutsenko et al., 2023).

**The concept of the "Defense of Ukraine" academic course: new challenges and new responses**

In Ukraine, the new compulsory course "Defense of Ukraine" is based on the current legislation of Ukraine and is studied in general secondary education institutions (schools) during the final 10th and 11th years of education, as well as during training sessions.

This updated subject (as a separate academic program) has been introduced in Ukraine in accordance with the Resolution of the Cabinet of Ministers of Ukraine dated February 26, 2020 No. 143 (Resolution No. 143, 2020). The then Minister of Education and Science of Ukraine, Hanna Novosad, noted: "Our education followed the Soviet paradigm for a long time, and the old subject "Defense of the Fatherland" is one of the manifestations of this. It is wrong that in the fifth, almost sixth year of the war with Russia, we have still not managed to replace the completely Soviet name of the subject "Defense of the Fatherland" with "Defense of Ukraine". It's an important point, and I'm glad we finally made this change. Now, an equally important task is to improve the content of this subject and the material and technical support of schools." (Ministry of Education and Science of Ukraine, 2020).

In the historical perspective, the dicussed academic program is directly related to the issue of national identity. Such phenomenon is extremely important for any modern society, being one of the factors that determine its vitality. A group of Ukrainian scholars have reached a sound conclusion that even during the time of significant socio-political, socio-economic, cultural and educational changes, when targeted leveling, standardization and ignoring of national interests of the person was carried out by the Soviet regime, the process of forming Ukrainian national identity and national intelligentsia continued (Pokhilko et al., 2020). Currently, curriculum of the "Defense of Ukraine" program includes two thematic plans (or curriculums). The first one (for boys) involves the study of the following sections: "Fundamentals of the National Security of Ukraine"; "Armed Forces of Ukraine in Defense of Ukraine"; "Drill and Applied Physical Training"; "Firearms Training"; "Tactical Training"; "Fundamentals of Civil Protection"; "First Aid". The second curriculum (for girls) is the "Basics of Medical Knowledge and First Aid"; "Basics of Civil Protection"; "International Humanitarian Law on the Protection of Civilians"; "First Aid in Combat".

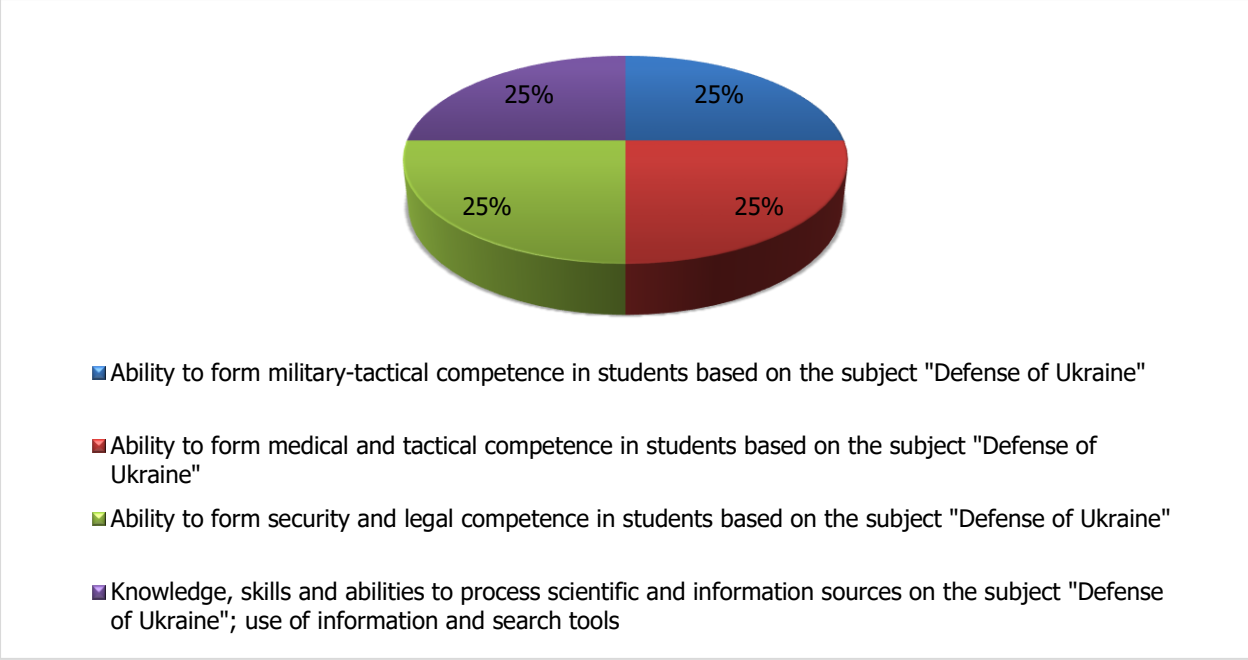


***Figure 1.*** Subject competence of future teachers of the "Defense of Ukraine" course.
**Source:** authors' own research

The purpose of the course is to develop among students the vital knowledge, skills and abilities to defend Ukraine as well as act confidently in emergency situations, and also understanding of military-patriotic education as being an integral part of the national-patriotic education. Based on our comparative research, such academic goals are similar to the Israeli model of the high school patriotic education.

The key purpose embodied in the "Defense of Ukraine" course is realised by a set of the following educational and training tasks: familiarising students with the basics of regulatory and legal support for the defense of Ukraine, civil protection of the population and personal security; awareness of the younger generation's duty to defend Ukraine in the event of a threat to the independence and territorial integrity of the state, etc.

Reserve or retired officers with a university degree, who are motivated to teach high-quality classes, as well as graduates of pedagogical universities with a newly established degree in Defense of Ukraine, are appointed as teachers of the subject "Defense of Ukraine". Currently, military operations in Ukraine significantly limit the functioning of scientific and educational centres across the country (Kozinchuk et al., 2022). However, training for teachers should not stop, and many pedagogical universities in the south and east of Ukraine continue to operate primarily online.

**Key learning components of the "Defense of Ukraine" program**

Nowadays, the relevance of the complicated issue of the military-patriotic education in conditions of ideological and worldview confrontation have been caused by the situation in the country, which developed as a result of armed and informational aggression of Russia Federation against Ukraine. The officially proclaimed course of Ukraine on the Euro-Atlantic course integration, reformation of the Armed Forces of Ukraine according to NATO standards, challenges to preserve the integrity and statehood of Ukraine, consolidation of society to protect Ukraine from any forms of armed and information – those are the key factors, which determine societal request to improve effectiveness of military-patriotic education (Ostapenko et al., 2022).

A few program documents underline the need for a "Defense of Ukraine" academic course. Among them: Strategy of the national security of Ukraine (2020); Military Security Strategy of Ukraine (2021); National Doctrine of development of education of Ukraine in the 21st century; Concept of pre-conscription training and military-patriotic education of youth (2002); Concept of military-patriotic education in the Armed Forces of Ukraine (2010); Concept of national and patriotic education of children and youth (2015).

Based on the purpose of the subject "Defense of Ukraine", the main feature of the professional training of future teachers is building their aptitude for a specific type of activity – legal education of students. In our opinion, the structural model of this professional quality includes three main components: 1) motivational and practical; 2) cognitive; 3) personal and reflective.

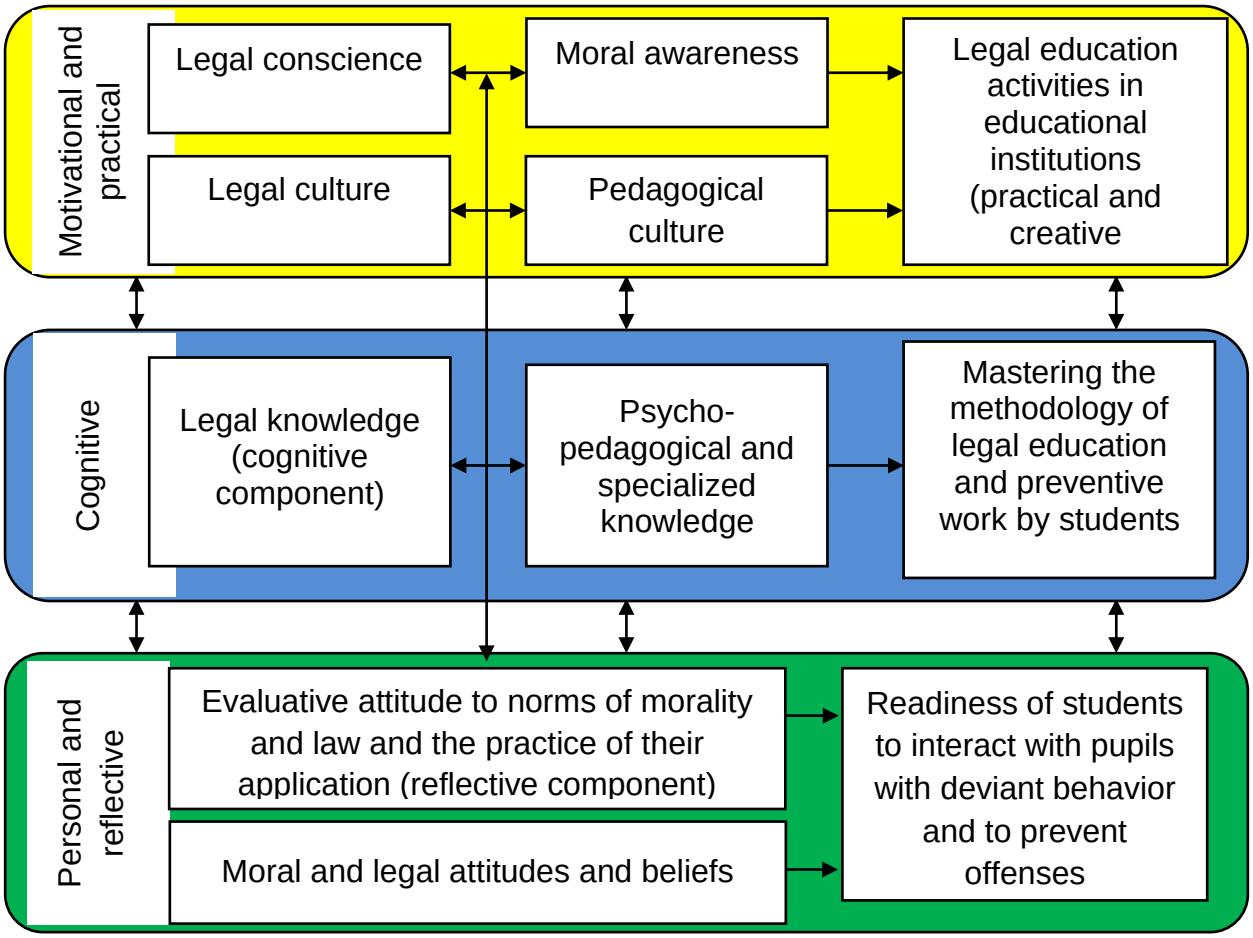


***Fig. 2.*** A structural model of the future teacher's readiness for legal education work.

The motivational and practical component includes internal positive attitudes of the future teacher towards learning and acquiring theoretical and practical skills (mastery of general ways of performing various activities, optimization of the sequence of selected activities). It includes legal and moral consciousness, legal and pedagogical culture, and the motivation to exercise legal education curriculum in educational environment.

Within this component, the key elements are legal conscience and legal culture. Without an adequate level of these two qualities introduced to the future teacher of defense of Ukraine, it is impossible to talk, in

turn, about their effective formation in students. Teachers need to focus on the formation of positive legal knowledge and psychological mechanisms of respect for law in the structure of legal consciousness in each student (for this, they will need high moral consciousness and pedagogical culture). In Ukraine, the motivation for active formation of legal consciousness and legal culture of all subjects of social relations should be constantly growing, since it is impossible to achieve the goal of building a civil society without them. The legal culture of citizens is the basis, the foundation of a new society. After all, citizens are the only factor in the creation and maintenance of the state and the rule of law, bringing the Constitution of Ukraine and national legislation into effect. Successful solution of these tasks depends on many factors, but mostly on the level of legal education and upbringing of the country's population (Sharavara, 2015).

The cognitive component includes legal, psychological and pedagogical, methodological and special knowledge of the teacher.

With regard to legal knowledge, it is clear that teachers of the "Defense of Ukraine" course are not lawyers or even teachers of history and jurisprudence. However, they should possess basic knowledge of the constitutional rights and obligations of Ukrainian citizens, as well as national security and defense law.

When developing their own tailored curriculum for the "Defense of Ukraine" degree at pedagogical universities, due attention should be paid to a block of legal courses, since such curriculum is interdisciplinary in its nature. For example, the curriculum for such degree at Berdyansk State Pedagogical University (currently relocated to the regional city of Zaporizhzhia because of the war) includes the following courses: "Actual Problems of National Security and Defense of Ukraine", "Methods of Legal Education in an Educational Institution", "Civil-Military Cooperation in Ukraine", "Criminal Liability of Military Personnel". The curriculum also provides for practical training (security and legal). When taken together, these components make it possible to professionally prepare future teachers of the subject "Defense of Ukraine" for the legal education of students, albeit on a limited scale. The full list of courses is presented in the table below.

**Table 1.**
*List of components of the educational and professional program and their logical sequence*

| № | Components of the study programme (academic disciplines) | Number of ECTS credits | Form of final control |
|---|---|---|---|
| 1. | Philosophy of education | 3 | Credit |
| 2. | Military pedagogy and psychology | 3 | Credit |
| 3. | History of international relations | 3 | Credit |
| 4. | Actual problems of national security and defence of Ukraine | 5 | Exam |
| 5. | Actual problems of drill, fire and tactical training | 3 | Exam |
| 6. | Topical aspects of tactical medicine | 3 | Exam |
| 7. | Pedagogy of specialised and higher education | 3 | Credit |
| 8. | Methods of legal education in educational institutions | 4 | Exam |
| 9. | Civil-military cooperation of Ukraine | 3 | Exam |
| 10. | Criminal liability of military personnel | 3 | Credit |
| 11. | Modelling the process of teaching the discipline "Defense of Ukraine" | 6 | Exam, course work |
| 12. | Methods of the national and patriotic education of youth | 3 | Credit |
| 13. | Practical session (medical and tactical) | 6 | Credit |
| 14. | Practical session (security and legal) | 6 | Credit |
| 15. | Practical session in an educational institution | 6 | Credit |
| **Total amount of mandatory components:** | | **6** | |

Source: Educational and Professional Program "Secondary Education (Berdyansk State Pedagogical University, 2023).

In the academic literature, researchers generally define the importance of pedagogical knowledge as a methodological foundation and a direct tool for pedagogical activity. In order to understand the essence of pedagogical knowledge, the functions of professional knowledge, such as ontological, orientation, evaluation, which, in our opinion, form the basis of readiness, become of great importance.

The ontological aspect of professional and pedagogical readiness is its methodological foundation and determines, first of all, a multifaceted theoretical level of knowledge that ensures the teacher's awareness of the essence of pedagogical phenomena and facts on the basis of mastering pedagogical ideas, concepts, laws, principles through mastering the categorical apparatus of professional and pedagogical concepts and terms. Theoretical and methodological pedagogical knowledge is more generalized and broadly transferable than subject knowledge, and at the same time serves as a tool for the reliability of the teacher's practical and transformational activity.

The orientation aspect of professional and pedagogical readiness is represented by both scientific and life-specific empirical knowledge, which mainly becomes the basis for decision-making, building a system of appropriate actions and operations. By mastering the system of knowledge, the student develops his/her conceptual and categorical apparatus, through the prism of which pedagogical situations are perceived and interpreted and which becomes an effective means of pedagogical activity based on the mechanism of transformation of theoretical knowledge, generalised concepts and categories into practical pedagogical solutions based on the learned principles, criteria, models, etc. The breadth of the categorical range, the nature and level of mastery of the student's conceptual apparatus are important components and indicators of readiness.

Special knowledge (competences) of a teacher reflects the specifics of a particular pedagogical activity. We consider the special competences of a future teacher of defense of Ukraine as the implementation of key competences in educational, legal and managerial activities.

**Pedagogical methods and techniques for the new program: scholarly comments**

Professional training of teachers of the "Defense of Ukraine" course should involve active use of various pedagogical technologies aimed at developing legal thinking and fostering patriotic feelings. Modern teaching methods enable creation of situations which stimulate interest in legal issues and support active participation of students in the education of civic consciousness.

In particular, M. Sydorkina proposes to use the technology by means of developing civic competence by actualization of social interest. Such pedagogical technology is aimed at achieving the following results: future teachers' awareness of their own strategies of interaction with other people; their choice of constructive interaction and communication; increased awareness of future teachers of themselves as members of communities and society, as well as their own role in development; increased sense of community of future teachers with other members of society; actualisation of the sense of responsibility for the welfare of the community and society; increased ability of future teachers to promote the development of a sense of civic responsibility (Poznyak et al., 2022). The results of an international study of civic education in Chile, Colombia, and Mexico reveal that teachers' practices and attitudes are related to students' civic outcomes (Treviño et al., 2017).

Sivers, Dukhnevych, Osadko recommend the use of various socio-psychological technologies to promote formation of political and legal consciousness: creation of problem situations (problem lecture as a tool for the formation of political and legal competence); project-based (course design as a way to improve political and legal competence of the individual); discussion and game-based (use of group discussions and role-playing games in the process of forming political and legal competence); World Café technology serves as a good tool for forming a common problem field and solving urgent problems; Open Space technology for

solving urgent political and legal issues; case technology (cases in the structure of political and legal competence formation; training (training on the formation of political and legal competence of youth) (Sivers et al., 2017).

In her teaching guide, N. Cherepovska describes in detail innovative means of developing patriotism in the digital age, which can also be used in the course of educating future teachers of the Defense of Ukraine course. This manual presents reflective methods as a tool for developing youth patriotism and their patriotic activity in the modern interactive information space. The author notes that innovative tools based on the principle of reflection contribute not only to the development of mental formations of the individual, such as patriotic and legal self-awareness, but also to the development of the functions of information patriotism for the implementation of constructive patriotic activity in the interactive environment (Cherepovska, 2023).

Innovative educational technologies, such as distance learning technology, are relevant and necessary, they require greater self-organization, provide an opportunity to choose their rhythm of education, provide students with the opportunity to carry out high-quality continuous independent work, provide opportunities for self-expression, and establish information culture among students. Such technology improves the content of carrying out and performing laboratory and practical tasks, systematizes materials, provides an opportunity at any convenient time to acquire knowledge in a professional field, and also enhances professional skills in the course of academic career. Innovative technologies contribute to education seekers in mobilizing forces for focused education, professional orientation of the individual, formation of creativity of education seekers. Such technologies increase motivation to work, orient students to create their own, potentially unique, methods of academic activity (Knysh et al., 2023).

Thus, the study of the peculiarities of professional training of future teachers of the course "Defense of Ukraine" in legal education reveals a wide range of tasks and challenges facing higher education in Ukraine. It is the teacher, on whom the State entrusts the fulfilment of the social demand for legal education of the younger generation, who should be a model of positive legal consciousness and behaviour, by properly implementing legal "backup" of his/her professional activities (Makhnovets, 2022).

Specificity of the "Defense of Ukraine" academic program is determined not only by the need to transfer knowledge about the national security and defense, but also by the emphasis on the formation of a high level of legal culture in the mindsets of future teachers. The primary task is to create a system of methods and techniques aimed at developing progressive legal thinking. It is important to take into account individual characteristics of students and their prior knowledge in the field of law. Pedagogical technologies which trigger student participation are most effective in this context. Project technology, role-playing games, business simulations, and the wide use of case method contribute to deep learning of the material and the development of skills in solving various legal problems. In addition, it is necessary to focus on the development of analytical thinking and critical understanding of the legal aspects of Ukraine's defense, which currently remains the pressing issue for the statehood itself.

One of the elements of the personal/reflective component of the proposed model is the students' readiness to interact with students with deviant behaviour and to prevent various violations. Social disorientation is a very serious obstacle to the formation of legal awareness. In order to overcome such barrier, not only economic improvement in the country is needed. It also requires intensive public legal education (Bieliauskaite & Slapkauskas, 2015). In this sense, it is especially important to improve the process of forming value orientations of students of pedagogical universities, since there is not only a direct opportunity to prevent deviations in the youth environment through adequately formed life positions, but also to form the knowledge base of a new generation of teachers, educators, school psychologists to work with children prone to deviations and their parents. Family counselling programs are seen as very promising interventions, which have the potential to reduce the likelihood of youth involvement in crime and violence (Stahlberg et al., 2022).

The current challenges in the field of national security require future teachers to take an active part in shaping students' legal self-awareness. Effective teachers' training for legal education involves the use of interactive methods, such as collective games, trainings and group projects. It is also important to take into account the socio-cultural characteristics of students and adapt teaching methods to their needs. A teacher's psychological readiness to teach the subject "Defense of Ukraine" is determined by his or her attitude to the importance of the topic, emotional stability and readiness to resolve conflict situations, which inevitable emerge. Understanding educational psychology and the use of methods to influence motivation contribute to the formation of a positive attitude of students towards this subject. General education and pedagogical practices reveal that an important component of successful teacher training is the use of innovative methods, such as virtual reality and online learning. The introduction of modern technologies into the educational process helps to create extensive and engaging academic content for the "Defense of Ukraine" program, thus ensuring high quality education and compliance with the requirements of a modern society, which is based on partriotic valuses and democratic principles of governance.

To summarize the results section of this article, we would like to make the following observation. Based on the analyses of foreign approach, proposed content of the course and its curriculum at one Ukrainian university, as well as pedagogical methods and techniques for the new program, as reflected in various scholarly papers, the "Defense of Ukraine" academic program should be developed further in order to address various security challenges that Ukraine currently faces. Academic knowledge of future teachers can and should become a potent tool to fight current and future crimes of aggression against the democratic state.

### Limitations

Despite the theoretical background of our study and the empirical data provided, we are of the opinion that further in-depth analyses of both goals and content of the "Defense of Ukraine" program is required. As we have made a point in the literature review section of the article, only fragmentary aspects of this academic course curriculum have been previously studied. Thus, when considering the ongoing security situation in Ukraine and the key points of the system of higher education in the XXI century, much more scholarly efforts should be put into the research of what should be studied within this academic program, and also how it should be studied. The content and methodology are key aspects here.

## 5. Conclusions

This article has examined some ground principles and content features of educating future teachers of the "Defense of Ukraine" course. The structural model of future teachers' readiness for this specific type of professional activity is defined. The modelling of the process of preparing applicants for higher pedagogical education is intended to determine the priority areas of such training; to ensure the systematic approach and integrity of training in the context of the processes of modernisation and development of higher pedagogical education. The use of such structural model in the process of training students for educational work involves the use of innovative didactic technologies and changes in the content of pedagogical education model.

Based on the results of our study, we conclude that effective professional training of teachers of the "Defense of Ukraine" course requires a comprehensive approach, which should include individual characteristics of students and also employment of modern teaching methods. Providing future teachers with the necessary theoretical knowledge as well as a set of prectical skills in the field of constitutional law, legal education and national security is an important aspect of both forming civic consciousness and promoting patriotic values among the younger generation. Time has come, at least for Ukraine, to strengthen national patriotism as well as legal culture and the ability to educate and defend those virtues.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.15

Cómo citar:
Niedialkova, K., Rybalko, A., Nikitchenko, L., Kabysh, M., & Khrenova, V. (2024). Influence of information technologies on the process of forming competences of future teachers. Revista Eduweb, 18(1), 204-217. https://doi.org/10.46502/issn.1856-7576/2024.18.01.15

# Influence of information technologies on the process of forming competences of future teachers

## Influencia de las tecnologías de la información en el proceso de formación de competencias de los futuros profesores

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Recibido: 19/12/23
Aceptado: 15/03/24

**Abstract**

The purpose of the study presented in this article is to examine the impact of information technology on the process of developing future teachers' competences and on teaching biology. Based on the data collected during interviews with 27 future biology teachers who used IT in their studies, five categories of IT impact on competence development were identified, namely: improving access to information, expanding learning opportunities, increasing the effectiveness of research activities, developing communication skills, ensuring continuous self-education; and three main categories of IT impact on students, namely: improving the quality of students' research competences, developing skills in analysing,

reasoning, modelling, and solving.

**Keywords:** research activity, research competence, teaching, learning, biology.

**Resumen**

El objetivo del estudio presentado en este artícul1o es examinar el impacto de las tecnologías de la información en el proceso de desarrollo de las competencias de los futuros profesores y en la enseñanza de la biología. A partir de los datos recogidos durante las entrevistas con 27 futuros profesores de biología que utilizaron las TI en sus estudios, se identificaron cinco categorías de impacto de las TI en el desarrollo de competencias, a saber: mejorar el acceso a la información, ampliar las oportunidades de aprendizaje, aumentar la eficacia de las actividades de investigación, desarrollar habilidades de comunicación, garantizar la autoformación continua; y tres categorías principales de impacto de las TI en los estudiantes, a saber: mejorar la calidad de las competencias de investigación de los estudiantes, desarrollar habilidades de análisis, razonamiento, modelización y resolución.

**Palabras clave:** actividad investigadora, competencia investigadora, enseñanza, aprendizaje, biología.

## 1. Introduction

Information technologies have had a significant impact on various aspects of education, including the formation of competences for future teachers. These technologies have revolutionized teaching and learning methods, providing new tools and resources for teachers to enhance their skills and knowledge.
One trend that has emerged is the shift towards digital and online platforms for instructional delivery. Teachers can now access a vast amount of educational resources, videos, interactive simulations, and online courses to enhance their subject knowledge and teaching techniques. This allows them to stay updated with current practices and engage their students in more interactive and personalized ways.

The use of technology can facilitate collaboration and communication among educators. Online platforms and social media groups provide avenues for teachers to connect with their peers, share ideas, and collaborate on projects or lesson plans. This allows them to benefit from the collective knowledge and experiences of other educators, fostering a culture of continuous professional development. Technology also enables teachers to implement various teaching strategies and personalized learning approaches. They can use learning management systems and educational apps to create individualized learning paths for their students, tailor instruction to their needs, and track their progress. This helps in fostering a student-centred approach to education and ensures that each student's unique needs are met.

Furthermore, information technologies provide opportunities for teachers to engage in lifelong learning. Online courses, webinars, and virtual conferences allow them to expand their knowledge base and acquire new skills without the constraints of time and geographical location. This continuous professional development ensures that teachers stay up-to-date with the latest research and best practices in education.
Looking ahead, the prospects for the influence of information technologies on the formation of teacher competences are promising. However, it is important to note that the successful integration of information technologies in teacher education requires proper training and support. Information technologies have already had a significant influence on the process of forming the competences of future teachers. They have facilitated access to resources, encouraged collaboration among educators, enabled personalized learning, and promoted lifelong learning. The future prospects for the impact of information technologies on teacher competence formation are promising, with advancements in technology offering even more transformative possibilities for teacher education.

## 2. Literature review

In the realities of scientific and technological progress, future teachers have a strong incentive to integrate IT as a pedagogical tool into their teaching practice (Borysova, Zadorina, Kotiash & Bukoros, 2023). However, despite such institutional incentives, an analysis of related studies found that only 11% of teachers demonstrate high engagement with the use of these technologies in their teaching practice (Zeng & Li, 2023). Admittedly, there are a number of obstacles to the integration of IT into education in general and the subject of biology in particular. In this context, Tsoli (2023) emphasises the lack of conviction of future teachers about the educational contribution of using IT in the classroom. In general, in the absence of experience with the use of IT in education, teachers are still reluctant to invest time allocated to the school curriculum in IT activities (Khorolskyi, 2023). Similarly, Stamelos & Adamopoulou (2023) are convinced of the importance of didactic integration of IT in education but highlight the risk that this integration is incomplete due to the lack of funding for education systems by governments.

Thus, despite the existence of many factors that hinder the integration of IT into education in Ukraine, we are witnessing strong involvement and increased motivation of most teachers towards this type of educational tool (Melnyk, 2022).

Thus, the interest in using IT in pedagogical practice can be explained by the positive impact of IT on both teaching and learning.

To this end, a qualitative study was conducted among student interns of future biology teachers who use IT in the classroom. Their opinions on the impact of these technologies on teaching and learning biology in the Ukrainian educational context were collected and analysed. Thus, the working questions focus mainly on the concept of IT in education, namely: What is the impact of IT on teaching practice? What is the impact of IT on the process of forming the competences of future teachers? Does IT affect the development of students' abilities to experiment, analyse, reason, model, and solve problems? What are the consequences of using IT on students' learning behaviour? To answer the working questions, IT is considered as "the only technologies that are mainly based on computers (hardware and software) that allow processing and storing information, microelectronics, telecommunications, networks in particular, that allow the exchange and transmission of information" (Maciej, 2023).

The use of IT in education in general, and in the teaching of science subjects in particular, offers several avenues of exploitation (Ali Iliyasu & Daramola, 2023). In fact, research shows that there are a number of technologies that allow educators and students to manipulate data in a variety of ways. Spreadsheets for arithmetic, computers, and various tools allow users to work with more and more complex categories (Zahorodna et al., 2022). Multimedia software makes it possible to build student learning by combining units of measurement, dynamic motion, sound, and graphic design. For example, specialised software such as formal computing systems (Computer Algebra System (CAS) and Dynamic Geometry Systems (DGS)) help students improve their skills and understanding of algebra and geometry. They provide students with the ability to manipulate, make assumptions, and measure shapes, leading to improved learning (Tsekhmister et al., 2022). In addition, IT can serve as a focal point that encourages and facilitates collaboration and interaction between learners. Networking of students, facilitated by IT, promotes scientific discussions in the classroom (Dobrovolska et al., 2023). However, in order to ensure the effectiveness of the technological tool and to obtain good learning outcomes, Pieshev et al. (2022) notes that the limitations of the technological tool should be considered when designing educational resources. Furthermore, according to Tsekhmister, Konovalova & Tsekhmister (2022), IT can facilitate access to knowledge through assessment of learning outcomes. They support the pedagogy of constructivism, which allows learners to explore and understand subject concepts. After comparing the use of three pedagogical approaches (traditional, cooperative, and cooperative with ICT) in medical education, Tsekhmister, Chalyi & Chalyy (2009) concluded that the achievements and attitudes of students who had undergone cooperative

education with ICT were significantly better than those of students who had been taught using traditional or cooperative methods without the use of ICT.

In this context, modern learning activities are profoundly transformed by the availability of technological tools. In fact, these technologies can develop skills of experimentation and critical thinking (Garvasiuk et al., 2023). In addition, it is a fact that through problem-solving, situation modelling, and progressive demonstration learning, future teachers can demonstrate to students the relevance of scientific activities, teach them to identify a problem and test it with examples, guess the outcome, develop a solution, monitor the results and evaluate their relevance to the problem under study (Namestiuk, 2022). Over the past two decades, the literature on the use of IT in education has found that the use of information and communication technologies in combination with pedagogical methods helps to improve and expand the pedagogical process (Lavina et al., 2020).

For their part, referring to the anthropological approach to learning, Lebid et al. (2023) believe that understanding the impact of software use on teaching and learning cannot be done by separating content from practice. In addition, based on the instrumental approach, Moshinski, Pozniakovska, Mikluha & Voitko (2021) consider the object of learning and the way of learning as being dependent on the artefacts used for it. Otherwise, the artefacts (software) influence not only the teaching practices but also the content being taught.

Studies measuring the impact of IT integration in education have concluded that these technologies have a positive impact on motivation Garvasiuk & Namestiuk (2023), and research competence plays an important role for future teachers. In the context of STEM education, for example, future teachers learn how to organise students' research activities during biology lessons. Research is important in the development of biology teachers' subject competences (Tsekhmister et al., 2021). Teacher training is carried out using research tasks.

## 3. Methodology

Qualitative studies aim to explore in-depth understanding and generate insights by examining the experiences, perspectives, and behaviours of participants. Unlike quantitative studies, where larger sample sizes are often required for statistical significance, qualitative research emphasizes the richness of data obtained from a smaller number of participants. A small sample size allows for deep engagement and detailed analysis of individual cases, ultimately providing a comprehensive understanding of the research questions.

In this particular study, focusing on the use of IT in teaching practice, the sample size of 27 is sufficient to achieve saturation, which means that data collection and analysis continue until no new insights or information emerge. Saturation is a critical criterion in qualitative research, as it indicates that the researcher has gathered enough data to develop a comprehensive understanding of the phenomenon under investigation. Given the exploratory nature of this study, a sample size of 27 is expected to yield a rich and diverse range of experiences, perspectives, and practices related to the active use of IT in teaching.

The selection of participants in this study is based on the criterion of active use of IT in their teaching practice. This criterion ensures that the participants have relevant experience and insights related to the research focus. The assessment of this criterion can be conducted through a combination of methods, including self-reported data and observational evidence.

To assess the active use of IT, participants can be initially screened using a survey or questionnaire that asks about their involvement with IT in their teaching practice (e.g., frequency of use, types of technology

utilized, specific tasks performed). This self-reported data can help identify potential participants who are actively engaged with IT.

Furthermore, to validate the self-reported data and ensure the authenticity of the criteria, additional evidence can be gathered through observations or documentation (e.g., lesson plans, student assignments, recorded teaching sessions). This would provide a more objective assessment of the participants' active use of IT and increase the reliability of the selection process.

In summary, the sample size of 27 trainee students, teachers, and future teachers is justified for this qualitative study based on the depth of inquiry needed and the principle of saturation. The criterion of active use of IT in teaching practice ensures that participants have relevant experiences, insights, and practices. This criterion can be assessed through a combination of self-reported data and supporting evidence gathered from observations or documentation.

In order to answer the research questions, a qualitative approach was used. Regular meetings and discussions among the coding team to address any coding-related questions or ambiguities were also conducted. This allowed for the refinement and clarification of coding guidelines throughout the analysis process. Thus, a survey was conducted among 27 trainee students, teachers, and future teachers from 14 schools in Ukraine. The sample size of 27 trainee students, teachers, and future teachers is justified based on two main factors: the qualitative nature of the study and the criterion of active use of IT in teaching practice.

The focus group was selected based on the criterion of active use of IT in their teaching practice. In addition, the participants were selected based on whether they had completed their pedagogical practice in a public or private institution (Table 1).

**Table 1.**
*Gender distribution of participants and type of institution*

| Gender | State institution | Private institution | Total value |
|---|---|---|---|
| Men | 11 | 4 | 15 |
| Women | 10 | 2 | 12 |
| Total value | 21 | 6 | 27 |

Table: authors' own development

The interviews were semi-structured using a questionnaire consisting of parts related to the use of IT and limitations on the way of integrating IT into the subject of biology, the impact of information technology on the process of forming the competencies of future teachers, on behaviour, and the development of creative thinking. Data collection was completed between January and June 2023, and the duration of each interview ranged from 45 minutes to one hour.

Ethical considerations were met in the research. All participants were given clear detailed information about the purpose, procedures, potential risks and benefits, and any compensation involved in the study.

To ensure the reliability and validity of our analysis, several measures were taken. First, we followed a standardised coding scheme and methodology. This involved developing a coding manual with clear definitions and guidelines for each category and subcategory. All coders underwent extensive training in using this coding manual to ensure consistency in coding.

Overall, the combination of rigorous coding protocols and triangulation methods helped ensuring the reliability and validity of our analysis. The limitations encountered were addressed through manual

adaptations and additional tools to mitigate any potential biases introduced by the software.

According to experts, any qualitative analysis can undergo various forms of thematization. In addition, this method of analysis is considered universal, as it can be applied deductively - starting from predefined themes - or inductively - using corpora to generate themes.

In order to remain consistent with its aims and issues, our research used a thematic analysis, which allowed us to move relevant topics to the beginning, while introducing new topics, which increased representativeness in the context of the problem under study.

Additionally, NVivo was used for easy classification, ordering, and recording of data. The data analysis procedure consisted of two main phases: preparation, which mainly involved transcription of the data, and coding, categorisation into themes, and interpretation of the data. Although the data was linear and ordered, there was often a feedback loop between data and analysis.

The interview instrument used in this study was a semi-structured interview guide, designed to explore participants' experiences, perspectives, and practices related to the use of IT in teaching. The interview guide included open-ended questions that allowed for in-depth discussions and the elicitation of rich, detailed responses from the participants. The interviews were conducted in person and lasted approximately 45-60 minutes each.

Data analysis procedures for this study involved a thematic analysis approach, which allowed for the identification of key themes, patterns, and insights within the data. The analysis process began with the transcription of the interview recordings, followed by the coding of the data to identify relevant themes and categories. The coding team consisted of multiple researchers who independently coded the data and then compared their findings to ensure consistency and reliability. Discrepancies were resolved through discussion and consensus among the coding team members.

The software used for data analysis in this study was NVivo, qualitative data analysis software that facilitates the organization, coding, and analysis of large datasets. NVivo helped streamline the data analysis process by providing tools for coding, categorizing, and visualizing the data. The software allowed for the systematic exploration of the data and the identification of key themes and patterns that emerged from the interviews. Additionally, NVivo facilitated the generation of reports and visualizations that supported the interpretation and presentation of the study findings.

In addition, although the value of the score is not of paramount importance in quality analysis, it is sometimes important to have an overall picture of the data and to draw conclusions about the research topic. Therefore, descriptive matrices (tables) have been created to provide an overview of the data from the corpus and their relationships between categories and subcategories. To confirm the data, excerpts from the interviews are included in the paper.

## 4. Results and Discussion

In this section, we are interested in presenting and analysing the responses of the surveyed future teachers from a scientific point of view. The statements of the survey participants show that IT is important for teachers in the process of preparing for classes. By analysing these statements, we have classified the benefits of IT in improving the teaching process in three ways: expanding the scope of attention, improving course content, diversity of teaching strategies and achieving learning objectives through the use of IT, and the ability to adapt learning to the level and pace of students (Table 2).

**Table 2.**
*The impact of it on pedagogical activity*

| Effect | Participants | Percentage ratio % |
|---|---|---|
| IT improves the school curriculum, making it more interesting, engaging, and useful. | 22 | 81% |
| IT offers great opportunities for a variety of learning strategies. | 18 | 67% |
| IT supports the achievement of curriculum objectives by adapting learning to the level and pace of each student. | 16 | 59% |

Table: authors' own development

According to Table 2, the majority of the surveyed participants (81%) say that IT makes classes richer, more interesting, more challenging, etc., as one of the future teachers noted:

*"After starting to use the STEM programme, my biology lessons have undergone positive changes. They have become more interesting, dynamic, interactive, and understandable. Indeed, my lessons are more stimulating and make my students want to follow them."*

However, most participants pointed out the importance of the variety of specialised software and resources available on the Internet, and they also emphasised the need to have the skills to design their own digital resources. Thus, when working with IT, future teachers primarily develop technical and scientific competencies. In this regard, the participant, sharing his previous testimony, clarifies that:

*"In general, it is difficult to find out about online digital resources that are well suited to the subject of biology. We use different software and simulators that allow us to develop digital resources adapted to the level of our students. Some topics present difficulties both in terms of teaching and learning. But with the use of software like STEM, we have the opportunity to develop lessons that are easy to understand."*

In the same vein, IT is seen, for some 59% of the participants surveyed, as a tool to help achieve the goals of the curriculum. In essence, for them, a successful act of teaching requires, first of all, taking into account the skill level of the students and ensuring their achievements. For example, a future teacher of a private secondary school notes that:

*"In general, IT helps teachers to adapt learning to the level and pace of each student by designing different lessons, and it is also effective for reviewing the material covered."*

In addition, the success of teaching with the use of ICT is noted, as 67% of the teachers surveyed have a positive reaction to ICT. This success is attributed to the fact that IT provides a variety of opportunities to enhance learning strategies. In particular, collaboration and group work between students facilitate the use of these technologies, according to one teacher:

> *"Before starting classes, we encourage students to participate in group work using the virtual experience they have gained. This gives students the opportunity to repeat this experience many times, collaborate with each other, analyse information, hold scientific discussions, and draw conclusions."*

Most of the future teachers surveyed believe that frequent use of software helps students gradually develop their skills in building and experimenting, as well as their ability to think logically. They also emphasise the importance of using IT wisely as part of a well-planned learning process that helps to concretise the

concepts taught. One participant emphasises that:

> *"We use IT devices to clarify, explain, or reinforce understanding of concepts and tasks. However, when it comes to solving them, students do not always realise that experiments are never a substitute for demonstration."*

Based on the participants' views, there is a broad belief in the role that IT can play in enhancing learning. However, they emphasise the need to use these technologies in a reasonable and sensible way, in particular taking into account constraints such as technical problems, lack of time, and classroom management difficulties. It appears that for them, the use of IT should be used in certain pedagogical scenarios, but it should not be considered a substitute for the curriculum.

As mentioned above, the aim of the study was to examine the impact of information technology on the process of developing future teachers' competences. The participants' perceptions and analysis of their comments allowed us to identify five categories of IT impact on competence development, namely: improving access to information, expanding learning opportunities, increasing the effectiveness of research activities, developing communication skills, and ensuring continuous self-education (Table 3).

**Table 3.**
*Five categories of it impact on competence development*

| Competences | Participants | Percentage ratio % |
|---|---|---|
| Improving access to information. | 17 | 63% |
| Expanding learning opportunities. | 14 | 52% |
| Improving the efficiency of research activities. | 14 | 52% |
| Development of communication skills. | 7 | 26% |
| Ensuring continuous self-education. | 7 | 26% |

Table: authors' own development

The first impact cited by seventeen out of twenty-seven participants (63%) was that information technology allows them to access a variety of information quickly and easily from anywhere, enabling them to find, analyse and evaluate new ideas and methods that improve their competencies.

52% say that information technology provides an opportunity to use a variety of online resources, software tools, and computer models to develop competencies in various fields. They can use specialised software to create interactive lessons with multimedia elements that improve their teaching skills.

52% of the participants believe that smart learning systems and intelligent analytical systems can help future teachers to increase the efficiency of research activities, develop the ability to assess students' potential, and identify their weaknesses, which allows them to focus on the development of specific competences. Information technology can also support individualisation of learning by creating personalised curricula and materials. The findings highlight the transformative potential of AI chatbots in education. By prioritizing digital literacy, fostering adaptability, promoting collaboration, supporting research, and addressing equity concerns, educators, policymakers, and curriculum developers can leverage the benefits of AI chatbots to enhance teaching and learning processes.

The limitations identified in the research highlight the importance of providing teacher training in IT, integrating IT in pre-service teacher education, offering in-service professional development, ensuring technical support and resources, and fostering a change in institutional culture. By addressing these

implications, educational institutions can better support the integration of IT into teaching and learning processes, ultimately enhancing the quality of education and preparing students for the digital age.

26% of respondents stated that information technology allows them to communicate and collaborate with each other, both online and offline. This develops their communication skills and promotes their ability to work in a team, which is important for future teachers.

Another 26% believe that information technology allows teachers to keep their knowledge and skills up to date. They can use online courses, webinars, and other electronic resources for professional development and improve their competencies in certain areas.

While the responses of the interviewed participants generally indicated that the pedagogical integration of IT in education has a positive impact on the development of knowledge and skills of both students and teachers, it is difficult to judge that the improvement in learning outcomes is solely attributable to this approach to learning.

Unfortunately, IT is not limited to technological tools alone and cannot be an effective teaching method unless it is combined with the planning and use of clearly defined pedagogical scenarios. According to the survey, approximately half of the respondents (48%) claim that learning outcomes have improved due to the introduction of IT. In addition, the majority of respondents frequently used dynamic biology software. This data clearly shows that the secondary school biology curriculum is in particular in need of IT.

According to the above statements of the participants, IT helps to create meaningful learning situations for students. Based on the analysis of the discourses of the interviewed teachers, it seems that the use of IT has a significant impact on students' behaviour. As Table 4 shows, for the majority of respondents (89%), the pedagogical use of IT motivates students and makes them more persistent and more autonomous.

**Table 4.**
*Teachers' perceptions of the impact of it on student motivation*

| Impact | Participants | Percentage ratio % |
|---|---|---|
| IT boosts motivation | 24 | 89% |
| IT promotes interest in learning | 24 | 89% |
| IT improves student autonomy | 18 | 67% |

Table: authors' own development.

Approximately nine out of ten future teachers (89%) reported that their students were more motivated when the course was taught using computers.

In addition to motivating students during IT classes, a quarter of participants believe that this motivation also continues outside of school, as one participant noted:

*"Students are more motivated to achieve and do their homework when the assignments are related to computer-assisted courses."*

However, every 10th future teacher believes it is obvious that:

*"The motivation of students during the first lessons with the help of IT loses its power when they get used to such learning."*

Similarly, nine out of ten participants (89%) said that IT helps students to persevere in their studies:

"The *use of technology provides an opportunity to make several attempts and check their validity, and students are actively involved in the process of finding solutions to the problem."*

According to the study, the use of IT helps to engage students in the learning process and attract their attention. Participants believe that it promotes students' autonomy, as it encourages them to complete tasks offered on the computer.

However, a third of the teachers surveyed do not share this view. They believe that the use of ICT does not ensure student autonomy unless factors such as access to digital resources to help with difficult situations, adaptation to different learning paces, and a self-assessment system that allows students to check their work independently of the teacher are taken into account.

The evidence shows that the majority of respondents say that the pedagogical use of ICT in the classroom has a positive impact on student behaviour, such as motivation, perseverance, and independence. However, about half of them point out that these effects are also not systematic. For the latter, the necessary use of IT should not be reduced to the transformation of the content format, paper to digital, but the successful integration of IT into teaching practice is based on the choice of resources in line with the object and objectives of learning.

Although only 11% of teachers reported using ICT to develop creative skills, we are still convinced of the importance of these skills and draw attention to this fact. According to our research, although only three participants use ICT to develop creativity, their examples show that they believe in the positive impact of these technologies.

The development of creative skills is undoubtedly important, because using IT, future teachers do not just passively use digital resources, but take the initiative to create their own simulations that allow them to make assumptions, participate in the evidence process, and develop design thinking (Dykhnych et al., 2022). Creativity is certainly a complex process, but it is "subjective and contextual" (Pikalova, 2015).

In other words, an achievement is judged as creative in relation to the context in which it is produced.

Most of the participants in the presented work believe that the variety of available specialised interactive digital resources on the Internet contribute to the enrichment of the subject and believe that IT offers many opportunities to diversify strategies through numerous learning situations for students. The results of a study conducted by Tytova & Mereniuk (2022) show that IT facilitates access to pedagogical goals, encourages communication, and promotes creativity.

Undoubtedly, the availability of digital educational resources expands the opportunities for teachers to inspire and create their own educational content. However, the abundance of such resources on the Internet and the lack of an editorial filter require users to evaluate and identify what meets their needs (Markova et al., 2019). Some teachers prefer to develop their own learning resources, taking into account the specifics of their students or their own approach (Yurinova, Byrdina & Dolzhenko, 2022). Others simply adapt digital resources created by other teachers for their students, as Tsankov & Damyanov (2019) emphasise.

Similarly, the analysis of the results shows that using IT as a didactic tool, in a way that is aligned with the objectives, can help develop students' skills, especially in terms of experimentation, modelling, analysis, reasoning, problem-solving, and creativity. These results are in line with the findings of a number of researchers (Voronin, Saienko & Tolchieva, 2020).

The results of this study also show that approximately half of the respondents (48%) stated that the use

of IT plays a major role in developing their pedagogical competences and is a significant contributor to improving educational outcomes and can contribute to higher student achievement. In fact, although it is difficult to say that the improvement of learning outcomes is solely due to the use of IT, the effectiveness of these technologies has been generally confirmed by many studies and experimental data (Frolova, Rogach & Ryabova, 2020).

On the other hand, research suggests that pedagogical integration of IT has a significant impact on improving students' attitudes and feelings towards learning. The issue of the causal relationship between IT use and motivation has been discussed for several years, and research has shown that the pedagogical use of IT encourages students to learn and makes their attitudes more positive (Marienko, Nosenko & Shyshkina, 2020). The results of the presented work also show that the successful use of IT contributes to the development of professional competences and encourages independence. The interactivity and opportunities for collaboration provided by IT allow for active participation in learning. Rudenko's (2022) research has shown that IT provides opportunities for interaction, which leads to motivation and perseverance. Furthermore, the results indicate that these effects are not automatic, and the pedagogical use of IT should be aligned with the learning objective to promote motivation, perseverance, and autonomy. Furthermore, our findings support the research of Zahorodna, Saienko, Tolchieva, Tymoshchuk, Kulinich & Shvets (2022), which indicates that IT alone is not sufficient to increase learner motivation, it also depends on how it is used.

As with any research, this paper also has some limitations. The debate on the effectiveness of IT in education is still ongoing, although there are international studies that cover this issue. However, relevant Ukrainian studies are very rare. Therefore, given the limited number of participants in the experiment, we can strengthen the reliability of the data collected by conducting an exclusive survey of teachers with significant experience in the practice of teaching with the help of IT. We believe that such a study can shed light on a question that still remains open.

## 5. Conclusions

The main purpose of this study was to investigate the impact of information technology on the process of developing future teachers' competences.

The results show that there is a positive trend of using IT in teaching and learning biology. In the context of this study, three main categories of prospects for the introduction of IT in educational programmes were identified.

The first category relates to the impact of IT on pedagogical practice and the development of professional competences. On the one hand, it includes the integration of IT to improve the quality of the learning process. On the other hand, the use of these technologies allows for the application of various teaching strategies and their adaptation to the needs of each student, their level, and the pace of learning.

The use of IT in pedagogy has a positive impact on learning and student achievement. Students who use this methodology develop skills in experimentation, modelling, analysis, reasoning, problem-solving, and creativity. However, the direct impact of such technologies on academic success is still difficult to prove.

As for the third category, it concerns the impact of IT on students' attitudes towards learning. In fact, the results show that the use of IT has a significant impact on student behaviour. It promotes motivation in students and makes them more persistent and more autonomous.

The results of this study have revealed a rather important topic in the context of Ukrainian education. The topic of introducing IT into educational programmes has always attracted the interest of many researchers

around the world. The study also raised issues that open the way for further research and prospects in this area. Additional analysis could focus on various aspects related to IT integration and its impact on learning. One of potential avenues for further exploration are the longitudinal studies. This could help determine if the initial positive impact persists or changes over time; as well as comparative studies for a better understanding of how IT integration affects learning in diverse contexts. Moreover, examining the impact of teacher training and support programs specifically focused on IT integration could help identify effective strategies to enhance teacher competencies and pedagogical practices in utilising IT tools for improved learning outcomes. By delving deeper into these aspects, researchers can gain a more comprehensive understanding of how IT integration affects learning and identify strategies to optimise its potential benefits.

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Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.16

Cómo citar:
Kuznetsova, H., Serdiuk, H., Bazyl, L., Vyshnyk, O., & Sobko, V. (2024). Realities of developing the research competence of teachers-philologists in wartime. Revista Eduweb, 18(1), 218-234. https://doi.org/10.46502/issn.1856-7576/2024.18.01.16

# Realities of developing the research competence of teachers-philologists in wartime

## Realidades del desarrollo de la competencia investigadora de los profesores-filólogos en tiempos de Guerra

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Recibido: 04/01/24
Aceptado: 04/03/24

**Abstract**

The relevance of the research topic is determined by the urgent need to adapt the educational process and professional development of teachers-philologists to wartime conditions. The education sector should swiftly adjust to new realities in light of the challenges posed by the war and global changes, including making use of digital technology to provide access to high-quality education. Martial law makes adjustments not only to teaching methods but also to approaches to teachers' professional development, emphasizing the need to integrate innovative methods and approaches. In the course of the research, it has been revealed that digital technologies play a crucial role in supporting language education in wartime by offering tools for distance learning and self-education. Innovative teaching methods, such as interactive exercises and online discussions, have been found to be effective in engaging students and motivating them to actively master the language. The reconstruction of the educational system provides an opportunity to revise and improve approaches to language teaching, with an

emphasis on integrating the experience gained during the war. This emphasizes the importance of developing targeted support programs for teachers-philologists in order to enable them to use these technologies and methodologies effectively in their practice. The research findings emphasize the need for a comprehensive approach to the renovation and development of language education, with an emphasis on the role of teachers-philologists as agents of change. Ensuring their professional development, adaptation to new challenges, and engagement in intercultural communication are key elements of successful post-war reconstruction. Further studies should focus on the effectiveness of specific innovative methods in language teaching and the development of integrated professional development programs for teachers-philologists, including comprehensive support and development of the relevant competencies in the post-war period.

**Keywords:** development, research competence, components of research competence, innovative methods, techniques, technologies for the development of research competence, psycho-pedagogical features of research competence development in wartime, informal education in the development of research competence, teacher-philologist.

**Resumen**

La relevancia del tema de investigación está determinada por la urgente necesidad de adaptar el proceso educativo y el desarrollo profesional de los docentes-filólogos a las condiciones de tiempos de guerra. El sector educativo debe adaptarse rápidamente a las nuevas realidades a la luz de los desafíos planteados por la guerra y los cambios globales, incluido el uso de la tecnología digital para brindar acceso a una educación de alta calidad. La ley marcial hace ajustes no sólo a los métodos de enseñanza sino también a los enfoques del desarrollo profesional de los docentes, enfatizando la necesidad de integrar métodos y enfoques innovadores. En el transcurso de la investigación, se ha revelado que las tecnologías digitales desempeñan un papel crucial en el apoyo a la educación lingüística en tiempos de guerra al ofrecer herramientas para el aprendizaje a distancia y la autoeducación. Se ha descubierto que los métodos de enseñanza innovadores, como los ejercicios interactivos y los debates en línea, son eficaces para involucrar a los estudiantes y motivarlos a dominar activamente el idioma. La reconstrucción del sistema educativo brinda la oportunidad de revisar y mejorar los enfoques de la enseñanza de idiomas, con énfasis en la integración de la experiencia adquirida durante la guerra. Esto enfatiza la importancia de desarrollar programas de apoyo específicos para profesores-filólogos a fin de permitirles utilizar estas tecnologías y metodologías de manera efectiva en su práctica. Los resultados de la investigación enfatizan la necesidad de un enfoque integral para la renovación y el desarrollo de la educación de lenguas, con énfasis en el papel de los profesores-filólogos como agentes de cambio. Garantizar su desarrollo profesional, su adaptación a los nuevos desafíos y su participación en la comunicación intercultural son elementos clave para una reconstrucción exitosa de la posguerra. Otros estudios deberían centrarse en la eficacia de métodos innovadores específicos en la enseñanza de idiomas y en el desarrollo de programas integrados de desarrollo profesional para profesores-filólogos, incluido el apoyo integral y el desarrollo de las competencias relevantes en el período de posguerra.

**Palabras clave:** desarrollo, competencia de investigación, componentes de la competencia de investigación, métodos innovadores, técnicas, tecnologías para el desarrollo de la competencia de investigación, características psicopedagógicas del desarrollo de la competencia de investigación en tiempos de guerra, educación informal en el desarrollo de la competencia de investigación, profesor-filólogo.

## 1. Introduction

In the current climate of global instability, particularly under the shadow of conflict, the role of educators, especially those in the field of philology, becomes profoundly challenging yet critically important. This article aims to explore and articulate the multifaceted impact of warfare on the pedagogical domain, with a special focus on the professional development of teachers-philologists. It delves into how these educators can sustain and enhance their research competence amidst the turmoil, ensuring the continuation of high-quality linguistic and literary education.

The introduction of digital technologies and innovative teaching methodologies presents a silver lining, offering tools and avenues for adaptation and growth. This study systematically examines the ways in which such technologies and methodologies can be harnessed to not only meet the immediate challenges posed by war conditions but also to lay a foundation for post-conflict educational recovery and advancement.

Our discussion is structured to first outline the challenges and adaptations faced by philology teachers in wartime, emphasizing the strategic use of digital platforms and innovative educational practices. We then transition to exploring the potential for post-conflict educational reconstruction, highlighting the importance of integrating wartime experiences and innovations into future teaching and research practices.

By weaving together insights from sociology, psychology, pedagogy, and military studies through a combination of systemic and autodidactic approaches complemented by analysis and synthesis, we offer a comprehensive overview of the situation. The aim is to present actionable strategies and recommendations to support philology teachers in their quest for professional development during and after conflict, thereby contributing to the resilience and dynamism of educational systems in facing global challenges.

In doing so, this article not only addresses the immediate concerns related to teaching and research competence in conflict settings but also considers the broader implications for educational practice and theory in the face of adversity.

## 2. Literature review

Primarily, it is worth mentioning one of the pioneering works in the chosen topic, namely, the work of R.E. Spiller (1942), which is still interesting nowadays despite the considerable time distance. This is one of the first studies of the role of higher education in wartime, which provides a deeper understanding of how wartime conditions have affected educational institutions in the past and what lessons can be applied today.

Let us pay attention to the scientific work of L. Bazyl, M. Klymenko, and V. Orlov (Bazyl et al., 2019), who analyze in depth the freedom of pedagogical activity, highlighting contradictions and ways to resolve them in the context of the educational process. The authors reveal the fundamental aspects that underlie pedagogical freedom and emphasize the need to harmonize the internal and external conditions of the educational environment. This study creates a conceptual framework for further consideration of the specifics of developing literary competence since it points to the importance of adapting pedagogical strategies to changing conditions. Following up on the topic, Bazyl (2016) in her doctoral dissertation focuses on the theoretical and methodological foundations of developing the literary competence of future teachers of the Ukrainian language and literature. The author analyzes in detail the mechanisms for the formation and improvement of professional skills that are critical for effective pedagogical intervention in the context of modern challenges, in particular, in the context of military events.

Next, H. Salmento, M. Murtonen, and M. Kiley (Salmento et al., 2021) delve into the nuances of teacher education students' research competencies by examining their perceptions of theory, underscoring the critical link between theoretical knowledge and its practical application in teaching. K. Selvi (Selvi, 2010) discusses the broad spectrum of competencies that contemporary teachers must possess, emphasizing the necessity for a dynamic skill set in today's educational environment. S. Mandal (Mandal, 2018) further expands on the competencies essential for modern teachers, highlighting the integration of technology as a key factor in contemporary education.

Subsequent analysis is presented in the publications of H. Kuznetsova, T. Zenchenko, L. Luchkina-Zahorodnia, N. Barannyk, and I. Kholiavko (Kuznetsova et al., 2023), where linguistic and literary educational field is considered in the system of forming a communicative field. The authors point

out the importance of integrating modern research approaches and methods into the educational process, which becomes especially relevant in the context of martial law, when traditional educational methods need to be adapted to new realities. Following this line, H. Kuznetsova, A. Panasenko, O. Vyshnyk, I. Danylchenko, O. Korchova, and V. Sobko (Kuznetsova et al., 2023) explore innovative approaches and methods in the professional training of teachers of language and literature. This study emphasizes the importance of innovations in improving teachers' research competence and training, which is especially crucial in the difficult conditions of wartime.

In this context, F. Böttcher and F. Thiel (Böttcher & Thiel, 2018), alongside F. Böttcher-Oschmann, J. Groß Ophoff, and F. Thiel (Böttcher-Oschmann et al., 2021), contribute to the literature by introducing innovative instruments for evaluating and enhancing research competencies among university and teacher training students, respectively, showcasing the importance of research-oriented teaching. B. Koichu and A. Pinto (Koichu & Pinto, 2018) present the TRAIL framework as an effective method for developing education research competencies in mathematics teachers, fostering a collaborative culture of inquiry.

In the next block of the analytical review, we continue to consider the development of research competence among teachers of Ukrainian language and literature, moving from theoretical analysis to practical application in educational institutions. In this context, the works of H.A. Serdiuk (Serdiuk, 2023a) deepens the understanding of this topic by focusing on the integration of research activities into teachers' professional development. The author emphasizes the need to adapt educational methods to modern challenges (Serdiuk, 2023b), which becomes especially significant in crisis situations and during war. Extending this discourse, the other work of the author (Serdiuk, 2022) focuses on specific examples of research activities in lyceums. This approach demonstrates how theoretical principles can be applied in real-world educational contexts, providing an important empirical dimension to the analysis of research competence. In another scientific work, H.A. Serdiuk (Serdiuk, 2023c) focuses on the analysis of the main definitions of studying the development of research competence of teachers of Ukrainian language and literature, the development of this competence in the conditions of martial law, as well as the pedagogical conditions for the development of research competence in the lyceum (Serdiuk, 2023 d). These works of the author demonstrate a comprehensive approach to studying the issue, offering specific strategies and recommendations for the effective development of teachers' research skills in complex social and political conditions.

Subsequently, the study by Dj. Dicum (Dicum, 2008) expands the contextual understanding of the impact of war on the educational process from the perspective of students. The author makes a significant contribution to our understanding of how educational processes can continue and advance even in the most trying circumstances by examining the effects of harsh situations on learning. T. Burgess (Burgess, 2018) analyzes the restoration of history and diversity in English language and literature after the war, considering how wartime events influence language and literature teaching. This study emphasizes the importance of cultural and historical awareness in shaping educational content. O. Topuzov, N. Bibik, O. Lokshyna, and O. Onoprienko (Topuzov et al., 2022) offer an analysis of the organization of primary education during the war in Ukraine, demonstrating how military operations affect the educational process and what strategies can be used to support students and teachers. Finally, the scientific work of N. Beadie (Beadie, 2016) explores the interrelation between war, education and state formation, analyzing the problems of territorial and political integration in the United States from 1848 to 1912. This research provides an important historical context for understanding the impact of war on education and state-building.

In their insightful analysis, Strohl and Ris (Strohl & Ris, 2023) delve into the transformative impact of World War I and the Truman Commission's efforts on higher education in the United States, tracing the trajectory towards universal college access. The study meticulously examines the societal and political shifts induced by World War I, setting the stage for significant educational reforms. The authors highlight how the Truman Commission, established in the aftermath of the conflict, played a pivotal role in advocating for broader

access to higher education, effectively laying the groundwork for what would become a fundamental aspect of American educational policy. This exploration into the historical context of educational transformation underscores the capacity of societal upheaval, such as war, to catalyze comprehensive reforms in educational accessibility and quality. Strohl and Ris's work provides a compelling parallel to the current study's focus on the challenges and opportunities for professional development among teachers-philologists in wartime conditions. It underscores the notion that crises, while presenting immediate challenges, also offer unique opportunities for systemic change and advancement in educational practices and policies.

The publication by V.A. Dobiesh and co-authors (Dobiesz et al., 2022) explores ways to support and develop health education activities during the war, emphasizing the importance of adapting educational programs to extreme conditions. This study points to the need for flexibility in approaches to medical education, which becomes especially relevant in the context of military conflicts.

Yu. Tsekhmister (Tsekhmister, 2022) examines the education of the future through the prism of post-war recovery and Ukraine's integration into the European Union. The author emphasizes the role of educational reforms as a tool for social and economic recovery and further development of the country.

M. Kahanets, S. Leu-Severynenko, A. Novosad, and Ya. Stadnyi (Kahanec et al., 2022) analyze educational reforms during and after the war, offering a perspective on strategies for rebuilding the educational system in Ukraine. These strategies include adapting curricula, integrating digital technologies, and supporting the psychological well-being of students and teachers.

M. Bjork, J. R. Boyle, and P. Kohl (Björck et al., 2023) emphasize the significance of science and education in the context of health crisis and war, stressing that education and research are crucial to overcoming crises and promoting stability and recovery. O. Topuzov & O. Lokshyna (2022) study education in wartime, focusing on international experience and Ukraine's achievements in this area. The authors point to successful practices of adapting the educational system to wartime conditions, in particular, through the introduction of distance learning and support for students and teachers. I. Vorotnykova, N. Morse, and L. Hrynevych (Vorotnykova et al., 2023) focus on the digital transformation of secondary education in Ukraine and the quality of science and mathematics teaching in conditions of war. The study points to the importance of integrating digital tools to ensure accessibility and quality of education even in difficult conditions.

Subsequently, we will consider methodologies and pedagogical approaches in teaching the second language, with a special emphasis on cognitive linguistics, spatial perspectives in language teaching, political aspects of translanguaging, plurilingual education, and professional language training for the military, intercultural approach in teaching English, the impact of war on academic identities, and the role of translators in wartime. For instance, J. Littlemore (Littlemore, 2023) proposes an innovative approach to second language teaching through the prism of cognitive linguistics, emphasizing the importance of understanding mental processes in language learning and teaching. This scientific article demonstrates how a deeper understanding of the cognitive aspects of language can improve the effectiveness of the learning process. P. Benson (Benson, 2021) explores spatial perspectives in language learning, considering physical and virtual environments as key components in the language learning process. The author emphasizes the importance of creating optimal conditions for language immersion and interaction. L. Wei (Wei, 2022) discusses translanguaging as a political stance, focusing on its implications for English language education. This approach opens up a discussion about the role of language in social integration and cultural diversity. E. Picardo, A. Germain-Rutherford, and G. Lawrence (Picardo et al., 2021) provide a comprehensive overview of plurilingual education, emphasizing the importance of multilingualism in the modern world. The edited scientific work provides an in-depth analysis of teaching methods and strategies that promote the development of plurilingual competencies. J. Corbett (Corbett, 2022) examines the intercultural approach to teaching English, offering strategies for developing learners' intercultural competence. The author

emphasizes the importance of understanding cultural diversity for effective language learning. J. Baigorri-Jalon (Baigorri-Jalon, 2021) analyzes the role of philology in the Spanish Civil War, highlighting the significance of language and communication in conflict zones. The author considers translation as a critical tool for ensuring understanding and cooperation between different parties.

It is worth noting the study of L. Kanova (Kanova, 2023), who focuses on the professional language training of military officers in higher military educational institutions of Ukraine in times of war, emphasizing the need to adapt educational programs to the specific needs of the armed forces. A. Oleksiienko, S. Terepyshchyi, O. Homilko, and D. Svyrydenko (Oleksiyenko et al., 2021) explore the impact of war on academic identities, focusing on the experiences of displaced academics in Ukraine. This publication highlights the difficulty of adapting to new social and academic environments in a conflict-affected environment.

The next section of our analytical literature review will cover the issues of organizing the educational process in the context of social disasters, wars and pandemics, the impact of digital technologies on teachers' training and professional development, and the challenges and opportunities for higher education in Ukraine in the context of military operations.

The study by D. Kolomiets, V. Ivashchevych, A. Hrytsak, V. Dobrynsky, and O. Khomyk (Kolomiiets et al., 2022) analyzes in detail the experience of organizing the educational process during the war and in the postwar period. The authors highlight the adaptation of educational institutions to new conditions, the use of distance and flexible forms of education, which demonstrates the importance of innovative approaches to education in times of crisis. T. Almpanis and P. Joseph-Richard (Almpanis & Joseph-Richard, 2022) share their experience of teaching at a distance during the pandemic, exploring the challenges and perspectives faced by educators. Their research emphasizes the need for support and skills development for effective distance learning. O. Yu. Burov (Burov, 2021) focuses on Ukrainian education in the context of cognitive warfare, analyzing the current state and challenges facing the educational system. This study highlights the importance of critical thinking and media literacy in the context of information warfare.

H. Crompton and K. Sikora (Crompton & Sikora, 2021) explore the development of instructional technology standards for educators, stressing the importance of integrating technology into the learning process. Their scientific work indicates the need to standardize pedagogical approaches to the use of technology. V.M. Hale and L. Lockard (Hale & Lockard, 2022) discuss teachers' perspectives on indigenous language education, emphasizing the importance of preserving cultural heritage and linguistic diversity. This study emphasizes the need for inclusive educational strategies. S. Hennessy, S. D'Angelo, N. McIntyre, S. Kumar, A. Kreimey, L. Cao, et al. (Hennessy, Angelo, McIntyre *et al.*, 2022) explore the use of technology for teachers' professional development in low- and middle-income countries, emphasizing the potential of technology for improving the quality of education. J. Rizk and K. Gillier (Rizk & Gillier, 2022) investigate the way digital technologies can increase the inclusion of students with disabilities, emphasizing the importance of access to education for everyone. I. Shevchuk and A. Shevchuk (Shevchuk & Shevchuk, 2022) analyze educational analytics through the prism of war, highlighting the challenges and opportunities for higher education in Ukraine. Their research emphasizes the importance of adapting education systems to changing conditions and using data to improve the quality of education.

Further discussing the subject, D. Uerz, M. Volman, and M. Kral (Uerz et al., 2018) review the competencies teacher educators need to foster technology proficiency in student teachers, indicating a shift towards technology-enriched teaching methodologies. C.M.D. Toquero (Toquero, 2021) addresses the challenges preservice teachers face in developing research competencies, particularly within action research, suggesting the need for practical guidance in real-world research endeavors.P. Mak, M. Yang, and R. Yuan (Mak et al., 2023) emphasize the significance of classroom-based research in nurturing teacher competence during field experiences, advocating for a hands-on approach to teacher training. H.H. Şahan and R. Tarhan

(Şahan & Tarhan, 2015), E. Wuttke and J. Seifried (Wuttke & Seifried, 2017), and W. Maba et al. (Maba et al., 2018) each contribute to understanding the facets of teacher competence, from scientific research skills to professional error competence and the impact of teacher welfare on education quality.

These studies collectively highlight the importance of adaptability, innovation, and inclusiveness in education in times of crisis and war, emphasizing the role of digital technologies and pedagogical innovation in addressing contemporary educational challenges.

The final part of our literature review examines studies that focus on the role of civil society in teachers' professional development, global trends in vocational teacher education, the need to rebuild the capacity of university teachers after the war, innovative approaches to teacher education, and the effectiveness of professional development programs.

O. Elkin, O. Marushchenko, O. Masalitina, O. Raskazova, T. Drozhzhyna, and K. Zhurba (Elkin et al., 2023) highlight the role of civil society organizations in transforming teachers' professional development in Ukraine during wartime. They prioritize social, emotional, and ethical learning as key components that help teachers adapt to the challenges of war. A. Popova, D.C. Evans, M.E. Breeding, and V. Aransibia (Popova et al., 2022) examine the professional development of teachers in a global context, identifying a gap between evidence and practice. Their analysis emphasizes the need to improve the effectiveness of professional development programs. H. Ma, I. Hryshova, I. Koshkalda, A. Suska, R. Hryshova, A. Riasnianska, and O. Tupchii (Ma et al., 2022) draw attention to the necessity of restoring the capacity of university teachers in Ukraine after the war in terms of stable and ongoing development. They emphasize the importance of adapting to changing conditions and challenges.

J.S.Z. Oghly (Oghly, 2023) describes the Japanese approach to postgraduate training and professional development of science and physics teachers, highlighting the effectiveness of this approach in creating highly qualified specialists. W. Hiew and J. Murray (Hiew & Murray 2021) seek to improve upon Huber's evaluation framework for teacher professional development programs by providing tools for effective curriculum analysis and planning. M.A. Thomas and F.K. Vavrus (Thomas & Vavrus, 2021) consider the "Pluto problem" in the context of teacher professional development, analyzing reflections of discomfort and their impact on the learning process. T.T. Stewart and T.A. Jansky (Stewart & Jansky, 2022) share the experiences of new teachers in taking on challenges through dialogue and reflection as part of professional development, emphasizing the importance of support in the early stages of their careers.

C. Miedijensky and I. Sasson (Miedijensky & Sasson, 2022) explore participation in action as a way to innovate in mathematics and science teaching, emphasizing the importance of teachers' participation in professional development. H.S. Yu, S.M. Chako, and V. Kapila (You et al., 2021) evaluate the effectiveness of a professional development program through the integration of educational robots into science and mathematics curricula, demonstrating a positive impact on the learning process. P. Lara-Alesio, S. Tang, C. L. Sutton-Jones, B. J. Irby, F. Tong, D. D. Jimenez, and E. G. Villarreal (Lara-Alesio et al., 2021) analyze teachers' knowledge and practices after participating in virtual professional development, pointing to the importance of digital platforms for improving pedagogical skills.

H. Tytova and K. Mereniuk (Tytova & Mereniuk, 2022) study the digital literacy of future teachers in the realities of large-scale military aggression, emphasizing the need to prepare teachers to use digital technologies in the learning process. D. Wyse and A. Bradbury (Wyse & Bradbury, 2022) examine the "reading wars" in the context of a critical analysis of studies, curriculum policies, and teachers' practices in teaching phonics and reading, emphasizing the need for reconciliation between different approaches to reading instruction.

The review of the literature proposed above, on the one hand, has revealed a deep interest in the development of teachers' research competence in the context of wartime, highlighting the variety of

approaches and strategies used in the educational sphere to adapt to extreme conditions. Considerable attention is paid to the use of digital technologies, innovative teaching methods, and psychosocial support for teachers and students. However, on the other hand, the analysis has also revealed a number of research gaps, including a lack of empirical data on the long-term impact of wartime conditions on teachers' professional development, as well as limited attention to interdisciplinary integrated approaches in research that would facilitate innovative development of educational programs.

These "white spots" emphasize the relevance of our chosen topic and the need for further studies to better understand how educational institutions can effectively adapt to wartime conditions while guaranteeing quality professional development for teachers. It is important to explore how pedagogical innovations and adaptive strategies can be integrated into the educational process to support teachers in their quest for ongoing development despite the challenges posed by military conflict. The creation and execution of professional development initiatives that would include the specifics of martial law and provide educators with the tools and resources they need to function well under such circumstances is very compelling. Thus, our academic paper aims to fill the existing gaps in the literature by offering a new perspective on strategies for developing teachers' research competence, which is crucial for ensuring the stability of the educational process and recovery in the post-war period.

**The purpose** of the proposed research is a comprehensive analysis of the impact of military conditions on the educational process and professional development of teachers-philologists, with a special emphasis on identifying adaptive strategies and innovative approaches in teaching and pedagogical practice. The academic paper seeks to identify how civil society, digital technologies, intercultural interaction, and changes in learning environments contribute to the formation of effective methods of teachers' professional development that meet the challenges of wartime and post-war reconstruction. The main focus is on analyzing Ukraine's experience in the context of large-scale military aggression, studying the impact of the conflict on the education sector and identifying pedagogical innovations that can be applied in similar situations globally.

## 3. Methodology

In the framework of our study, we focus on the application of systemic and autodidactic approaches, complemented by methods of analysis and synthesis. This allows for a deeper understanding of how philology teachers can maintain and develop their research competence under changing conditions due to warfare.

The systemic approach provides a comprehensive review of the educational process, considering both internal and external factors that influence the professional development of teachers in crisis conditions. Meanwhile, the autodidactic approach emphasizes the self-directed learning of teachers, their ability to independently find, assimilate, and integrate new knowledge and methodologies into their practice, adapting to rapidly changing conditions.

Analysis enables us to deconstruct existing practices, methodologies, and strategies to identify the most effective ones for supporting the research competence of philology teachers. Synthesis, in turn, helps to combine the obtained data into a coherent picture, forming new approaches and recommendations that can be used for further development of the educational process under similar conditions.

We apply a critical approach to assess existing studies and practices, identifying potential gaps in knowledge and opportunities for further explorations. This also includes evaluating the effectiveness of various pedagogical innovations and professional development programs in the context of their application in the conditions of war and post-war reconstruction.

The empirical basis of our article is derived from recent sociological studies on the attitudes and needs of educators and students in Ukraine. These studies provide a rich dataset that allows us to explore the impact of conflict on the educational environment from multiple perspectives. By analyzing these sociological findings, we aim to uncover the specific challenges faced by educators in maintaining the quality of education and their professional development under duress, as well as the adaptive strategies they employ. This approach enables us to not only highlight the resilience and ingenuity of teachers in crisis conditions but also to identify gaps in the current support systems that could be addressed to better meet the needs of educators and students alike. Utilizing qualitative and quantitative data from these studies, we apply thematic analysis to distill key insights into the evolving dynamics of education in conflict zones, ensuring our discussion is grounded in the lived experiences of those directly impacted.

Thus, our methodology aims at a deep understanding and development of strategies that will allow philology teachers to effectively develop their research competence, using systemic and autodidactic approaches, as well as methods of analysis and synthesis to adapt to wartime conditions.

## 4. Results and discussions

### The impact of war on educational processes.

Military conflicts pose enormous challenges to all aspects of public life, including education. In times of war, teachers face a number of specific challenges affecting their ability to continue their professional development and fulfill their educational responsibilities. We will analyze below how the war conditions influence the educational process and professional development of teachers, highlighting key challenges and possible adaptation strategies.

According to sociological research conducted by Goglobal (Goglobal, 2023), there is a significant concern regarding professional burnout among teachers in Ukraine, particularly in the context of the ongoing conflict. The study reveals that 54% of teachers report experiencing burnout, while 40% do not, and 6% are undecided or find it difficult to articulate their state clearly.

Additionally, the psychological needs of educators during this period have come to the forefront, with 54% of the respondents expressing a need for psychological help. In contrast, 39% feel they do not require such assistance, and 7% remain uncertain about their needs in this area (Goglobal, 2023).

Furthermore, when assessing the workload changes since February 24, 2022, a striking 80% of teachers perceive an increase in their workload. Only 12% have noticed no change, and a mere 5% report a decrease. Notably, 3% find it challenging to provide a definitive response (Goglobal, 2023).

These findings indicate a crucial pressure point within the Ukrainian educational system, highlighting the exacerbated challenges faced by teachers during the crisis. Apparently, the reported high levels of burnout and the significant acknowledgment of increased workload underscore the pressing need for systemic support and targeted measures to ensure educators' well-being and professional resilience.

One of the biggest challenges is the loss of the conventional educational environment and the need to quickly adapt to new forms of learning. Martial law often leads to the closure of educational institutions and the transition to distance learning without proper training and psychological support for both teachers and students. This puts additional pressure on teachers who are trying not only to provide training without interruptions but also to maintain high quality education.

Adapting to new conditions requires teachers in general, and teachers-philologists in particular, to develop new skills, including mastering digital tools for distance learning, introducing innovative teaching methods,

and searching for ways to interact effectively with students online. However, opportunities for professional development are limited in such circumstances since most resources and attention are focused on addressing immediate security and survival concerns.

Despite the challenges, there are adaptation strategies that can help teachers continue their professional development even in wartime. These include, first of all, *the use of open educational resources*. For instance, online platforms and open educational resources can provide teachers with access to educational materials and courses for self-study. *Networking* is of equal importance: creating and maintaining professional networks through social media and forums ensures the exchange of experience, resources, and emotional support among teachers. Finally, *flexible forms of professional development* are becoming increasingly important: adapting professional development programs to flexible formats, such as webinars, online seminars, and short courses, helps teachers gain new knowledge without investing a lot of time and resources.

As we delve into the crux of how war reshapes educational landscapes, it becomes clear that technology and innovation are not mere adjuncts but central pillars in sustaining and advancing pedagogical objectives under duress. This segment of our exploration not only highlights the pivotal role of digital platforms and innovative teaching methodologies but also situates these tools within the broader context of educational resilience and adaptability. Here, we bridge the theoretical underpinnings of educational science with the practical exigencies of wartime teaching, illustrating the symbiotic relationship between pedagogical innovation and the imperative of educational continuity.

**Challenges and adaptation strategies for teachers.**

Adapting the educational process to the conditions of war requires not only changing approaches to teaching but also integrating innovative methods and technologies that can contribute to the effectiveness of training and professional development of teachers. This block focuses on analyzing how innovations in education can respond to the challenges posed by martial law and how teachers can use these new approaches to support their development and ensure quality education.

Digital technologies have become a key element in supporting the educational process in conditions of war. Online learning platforms, virtual classrooms, mobile apps for self-education, and interactive resources allow teachers and students to stay connected regardless of their physical location. The application of these tools contributes to preserving access to education as well as opens up new opportunities for the professional development of teachers through online courses, webinars and virtual conferences.

Wartime conditions require teachers not only to adapt to new technologies but also to use innovative teaching methods that take into account the psycho-emotional state of students, such as project-based learning, gamification, video and interactive tasks. These techniques help keep students engaged, and they also assist teachers in developing their pedagogical skills by adapting the learning process to unpredictable conditions.

The necessity of adapting professional development programs to the teachers' requirements working in the war is becoming especially urgent. Developing specialized programs that focus on promoting resilience, stress tolerance, and critical thinking and problem-solving skills can help support teachers' professional development even in the most challenging environments.

In general, the integration of innovative methods and technologies into the educational process during the war opens up new horizons for the professional development of teachers, allowing them not only to respond effectively to current challenges but also to prepare for future changes in the educational sphere. However,

support is necessary at all levels of the education system to fulfill these opportunities, including access to resources, training, and methodological assistance.

**Post-war educational system reconstruction and development**.

Finally, we will provide several considerations in this section regarding the prospects for the development of research competence in the post-war period, which will certainly be based on the experience gained during the war. The post-war period offers unique opportunities for rethinking and improving the educational system, particularly in the area of teachers' professional development. The quality of education can be significantly improved and teachers can be prepared for future challenges by focusing on lessons learned during the war and integrating innovations that have proven effective in extreme environments. This block analyzes the key areas of post-war reconstruction of the educational system and the development of teachers' professional competencies.

Post-war reconstruction should include not only the physical restoration of educational institutions but also the rethinking of educational programs and methods to adapt to the changed social context. The elaboration and implementation of professional development programs that focus on stress management, critical thinking, the use of IT tools in the learning process, and teaching methods adapted to the needs of modern students is an important aspect.

Effective post-war reconstruction requires interdisciplinary cooperation between educational institutions, government agencies, non-governmental organizations and the private sector. Such cooperation can facilitate the exchange of experience, resources, and innovative practices, providing a comprehensive approach to addressing educational challenges. Particular attention should be paid to the integration of social, psychological and technological aspects into teacher professional development programs.

The postwar period is a time for reflection and analysis of the experience gained during the war. This experience provides valuable lessons on adaptability, innovation and collaboration in extreme environments that can be integrated into future educational strategies. Particular attention should be paid to studying and adapting effective innovative methodologies and technologies used during the war to support the ongoing professional development of teachers.

The prospect of post-war reconstruction and development in the educational sector invites a forward-looking perspective, one that synthesizes the lessons of the present with the possibilities of the future. This reflection is not merely a contemplation of what has been but a strategic blueprint for what could be, leveraging the insights and innovations born out of necessity to envision a more resilient and dynamic educational framework. As we contemplate the future of education in a post-war context, this section aims to extrapolate the current findings towards broader implications for policy, practice, and pedagogical theory.

In integrating these paragraphs into the existing structure, the introduction is enhanced to provide a clearer roadmap for the reader, offering both a macro and micro perspective on the study's objectives, methodologies, and anticipated contributions to the field. This revised structure aims to offer a more guided exploration of the topic, ensuring that readers are not only informed of the challenges and opportunities identified but are also engaged in a dialogue that extends beyond the immediate context to the future of education in post-war recovery and development.

Integration of digital technologies into teachers' professional development in wartime is considered an effective way to ensure access to education and lifelong learning. Supporters of this viewpoint argue that technology can contribute to the flexibility of the learning process, allowing teachers to adapt to changing conditions and keep in touch with students regardless of their physical location. Opponents of the intensive integration of digital technologies point to the risks associated with digital exclusion, increased inequality

in access to educational resources, and potential harm to the psychological well-being of teachers and students. They emphasize that an over-reliance on technology can distract from the deep pedagogical content and interpersonal interactions that are crucial to effective learning.

We believe that while the integration of digital technologies has its challenges, its potential to support teachers' professional development in wartime cannot be ignored. It is important to find a balanced approach that takes into account both the opportunities and limitations of technology, focusing on the development of inclusive and accessible educational programs.

Some researchers and practitioners have also emphasized the critical need for psychosocial support for teachers in wartime, arguing that such assistance is essential to ensure their ability to teach effectively and develop professionally. The importance of creating a safe environment to discuss the difficulties teachers face and develop strategies to overcome them is emphasized. Another group of experts, on the other hand, emphasizes that while psychosocial support is important, it should not distract from the main goal of the educational process – learning and competence development. They argue that resources and attention should be directed to improving the quality of education and professional development.

In our opinion, based on long-term practical experience in the field, psychosocial support contributes to the efficiency of the educational process, allowing teachers to better cope with stress and uncertainty, which in turn has a positive impact on the quality of learning. Providing psychosocial support should become an integral part of teacher professional development programs, especially in the context of war and post-war reconstruction.

Our research findings illuminate the unique challenges faced by teachers-philologists during wartime, drawing parallels and contrasts with existing literature. Similar to Salmento, Murtonen & Kiley (2021), who underscored the critical role of teachers' conceptualization of theory in their professional development, our study sheds light on the heightened complexities of fostering research competence under the duress of conflict. The urgency and necessity for adaptive strategies, as highlighted in our findings, resonate with the educational disruptions discussed by Dicum (2008). However, the context of war accentuates these challenges, demanding not only flexibility but also innovation in pedagogical approaches to ensure the continuity of quality education in the field of philology.

Philology teachers, specifically, grapple with maintaining the integrity and depth of language and literature education through digital mediums—a challenge that is not as pronounced in the broader discourse on emergency remote teaching. This nuanced obstacle expands upon the discussions by Böttcher & Thiel (2018) and Uerz, Volman, & Kral (2018), who advocate for comprehensive professional development programs. Our study suggests that these programs must transcend general technological proficiency, incorporating cultural and linguistic sensitivity to address the unique demands of philology education in crisis settings.

The adaptation strategies we've identified, such as leveraging open educational resources and fostering professional networks, offer pragmatic solutions to the wartime challenges identified. These strategies not only align with the findings of Toquero (2021) and Mak, Yang, & Yuan (2023) regarding the importance of digital tools for teacher development but also emphasize the specific requisites for philology teachers. Implementing these strategies requires a mindful approach that considers the constraints of the wartime environment, ensuring that the solutions are not only innovative but also accessible and feasible under the circumstances.

## 5. Conclusions

The research, focused on analyzing the impact of wartime conditions on the professional development of teachers-philologists, revealed the profound challenges faced by teachers of this specialization. The study showed that the crisis conditions require not only adaptation to the new realities of education but also the use of innovative approaches to ensure the effectiveness of the educational process.

Despite the difficulties, there are methods of adaptation that allow teachers to maintain and develop their professional skills even during the war. First and foremost, it is worth noting the importance of access to online resources and platforms that open up the possibility for teachers to acquire knowledge independently through various training materials and courses. In addition, online interaction through social networks and forums is becoming increasingly essential in the formation of professional communities, which facilitates the exchange of experience, information and mutual support between colleagues. Adaptive professional development programs, such as webinars and online seminars, also play a significant role, allowing teachers to enrich their knowledge and skills while minimizing time and resources.

Digital technologies play a crucial role in supporting the accessibility of language education by offering tools for distance learning and self-education in conditions of limited access to traditional educational resources. However, the use of these tools requires teachers-philologists not only to master new technologies but also to develop the skills of their effective application in language teaching. Innovative teaching methods, such as interactive exercises, online discussions, and project-based learning, are becoming key tools for motivating students and engaging them in active language learning. At the same time, wartime conditions place specific demands on the content of education, emphasizing the importance of critical thinking, cultural awareness, and intercultural communication.

An important aspect for countries going through a wartime period in their history is not only the restoration of physical infrastructure but also the integration of the experience gained during the war into the development of innovative teaching methods and professional development of teachers-philologists. Interdisciplinary cooperation and exchange of experience between philologists, psychologists, technologists and representatives of other fields of knowledge can contribute to the development of effective programs that meet the needs of modern society.

Taking into account the aforesaid, further researches should be aimed at studying the effectiveness of specific innovative methods in language teaching, developing integrated professional development programs for teachers-philologists, including psychosocial support, development of stress resistance and adaptation to post-war realities. It is also necessary to pay attention to creating conditions for the development of intercultural competence, which is an integral part of modern language education, especially in the context of globalization and international integration.

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Revista de Tecnología de Información y Comunicación en Educación • Volumen 18, N° 1. Enero-marzo 2024

Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.17

Cómo citar:
Benkovska, N., Kharchenko, N., Kulbach, L., Rabokorovka, G., & Bolotnykova, T. (2024). Analyzing pedagogical strategies for personalized learning to compensate for students' learning losses. Revista Eduweb, 18(1), 235-244. https://doi.org/10.46502/issn.1856-7576/2024.18.01.17

# Analyzing pedagogical strategies for personalized learning to compensate for students' learning losses

## Analizar estrategias pedagógicas de aprendizaje personalizado para compensar las pérdidas de aprendizaje de los estudiantes

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Recibido: 19/12/23
Aceptado: 15/03/24

**Abstract**

The article is a comprehensive study of current methods and approaches used in modern educational practice to support students facing educational difficulties. The purpose is to analyze the effectiveness of individualization and personalization of the educational process in restoring educational losses. The literature review allows us to cover the existing theoretical frameworks of individualization and personalization in education. The analysis of pedagogical practice includes case studies and expert interviews, which provides an overview of successful strategies in real educational scenarios. The article presents a literature review, including current trends in individualization and personalization of education.

In addition, the authors analyze pedagogical strategies to improve the level of learning. The study identified pedagogical strategies to compensate for students' educational losses, including differentiation of instruction, use of technol ogy, individual counseling, portfolio and self-assessment, flexible assessment methods, individualized curricula, team learning, and a feedback system. The study includes an analysis of the effectiveness of technological innovations integrated into the educational process, as well as the role of socio-cultural aspects in the successful implementation of individualized approaches, and contains a statistical analysis of the collected data. The results of the study provide practical recommendations for the implementation of successful strategies in educational institutions.

**Keywords:** Individualization, personalization, educational losses, pedagogical strategies, educational process, education applicants, technologies in education, statistical analysis.

## Resumen

El artículo es un estudio exhaustivo de los métodos y enfoques actuales utilizados en la práctica educativa moderna para ayudar a los estudiantes que enfrentan dificultades educativas. El propósito es analizar la efectividad de la individualización y personalización del proceso educativo en la recuperación de las pérdidas educativas. La revisión de la literatura nos permite abarcar los marcos teóricos existentes sobre la individualización y personalización en educación. El análisis de la práctica pedagógica incluye estudios de casos y entrevistas a expertos, que proporciona una visión general de estrategias exitosas en escenarios educativos reales. El artículo presenta una revisión de la literatura, incluidas las tendencias actuales en individualización y personalización de la educación. Además, los autores analizan estrategias pedagógicas para mejorar el nivel de aprendizaje. El estudio identificó estrategias pedagógicas para compensar las pérdidas educativas de los estudiantes, incluida la diferenciación de la instrucción, el uso de la tecnología, el asesoramiento individual, el portafolio y la autoevaluación, métodos de evaluación flexibles, planes de estudio individualizados, aprendizaje en equipo y un sistema de retroalimentación. El estudio incluye un análisis de la eficacia de las innovaciones tecnológicas integradas en el proceso educativo, así como el papel de los aspectos socioculturales en la implementación exitosa de enfoques individualizados, y contiene un análisis estadístico de los datos recopilados. Los resultados del estudio brindan recomendaciones prácticas para la implementación de estrategias exitosas en las instituciones educativas.

**Palabras clave:** Individualización, personalización, pérdidas educativas, estrategias pedagógicas, proceso educativo, aspirantes a educación, tecnologías en educación, análisis estadístico.

## 1. Introduction

In the contemporary educational landscape, ensuring effective learning for every student, particularly those encountering educational barriers, is a critical imperative. Various factors, including interruptions in schooling, individual characteristics, and socio-economic factors, contribute to the accumulation of educational setbacks. Consequently, there is a growing need to focus on pedagogical strategies aimed at personalizing and customizing the learning experience to actively engage students and address their diverse needs. The most effective strategies include the use of technology, learning differentiation, team-based learning, use of flexible assessment methods, etc. Understanding and implementing these strategies are crucial steps towards fostering an inclusive educational environment and ensuring equitable access to quality education for all learners, regardless of their circumstances. Therefore, this study endeavors to identify, evaluate, and explore the practical application of key pedagogical approaches to remedying educational setbacks and fostering educational inclusivity.

**Research goals**:

1. To examine current educational trends, identifying the relevance of individualization and personalization in the context of mitigating educational losses.
2. To analyze various pedagogical strategies designed to individualize and personalize the educational process and evaluate their effectiveness in making up for educational losses.
3. To explore the practical aspects of implementing individualized strategies, including technological tools, assessment methods, and student engagement.
4. To assess the extent to which the proposed strategies contribute to the creation of an inclusive educational environment where each student can maximize their potential.

## 2. Literature review

Shvardak (2022) explores educational trends in the context of the new Ukrainian school, examining current changes and challenges in the education sector. Lytvynova (2020) explores the organization of distance learning during the COVID-19 pandemic and discusses issues related to the organization of remote learning in secondary school. Marienko, & Sukhikh (2022) consider the organization of pedagogical strategies in the educational process under conditions of martial law using digital technologies. Tovstohan et al. (2023) explore leading aspects of the transformation of inclusive educational space in the context of compensating for the educational losses of younger students. Batsurovskaya I. and Dotsenko N. are exploring the technology of acquiring competencies by bachelors of higher educational institutions in a digital media communication environment. Batsurovska et.al. (2021).

In his research, Shyrokov (2021) investigates the learning process in the context of the platformization of the educational process in conditions of distance and blended learning in school. Yastrub (2021) studies current issues of school adaptation for first-graders in the context of modern education. Yatsko (2023) presents an analysis of the elective module in 10th-11th grades of the high school.

Dumitrache, & Dumitraşcu (2014) consider the principle of personalization as the basis for an effective educational process. The authors focus on the individualization of learning and the consideration of students' characteristics. Graf (2023) investigates the role of personalization in adaptive educational environments. The author covers aspects of personalized learning using technologies. Demydenko (2023) dedicated their research to the possibilities of building a personalized educational trajectory using the Moodle platform. The article by Denicheva, O. (2018) is devoted to the individualization and differentiation of learning in developing personality in various educational institutions in Austria.

The article by Quandeng (2023) is dedicated to reviewing the personal learning model and provides an overview of current approaches to personalized learning. Pedagogical aspects and strategies for using open scientific services to improve distance, blended, and family learning in secondary school are presented in the research by Sukhikh (2023). Sakhnovskyi (2013) article focuses on specialized education in Ukrainian schools and the search for a new model. The essence of teaching strategies and approaches to their classification were studied by Olendr, & Tsar (2023). Cyphers (2022) investigated the peculiarities of organizing the educational process in schools in European countries in the face of modern challenges and threats. The article contains the experience of Ukraine.

Balukh (2022) research is dedicated to psycho-pedagogical approaches to the formation of competencies for future teachers of primary classes. The article by Kalaian (2017) focuses on pedagogical approaches to the education of learners in STEM classes. The author considers methods that focus on their active participation in the educational process. The article by Kulsharipova, et.al. (2021) is dedicated to pedagogical management in the practice of managing the educational process in primary school. It analyzes

aspects of organizing and managing learning in elementary classes. Sidanich, & Zvarych (2020) characterize the model for monitoring the quality of educational services in secondary schools.

Ovcharuk et al. (2023) investigate the organizational and pedagogical conditions for the use of the informational and digital environment in general educational institutions. The article by Rybalka (2023) analyzes the philosophy of the lesson as a psychological-pedagogical unit and its impact on the personal development of the education recipient. Shi, & Blau (2020) provide an overview of modern learning theories and pedagogical approaches to ensure the success of all education recipients. The literature review by Thakuri (2023) is dedicated to promoting innovative pedagogical teaching for meaningful learning. Lukianova, & Filon (2023) dedicate their research to intra-subject connections as a means of overcoming educational losses for students in mathematics.

However, the issue of analyzing pedagogical strategies aimed at individualizing and personalizing the educational process in order to compensate for the educational losses of students has yet to be sufficiently studied in the psychological and pedagogical literature.

## 3. Methods

1. *Literature review.* An extensive literature review includes current research, scientific articles, and methodologies for individualizing and personalizing the educational process.
2. *Analysis of pedagogical practices.* This includes case studies, providing an overview of pedagogical strategies for individualization and personalization in real educational institutions. It also focuses on analyzing successful practices and identifying technologies that show high efficiency in leveling educational losses.
3. *Statistical analysis of data.* A statistical analysis of the collected data using appropriate methods, such as calculating the empirical value of $\chi^2$ based on the results of the initial control. This stage will help to identify statistically significant differences and trends in the study results.
4. *Comprehensive comparison of pedagogical strategies.* This stage involves the development of comprehensive comparative analyses of pedagogical strategies, including their effectiveness, adaptability to different contexts, cost of implementation, and level of acceptance by participants in the educational process.
5. *Monitoring the dynamics of students' success.* Implementation of long-term monitoring of the success of students involved in individualized and personalized educational processes.

## 4. Results and discussion

Individualization and personalization of the learning process are essential strategies for compensating for students' educational losses. The following pedagogical strategies aim to individualize and personalize the learning process to recover students' educational losses. Let us analyze them.

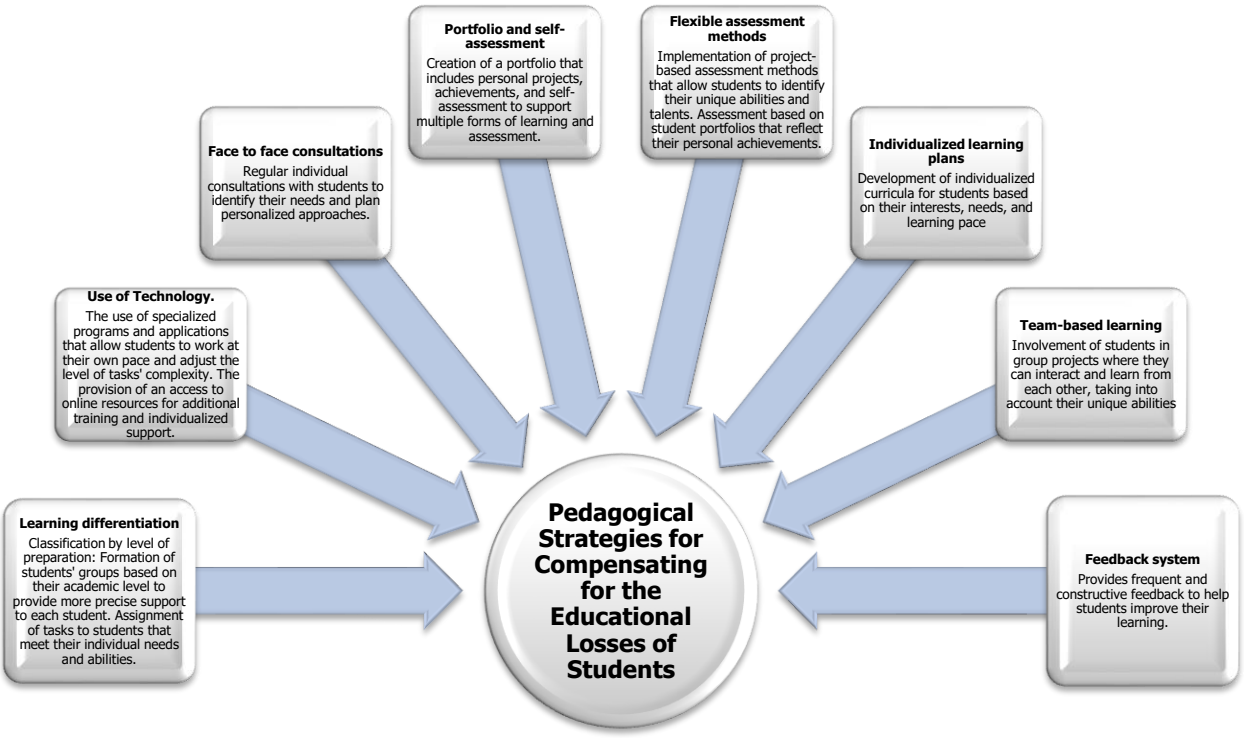


***Figure 1.*** Pedagogical strategies for compensating the educational losses of students.

***Differentiated learning*** is an approach in education aimed at adapting the learning process to the diverse needs and levels of preparedness of students. The main idea of differentiated learning is to provide students with various teaching methods, materials, and assignments based on their individual needs. This approach allows teachers to consider differences in learning paces, styles, and levels of abilities among students. Differentiated learning also involves the use of various assessment methods to evaluate individual student achievements. It creates a more inclusive educational environment where students can maximize their potential. This approach can be applied at multiple educational levels, from elementary school to higher education. It considers each student group's specific characteristics.

***The use of technologies*** focused on individualization and personalization of the learning process becomes an effective tool for compensating for students' educational gaps. Technological tools (for example, educational programs that adapt to individual student needs) help to bridge knowledge gaps and enhance educational levels. Programs based on artificial intelligence can analyze unique abilities and learning paces, providing personalized learning materials. Technologies also enable the creation of interactive educational platforms. They promote a deeper understanding of the material and improve academic performance. A customized approach based on technology can be particularly beneficial for students with different learning styles and levels of preparedness. The integration of modern technologies into the educational process contributes to the development of flexible and adaptive teaching methods, leveling educational inequalities.

***Face-to-face consultations*** become a key element in individualizing and personalizing the learning process to compensate for students' educational losses. Organizing individual consultations allows teachers to more accurately identify the personal needs of each student and develop personalized learning plans. During private consultations, teachers can assess the level of understanding of the material and adjust teaching to the specific characteristics of the student. Such consultations create a favorable environment for discussing difficulties and questions, leading to more effective addressing of educational gaps. Private

consultations may include applying various teaching methods and using additional educational resources tailored to the student's needs. Overall, personal consultations play a crucial role in creating an individualized academic environment, contributing to the successful recovery from educational losses.

***Portfolio and self-assessment.*** The use of portfolios in education promotes the individualization and personalization of the learning process. They allow students to document their educational journey. Systematic self-assessment, included in the portfolio, enables students to consciously evaluate their progress, identify strengths, and determine areas for further development. Portfolios can consist of various materials such as projects, essays, and creative works. They allow students to demonstrate their unique abilities and achievements. The individualized self-assessment, embedded in the portfolio, helps students work more consciously on addressing educational gaps. Creating a portfolio can be adapted to each student's individual needs, supporting their unique learning styles. Overall, the combination of portfolios and systematic self-assessment contributes to more effective tracking of educational losses. It highlights personal achievements and potential.

***Flexible assessment methods.*** The application of flexible education assessment methods aims to individualize and personalize the learning process, considering the diversity of students' needs. Flexible assessment methods allow teachers to adapt assessment procedures to the individual abilities and learning styles of each student. The use of various forms of assessment, such as projects, portfolios, and self-assessment, contributes to a more objective evaluation of students' achievements. Flexible assessment methods support students in the process of tracking educational losses. These methods allow them to demonstrate their progress in a more tailored form. A personalized approach to assessment may also involve considering individual interests and goals and promoting active student participation in the educational process. Flexible assessment methods contribute to tracking educational losses and create incentives for self-development and motivation for students.

***Individualized learning plans*** play a key role in the strategy of individualization and personalization of the education process, especially in compensating for educational losses in learners. Creating individualized learning plans allows teachers to adapt the content and teaching methods, taking into account the level of knowledge, interests, and needs of each student. Individualized learning plans include a flexible learning schedule and a personalized approach to assessment. They promote a more effective process of tracking losses. Learners with individualized learning plans can better cope with educational challenges, as learning is structured considering their unique needs. Individualized learning plans also include mechanisms for regular reflection and adaptation. They allow quick responses to changes in the learning process and the needs of the student.

***Team-based learning*** provides an opportunity for students to work together, taking into account their individual needs. It aims to individualize and personalize the learning process. As part of team-based learning, teachers can use differentiated methods and approaches to meet the unique educational needs of each student. Group learning projects promote mutual understanding, collaboration, and knowledge sharing, which contributes to more effective learning loss management. Collective educational research can become a platform for sharing experiences and mutual support, strengthening individual efforts to overcome educational losses. Teamwork also creates a favorable environment for sharing learning strategies and techniques. This can have a positive impact on the success of learning loss management. Team-based learning focused on individualization contributes to the formation of an inclusive educational environment where each student can contribute to the overall educational achievement.

An individualization-oriented ***feedback system*** is becoming a key tool for compensating for students' educational losses. It allows us to determine their needs accurately. Personalized feedback will enable teachers to assess the academic progress of each student, identify weaknesses, and direct efforts to overcome them. The feedback system can include both formal methods, such as assessments, and a more

informal one, such as discussions and regular conversations with students. Personalized feedback contributes to a deeper understanding of individual student needs, which is vital for effective learning loss prevention. Transparency and dialogue in the feedback system create a favorable environment for discussing improvement strategies and developing personalized education plans. A feedback system focused on individualization stimulates active interaction between teachers and students. It supports their joint efforts to overcome educational losses. These strategies can be successfully integrated to create a supportive and inclusive educational environment that promotes successful coping with students' academic losses.

A pedagogical experiment was conducted during the academic year 2022-2023 to test the effectiveness of pedagogical strategies. These strategies are focused on individualizing and personalizing the educational process in order to compensate for the educational losses of students. The experiment involved students from 3rd to 10th grades in Ukrainian secondary education institutions, totaling 470 students. The experimental group (EG) included 234 students, while the control group (CG) had 236 participants. In the CG, education was conducted using traditional methods.

In the EG, the implementation of pedagogical strategies focused on individualization and personalization of the learning process was planned to address the educational losses of students. Strategies for compensating educational losses included the formation of groups based on students' academic levels to provide more precise support to each student. Additionally, students were given tasks tailored to their individual needs and abilities. The research team used modern technologies. Furthermore, specialized programs and applications allowed students to work at their own pace and adjust the level of task difficulty. Students received an access to online resources.

The school held regular face-to-face consultations with students to identify their needs and plan individualized approaches. The school also implemented a portfolio that includes personal projects and introduced project-based assessment methods that allow students to identify their unique abilities and talents. Individual curricula were developed for students, taking into account their interests, needs, and pace of learning. Students were involved in group projects where they could interact and learn from each other, taking into account their unique abilities. Also, there was constructive feedback to help students correct their performance. The results of the study are presented in Table 1.

**Table 1.**

*The results of implementing pedagogical strategies focused on individualization and personalization of the educational process in order to compensate for the educational losses of students after the experiment: calculation of the empirical value of $\chi^2$ based on the initial control results.*

| Score | Percentage (EG) | Empirical frequency $n_i$ (EG) | Percentage (CG) | Empirical frequency $n_{i1}$ (CG) | $(n_i-n_{i1})^2$ | $(n_i-n_{i1})^2/n_{i1}$ |
|---|---|---|---|---|---|---|
| **12** | 3,85% | 4 | 0,95% | 1 | 9 | 9,00 |
| **11** | 43,27% | 45 | 3,81% | 4 | 1681 | 420,25 |
| **10** | 39,42% | 41 | 8,57% | 9 | 1024 | 113,78 |
| **9** | 37,50% | 39 | 5,71% | 6 | 1089 | 181,50 |
| **8** | 33,65% | 35 | 18,10% | 19 | 256 | 13,47 |
| **7** | 25,00% | 26 | 46,67% | 49 | 529 | 10,80 |
| **6** | 17,31% | 18 | 56,19% | 59 | 1681 | 28,49 |
| **5** | 13,46% | 14 | 56,19% | 59 | 2025 | 34,32 |
| **4** | 10,58% | 11 | 15,24% | 16 | 25 | 1,56 |
| **3** | 0,96% | 1 | 10,48% | 11 | 100 | 9,09 |
| **2** | 0,00% | 0 | 2,86% | 3 | 9 | 3,00 |
| **Total amount** | 100,00% | 234 | 100,00% | 236 | | 825,26 |

The empirical value is $\chi^2$=825,26. The critical value is chosen for the extent of freedom v=10. $\chi^2_{емп} \geq \chi^2_{кр}$ means that there are significant deviations between the distributions. It means that they belong to the zone of significance. It is evident that the introduction of pedagogical strategies aimed at individualizing and personalizing the educational process in order to compensate for the academic losses of students, which was carried out in the context of the experimental group, is promising.

The statistical results can be presented graphically in Figure 2.

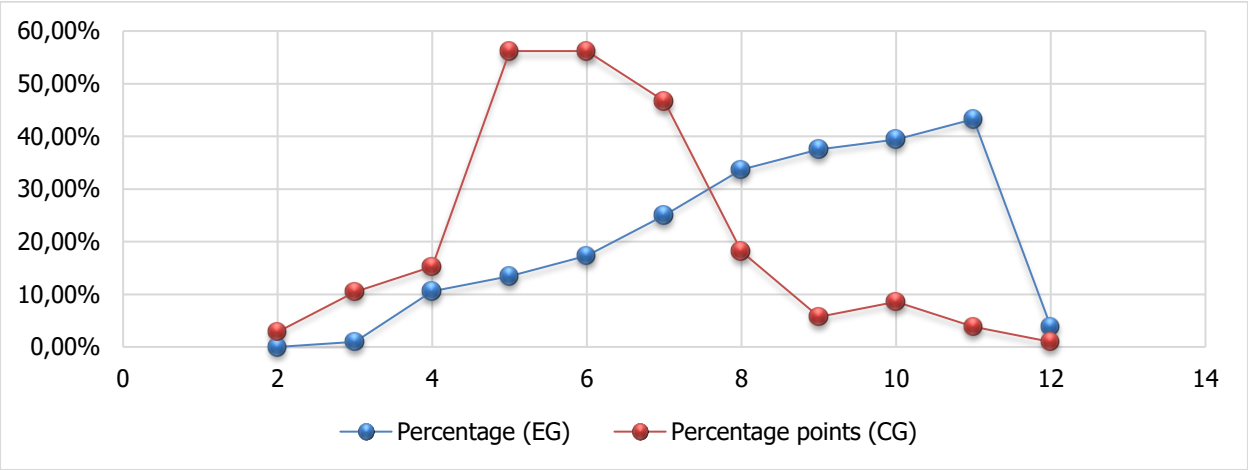


***Figure 2.*** Statistical results of implementing pedagogical strategies focused on individualization and personalization of the educational process in order to compensate for the educational losses of students.

The grades range from 2 to 12 points. This is a wide range, which may indicate a diversity of student performance. Most students received grades between 6 and 11, showing that most students coped with the experiment quite well. The percentage of higher grades (11 and 12) in CG and EG is relatively small (3.85% and 0.95%, respectively). This indicates that the experiment was a challenge for most students. The grades of 3 and 2 are rare, which may suggest that most students coped with the minimum requirements. The percentages in the CG are more variable, especially with low grades. This may indicate differences in the performance of students in the CGs. The most frequent grade is 7, and the percentage of students in CG (46.67%) is significantly higher than in EG (25.00%).

We agree that recent research in the field of education, conducted by Shvardak (2022) and Lytvynova (2020), reveals the current trends and challenges facing modern education. Special attention to pedagogical strategies in the context of the implementation of digital technologies, as shown by the studies of Marienko & Sukhikh (2022), Tovstohan et al. (2023), is an important step in solving the problem of educational losses among younger students. We also agree that the studies of Shyrokov (2021), Yastrub (2021), and Yatsko (2023) reveal key aspects of the adaptation of the educational process to modern realities, in particular, in the context of distance learning and the choice of subjects for study. We partially agree with the articles of Dumitrache & Dumitraşcu (2014), Graf (2023), Demydenko (2023), which emphasize the role of individualization and personalization of learning in the formation of an effective educational process. However, we believe that this aspect can be more deeply analyzed in view of the relationship between individual needs and general educational goals. We do not agree that the problem of analyzing pedagogical strategies aimed at individualizing and personalizing the educational process in order to compensate for the educational losses of students has been sufficiently explored in the psychological and pedagogical literature. This problem remains relevant and requires further research and discussion.

## 5. Conclusions

The analysis of pedagogical strategies aimed at individualizing and personalizing the educational process clearly indicates their key role in successfully building educational links for students. These strategies not only take into account the specific needs of students but also create favorable conditions for their active participation in the educational process. The results of the analysis emphasize the importance of integrating modern technologies into pedagogical strategies. Electronic educational resources, adaptive programs, and online platforms have a significant impact on the creation of individualized learning environments. The balance between freedom of choice and educational standards includes one of the key issues - the need to strike a balance between individual freedom of choice and adherence to common academic standards. Effective strategies should provide students with freedom while maintaining a high standard of education.

The prospects for further research and practice include:
- Additional research on the effectiveness of specific methods.
- The development of new technological solutions.
- Deepening the issues of cultural adaptation of educational strategies.

Overall, the results of the analysis confirm the importance of continuing research in this area to improve the learning process further and ensure equal educational opportunities for everyone.

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Revista de Tecnología de Información y Comunicación en Educación • Volumen 18, N° 1. Enero-marzo 2024

Check for updates

DOI: https://doi.org/10.46502/issn.1856-7576/2024.18.01.18

Cómo citar:
Bidenko, L., Diachuk, L., Ghahrodi, H.L., Krymets, O., & Cherniavska, S. (2024). Project-oriented teaching during learning ukrainian as a foreign languages: development of students' communication skills. Revista Eduweb, 18(1), 245-258. https://doi.org/10.46502/issn.1856-7576/2024.18.01.18

# Project-oriented teaching during learning ukrainian as a foreign languages: development of students' communication skills

## Enseñanza orientada a proyectos durante el aprendizaje del Ucraniano como lengua extranjera: Desarrollo de las habilidades comunicativas de los estudiantes

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Recibido: 04/01/24
Aceptado: 18/03/24

**Abstract**

Perception of professional information is possible due to orientation to different sources that are related to foreign language learning. The study aims to determine the peculiarities of the development of communication skills of students through the use of project-oriented teaching of Ukrainian as a foreign language. Ensuring the development of the set purpose was possible due to the use of the methods of analysis, observation and estimated efficiency coefficient, effect level coefficient, Student's coefficient. Project-oriented approaches to education, oriented to the development of communication skills were developed during the study. They were based on dubbing the disciplines in two languages, formation of theoretical language knowledge, and development of dialogue communication and writing skills. The most positive role of the selected project-oriented teaching was found using SWOT analysis. The practical significance of the work provides for the possibility of the use of developed approaches to studying Ukrainian as a foreign language for the possibility of obtaining communication skills. The perspective of the

study will be oriented towards a comparison of the influence of project-oriented studying of students of different ages with consideration of their possibilities at the beginning.

**Keywords:** Bilingualism, language knowledge, communication skills, dialogue communication, interactive technologies, active student interaction.

**Resumen**

La percepción de la información profesional es posible gracias a la orientación a diferentes fuentes relacionadas con el aprendizaje de lenguas extranjeras. El estudio tiene como objetivo determinar las peculiaridades del desarrollo de las habilidades comunicativas de los estudiantes mediante el uso de la enseñanza orientada a proyectos de ucraniano como lengua extranjera. Asegurar el desarrollo del propósito establecido fue posible gracias al uso de los métodos de análisis, observación y coeficiente de eficiencia estimado, coeficiente de nivel de efecto, coeficiente de Student. Durante el estudio se desarrollaron enfoques educativos orientados a proyectos, orientados al desarrollo de habilidades comunicativas. Se basaban en el doblaje de las disciplinas en dos idiomas, la formación de conocimientos lingüísticos teóricos y el desarrollo de las habilidades de comunicación y escritura en el diálogo. El papel más positivo de la enseñanza orientada a proyectos seleccionada se constató mediante el análisis FODA. La importancia práctica del trabajo prevé la posibilidad del uso de los enfoques desarrollados para el estudio del ucraniano como lengua extranjera para la posibilidad de obtener las habilidades comunicativas. La perspectiva del estudio se orientará hacia la comparación de la influencia del estudio orientado a proyectos de estudiantes de diferentes edades teniendo en cuenta sus posibilidades al principio.

**Palabras clave:** Bilingüismo, conocimientos lingüísticos, destrezas comunicativas, comunicación dialogada, tecnologías interactivas, interacción activa de los alumnos.

## 1. Introduction

Development of the language and cultural variety affects societal change, which is related to additional mobility and communication. Such approaches contribute to the formation of new possibilities for students, which is reflected in self-organisation and self-education. Therefore, current changes should be considered in students' training, which stipulates the relevance of the article.

Qualitative mastering of the studying materials can be achieved through understanding and ensuring active communication with a lecturer and other students (Akhmetova et al., 2023). This approach may be especially expressed due to training foreign citizens. Therefore, lecturers should ensure the development of communication skills, which provides for free communication in foreign languages, during education. Traditional education does not ensure a deeper approach to language studying for foreigners (Mukhtarkhanova et al., 2023). Different project approaches, educational games, and discussions, which contribute to the development of oral and written communication, are more frequently used to ensure qualitative education (Khalilia et al., 2023). It is important to ensure both theoretical and practical development of language knowledge. Obtaining a high level of specific knowledge is possible by ensuring the qualitative inclusion of foreign languages into practical training. In the teaching-learning process, communication skills ensure effective communication, which allows achieving professional competence formation. Communication skills enable ensuring perception of the actual information, and coordination of the received knowledge, which affects achieving certain results (Alhabdan, 2021; Handzilevska et al., 2023). Knowledge of a relevant theme, which influences professional skills formation, may be expanded using communication skills. The efficiency of such an approach depends on the selected educational approach and the teacher’s competence.

It is possible to ensure the development of communication skills during foreign language study through the understanding of studying materials, ensuring grammar accuracy (Slipetska et al., 2023). Such an approach allows excluding even minor mistakes. Formation of correct pronunciation, which contributes to accurate perception of the information heard, and motivation for the perception of new information are also important. The common projects of communication skills development and linear and integrative. The linear project provides for the preliminary development of communication competence before obtaining professional knowledge (Tedeneke, 2022). The integrative project foresees the development of communication skills directly during education, which forms communication competence (Alrashidi, 2022). Foreign language mastering should be based on the development of communication skills, which can be realised through authentic materials use. Hence, it is necessary to ensure an individual approach to education, which contributes to the use of the mother language of students and the perception of studying materials due to foreign language use. The interaction of two languages during education (bilingualism) enables ensuring qualitative perception of studying materials (Saito et al., 2019; Al-Hawamleh et al., 2022). The use of language models enables ensuring not only foreign language improvement but also studying materials mastering. Project-oriented studying allows ensuring a new form of information presentation to achieve higher professional results (Zavaruieva et al., 2022).

The theoretical grounds of the presented theme allowed us to determine that many studies are oriented on the necessity of forming communication competence. It is worth noting that studies consider not only the development of linguistic competence but the system of education in general. The study aims to ensure the development of communication skills of students through the use of project-oriented teaching of Ukrainian as a foreign language.

Study tasks, set to achieve the presented aim, were:

- development of the approaches to project-oriented education of students with the purpose of studying Ukrainian language as a foreign language for the development of communication skills;
- determination of the level of obtained communication skills of students, using calculation of the efficiency coefficient;
- determination of the study elements, which according to the students were the most influential on the development of communication skills;
- use of SWOT analysis to determine the advantages and disadvantages of the developed project-oriented education.

## 2. Literature review

Globalisation processes influence the necessity of the development of communication skills, which provides for communication not only in native but also foreign languages. To develop communication skills, it is above all necessary to ensure the elimination of the existing problems in education and form strict practical strategies for the development of intercultural communication among students (Zhylin et al, 2023).

Ensuring the development of communication skills in European countries is possible through the formation of interest in the teaching-learning process in students. Professional training should foresee education perception, orientation to students, development of competencies of disciplines integration, and ensuring teamwork. It is necessary to focus on teaching-learning process planning, excluding fear in foreign language learning (for example, public speeches) (Ciuciulkiene et al., 2023). Ensuring an intercultural approach to language learning is possible due to information literacy ensuring. Joint educational space enables ensuring the development of the learning activity and communication competence. Such an approach enables ensuring information exchange, which affects practical skills mastering in the process of studying. Ensuring feedback in the teaching-learning process provides for achieving higher results.

Learning Thai as a foreign language should be based on additional study of Thai culture. Herewith, ensuring development of the communication competence is possible due to digital education, excluding focusing on only traditional textbooks. Intercultural communication can take place due to intercultural expansion, which is related to the use of international programs. It is also necessary to orient to continuous education and ensure a balanced approach (Pimpuang et al., 2023). Foreign language studying can be related to the use of a creative approach, which ensures the development of foreign language communication skills. During the process of studying, it is necessary to ensure the specific algorithm of evaluation of the level of knowledge efficiency of students and develop creativity. The creative approach can be realised by ensuring the performance of creative tasks. First, it is necessary to ensure the study of the theoretical framework, which enables concentration on important social issues, which contribute to communication development (Byram et al., 2023). An effective approach is foreign language studying is the use of mobile and sensor technologies, as it contributes to constant communication between students. The highest results can be achieved by ensuring personal and context support. Digital technologies enable ensuring situated learning, which affects ensuring qualitative communication practice. The process also manifests in the facilitated perception of theoretical material and students' interaction (Hsu & Liu, 2023a).

Ensuring profession-oriented foreign language studying is possible due to ensuring focus on practical activity. Within teaching, it is necessary to ensure a combination of lexical-semantic groups and professional terminology, which facilitates studying materials and memorising. While teaching, it is important to ensure the consistency of material presentation, |which contributes to professional information mastering. It is possible to ensure a more oriented approach to education with the use of digital technologies (Antufieva et al., 2023). Information and communication technologies shall be used for the development of communication skills of students. They contribute to the optimization of the teaching-learning process and ensure detailed analysis of information and its presentation (El Khaymy, 2023).

The literature review showed that the formation of communication skills during foreign language studying is a common issue for the research. Still, gaps in the research are related to the absence of the use of various approaches within one studying process for determination of their efficiency. The possibility of learning Ukrainian as a foreign language is also an understudied issue, as the main focus is given to the English language.

## 3. Methods

### *Study procedure*

The first stage of the study was directed at the development of the project-oriented approach to learning the Ukrainian language as a foreign language. Ensuring the search for non-standard learning mechanisms, which are directed at professional skills development and communication development was provided. The second stage of the study was oriented to the determination of the level of communication skills obtained by students. It foresaw the determination of advanced, intermediate, pre-intermediate and elementary knowledge levels. The second stage of the study was directed at the determination of project-oriented approaches, which had the largest effect on the development of communication among students. The third, final, stage of the study aimed at determining the advantages and disadvantages of project-oriented teaching which was presented within the study. The results were presented with the use of SWOT analysis.

### *Sampling formation*

Sampling formation provided for the engagement of 169 second-year students in higher educational institutions in Ukraine. Students were representatives of Sumy State University and National Technical University 'Kharkiv Polytechnic Institute'. Students did not have a speciality and studied different majors (economic, philological, pedagogical). The main condition of students engaging was being a foreigner, for

whom Ukrainian was a foreign language. Respondents were representatives of Kazakhstan, Poland, Slovakia, and the Czech Republic, who studied in Ukraine. In the beginning stage, the authors planned to engage students in the 4th-5th year of studying. However, these students have already formed their knowledge of a foreign language, which could be incorrectly reflected in the study results.

### *Methods*

For the development of project-oriented studying approaches, the authors first studied available non-standard learning mechanisms. The authors excluded the development of a specific educational program for students, as they studied in different departments and chairs. The possibility of the use of non-standard approaches to learning the Ukrainian language as a foreign language was emphasised. The process of studying foresaw ensuring the use of digital technologies, which were selected among 50 different applications. The selection process included familiarising with the theoretical peculiarities of applications, which included their compatibility with the developed project-oriented approach. During the study, studying was not limited to learning Ukrainian as a foreign language exclusively. The possibility of its use while studying other disciplines was also considered.

The use of observation methods by the lecturers was foreseen to determine the level of communication skills obtained by students. This enabled the comparison of the beginning level of the communication skills and the level achieved after 6 months of studying. The data received from lecturers were used to calculate the efficiency coefficient, developed by the authors of the study:

$$c^i = j^i \sum_{i=1} \frac{l_i + \frac{y_i}{j^i}}{l_i}, \qquad (1)$$

$j^i$ – conditional grade for the possibility of free discussion of the class theme by students;
$y_i$ – conditional grade for solving specific situations during the teaching-learning process;
$l_i$ – grade for studying material perception and the possibility of varying it.

Determination of the most influential studying approaches, which affected the development of communication skills was conducted by students. The students were offered to use Thurstone-type scales, which provided evaluation with grades from 1 to 5 to project-oriented approaches, which facilitate communication formation. The students had to describe why a certain parameter was more influential than others. Such an approach contributed to ensuring the validity of the results, which excluded receiving incorrect data. Students' data were collected using electronic mail, which enabled tracing information receipt from all students. The received results were used for the calculation of the efficiency level coefficient, developed by the authors of the study:

$$b^n = \frac{r^n + l^m}{0{,}5 * s^n}, \qquad (2)$$

$r^n$ – level of certain studying approach perception by the students
$l^m$ – difficulty of material learning with the use of the selected studying approach
$s^n$ – the possibility of a separate studying approach, use not only for learning the Ukrainian language as a foreign language, but also for studying other disciplines.

SWOT analysis was used to determine the advantages and disadvantages of project-oriented studying.

SWOT analysis is a subjective method, which excludes any calculations, but is based on actual statements, which contribute to it. This method includes Strengths, Weaknesses, Opportunities, and Threats. The study

of certain aspects has both advantages and disadvantages. The use of SWOT analysis enables the determination of the advantages of one parameter over the others.

### *Data analysis*

Conducted calculations were also confirmed by relevant statistical calculations of the Student's coefficient (Sahrim et al., 2023). The use of the Student's coefficient enabled ensuring substantiated confirmation of the received data. Additional calculations were conducted to determine the level of communication skills obtained by students and the most influential studying approaches. The calculation of the Student's coefficient provides for parameters ratio, if the value does not exceed table one (is equal to 1,895).

$$t = \frac{M_1 - M_2}{\sqrt{m_1^2 + m_2^2}} \qquad (3)$$

$M_1$, $M_2$ – average divergence of parameters;
$m_1$, $m_2$ – average deviation of parameters for comparison.

### *Ethical criteria*

Ethical norms included compliance with the accuracy of the information provided, which excluded presenting information, unrelated to the study. The authors confirm the credibility of the received data, which was confirmed with the relevant calculations (National Research Ethics Committees, 2019).

## 4. Results and discussion

The authors have developed a project-oriented approach for the development of communication skills as a result of learning Ukrainian as a foreign language. Project-oriented approach lies in the use of a non-standard approach to studying, considering the combination of native and Ukrainian language as a foreign one (Figure 1).

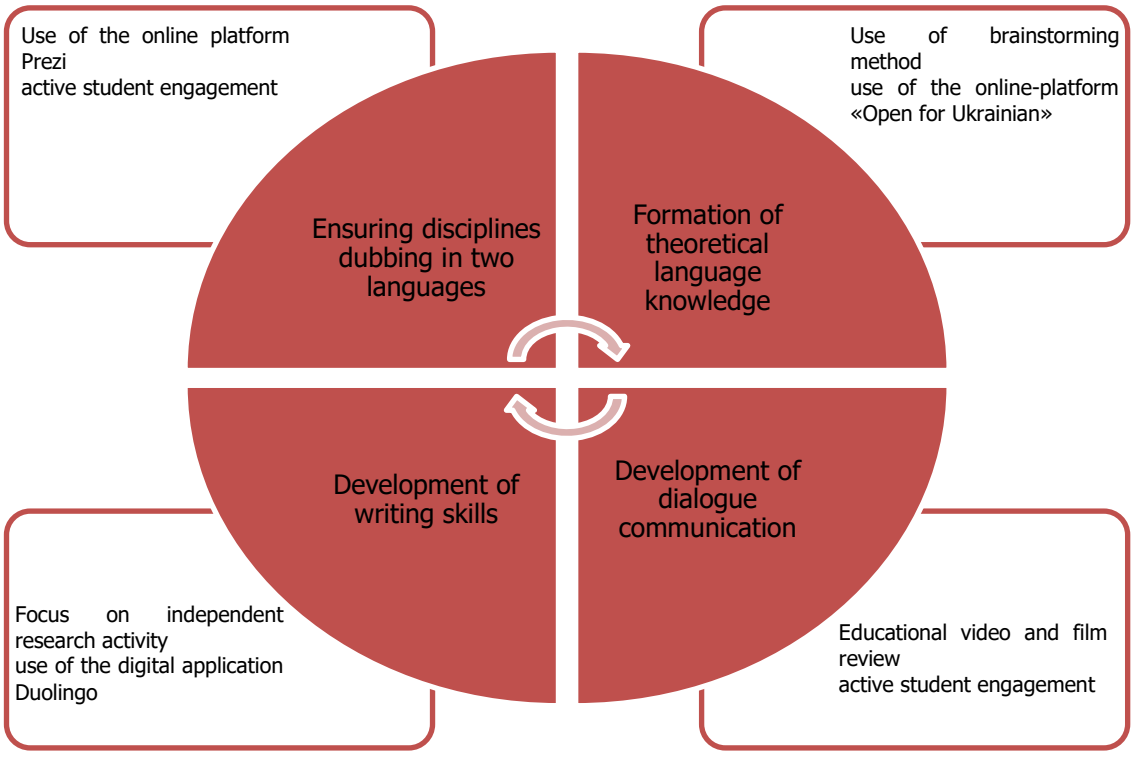


***Fig. 1.*** Project-oriented approach for learning Ukrainian language as a foreign language.

During the studying process, ensuring the creation of the linguistic environment which involves dubbing of all disciplines in two languages was provided. Bilingualism was used to ensure an understanding of educational information, which enabled ensuring deeper understanding of the specific theme. For this, the interactive technologies use, which facilitates the meaningful perception of information, was foreseen. The use of the online platform Prezi enabled ensuring active student engagement in studying, and teamwork, which affects development of the communication competence. Presentation displaying in two languages and their commenting in Ukrainian was oriented on ensuring better information perception, which contributes to its learning. The use of the research method, which lay in additional information search, which contributes to the profound study of the theme was provided in the teaching-learning process. Paying detailed attention to the issue influences the absence of the necessity of intentional terminology memorising, which excludes conscious theme perception.

Formation of theoretical language knowledge involves studying rules, which manifests in understanding peculiarities of the formation of words, morphological and word-composing materials. The studying process also involved ensuring syntactic material studying. It was also directed at studying approaches to composing simple and complex sentences. Formation of theoretical language knowledge involved the development of interaction between students, which foresaw discussing the studied material. The use of the brainstorming method contributed to discussing studying materials, which facilitated students' socialisation and meaningful perception of the studying materials. The online platform 'Open for Ukrainian' was used to enhance the quality of theoretical language knowledge. The platform's use enabled ensuring the use of audio recordings, presentations, and quizzes for better visual information perception.

The development of dialogue communication involved the interaction of students with each other and influenced the solution of the programmed situation. Dialogue communication involved video and film review, which contributed to the development of documentation and dialogue thinking. The approach

affected ensuring logical thinking in the process of interaction with other students and lecturers, which facilitated learning the Ukrainian language. This enabled an understanding of professional terminology and communication on a separate social theme. While studying students could receive feedback which affected motivation in learning a foreign language. Dialogue communication was focused on the possibility of practical application of the received knowledge. Dialogue communication was directed at ensuring grammar accuracy in a foreign language environment, which contributes to understanding language rules. Dialogue communication ensures the possibility of own opinion expression, using standard specific language means.

The other important element was the development of the writing skills of students, which involved the development of creative skills. The use of independent research activity for studying a particular theme was involved during studying. In this stage of studying their realisation was oriented on writing compositions on the studied theme. Herewith, it is worth considering consistency and logic of writing, considering following language rules. Development of writing skills was oriented on ensuring skills of mastering different information for the possibility of ensuring free variation in the Ukrainian language by students. This allowed students to correctly understand the meaning of every word and use it depending on the context. Development of writing skills is of significant importance for practical knowledge formation, which is reflected in communication skills, based on the correct word usage. Digital application Duolingo, which provided learning Ukrainian language as a foreign language was also used in the studying process. The studying process has a game form, which motivates students to new achievements.

Final control of the students enabled determining the level of communication skills achieved by students. The results were received after five months of studying (Figure 2).

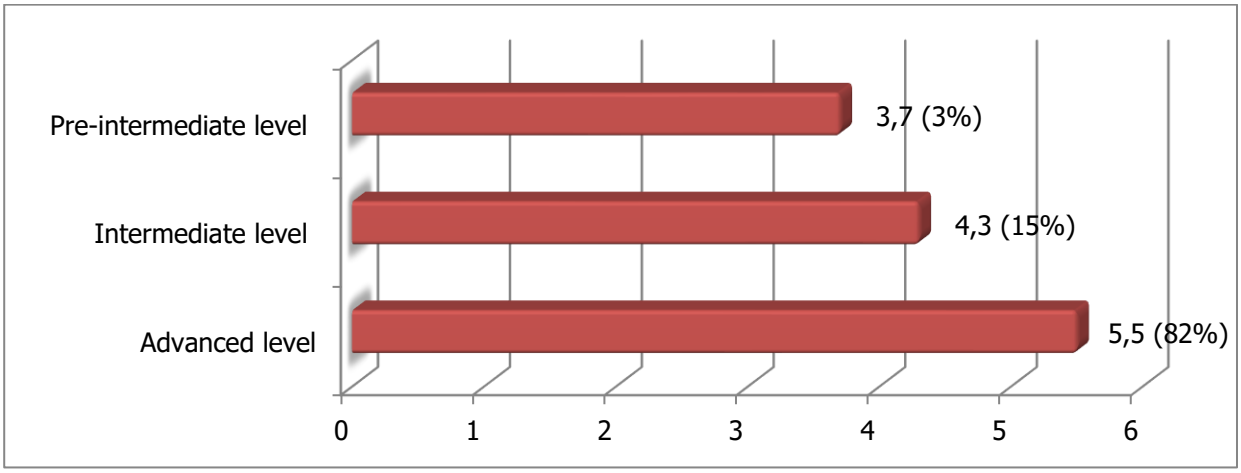


***Fig. 2.*** The level of communication skills of students, which were formed in the studying process, t: advanced - pre-intermediate: 1,954; advanced - intermediate: 2,037; pre-intermediate - intermediate: 1,821.

The students were found to achieve an advanced level of communication skills, which was observed in free communication in the studying process and interpersonal communication. This also affected thinking flexibility, ability to work in a team, and confidence in education. An advanced communication level was achieved by understanding professional information and the ability to vary it. Students' initiatives, which influenced professional knowledge expansion, contributed to this. This also manifested in the possibility of communication skills application during public speeches, expressing opinions and keeping the conversation. Students also developed listening skills, which allowed them to correctly perceive studying materials.

Pre-intermediate level of communication skills of students was achieved due to the possibility of solving the task set by a lecturer, with his support in certain stages. At the same time, students took initiative while studying.

An intermediate level of communication was achieved among students, who could not freely express their thoughts, which influenced their inner self-disclosure. Such students also did not actively participate in discussions.

The element of project-oriented teaching which influenced the development of communication skills the most was also studied during the study (Table 1).

**Table 1.**
*Determination of the most influential element of project-oriented teaching on the development of communication skills*

| Element of project-oriented studying | Influence level | Student's coefficient |
|---|---|---|
| **Interactive technologies use** | 3,6 | Interactive technologies use - Active student engagement: 0,938<br>Interactive technologies use - brainstorming: 0,817<br>Interactive technologies use - independent research activity: 0,842<br>Interactive technologies use - video and film review: 0,759 |
| **Active student engagement** | 3,7 | Active student engagement - brainstorming: 0,861<br>Active student engagement — independent research activity: 0,863<br>Active student engagement — video and film review: 0,979 |
| **Brainstorming** | 3,3 | Brainstorming — independent research activity: 0,731<br>Brainstorming — video and film review: 0,894 |
| **Independent research activity** | 3,3 | Independent research activity — video and film review: 0,927 |
| **Video and film review** | 3,4 | |

During the study, we found that all the elements of project-oriented studying influenced the development of communication skills. A partial advantage was observed in the mechanism of active student engagement, as the presented mechanism contributed to the meaningful approach to information learning and understanding foreign languages.

Interactive technology use also has advantages, as it contributes to the elimination of gaps in knowledge due to constant knowledge evaluation. Interactive technologies ensure visual information perception, using bilingualism methods. Interactive technologies are a qualitative studying element, which contributes to active engagement in the studying process, work on the studying project, teamwork, etc.

Educational video and film review contributed to the development of communication skills, as it ensured the use of bilingualism approaches. This enabled a meaningful approach to the perception of the Ukrainian language as a foreign language, which expanded the possibilities of its use.

Independent research activity and brainstorming methods have approximately similar influences on communication skills formation. This is related to the possibility of solving different tasks, which involve active interaction of students with each other and lecturers. These approaches also reflected in the formation of creative thinking, which enabled enhancing the professional competence of students.

In the final stage of the study advantages and disadvantages of project-oriented teaching of the Ukrainian language as a foreign language were found. The results were received due to the use of SWOT analysis (Table 2).

**Table 2.**
*Analysis of project-oriented teaching of Ukrainian language as a foreign language on the basis of SWOT analysis*

| Strengths | Weaknesses |
|---|---|
| Contributes to a more detailed study of a certain theme<br>Ensures active interaction between the students<br>Contributes to the use of innovative studying approaches<br>The use of bilingualism while teaching students leads to better material mastering. | Necessity of Active student engagement in the studying process<br>Use of a large period of time for one theme preparation<br>Student's passivity in relation to new material perception |
| **Opportunities** | **Threats** |
| A student forms skills of free communication in the professional sphere based on the studied material.<br>It contributes to revealing the creative potential of students, which affects fluency in professional material. | The absence of mechanisms of lecturers training to ensure a qualitative studying process.<br>The absence of knowledge of a certain aspect of a foreign language, that influences correct language understanding. |

Study results show that the use of project-oriented studying has a positive influence. Present weaknesses and disadvantages can be eliminated by ensuring a substantiated approach to planning both the teaching-learning process and a separate theme. The positive role of such an approach lies in ensuring the possibility of expanding knowledge in a separate discipline, orienting on foreign language studying. This enabled the perception of educational information from different resources.

An authentic educational environment can be used to ensure learning English as a foreign language. It can be realised with the use of augmented reality technologies. These technologies contribute to ensuring multi-modal support, which satisfies the individual needs of students. According to the developed study program, the focus was on the development of communication skills. The studying materials should be related to a combination of educational theories (Hsu et al., 2023b).

The use of mass open online course enabled interaction between students, which facilitates solving specific tasks. The process of studying involved ensuring a more profound study of the theme, which involved the use of digital technology Selenium. The depth of the theme learning influences the use of new technology, which contributes to studying efficiency (Li et al., 2023). The use of games ensures the learning of a foreign language, as it facilitates and influences cultural awareness. The positive role of the gaming approach is related to expanding the vocabulary through active cooperation. The process ensures the development of students' motivation, which ensures critical thinking formation. The game format ensures the development of situational exercise, which affects the possibility of new material memorising and active participation of students (Diachenko et al., 2022). Interactive technologies in education were used in our work. The focus was also made on dubbing disciplines in two languages, the formation of theoretical language knowledge, and the development of dialogue communication and writing skills.

As the result of a comparison of individual pedagogical and social normative education, the advantages of the second were found. Orientation to socialisation ensures the development of communication skills. Communication skills ensure easy interaction with other students, which contributes to a better understanding of the studying materials. It also enables ensuring the clarity of one's own opinion expression, which provides thinking flexibility (Herrmann-Israel & Byram, 2023). Ensuring foreign language learning is possible due to orientation towards information, which reflects folk nature. Their efficiency lies in the formation of the correct communication strategies, which affects expression and diction. For example,

studying tales contributes to learning different phrases, which facilitates the memorization of new words. Such an approach also affects the understanding of linguistic values (Pimpuang & Yuttapongtada, 2023). The principles of integrated education became common in different countries of the world, which has ensured the development of communication competence while learning a foreign language. Integrated education ensures the development of cognition and foreign culture. Cognitive skills contribute to a more detailed understanding of disciplines, which is related to social factors (Campillo-Ferrer & Miralles-Martínez, 2022). In the presented works, the focus of the studies was on ensuring integrated studying, which affects the understanding of a foreign language. In our work, we found not only the advantages of such studying but also determined the weaknesses in the teaching-learning process.

Learning Ukrainian as a foreign language causes the biggest difficulties in mastering phonetic aspects of the language for Chinese students. The results are related to different typologies of Chinese and Ukrainian languages, which manifests in the wrong pronunciation of Ukrainian sounds. To eliminate difficulties, the authors have developed the program, which contributed to the automation of studying, which provided for studying the rhythmic theory and socio-cultural peculiarities (Morhunova et al., 2023). Competence-oriented studying ensures the development of communication skills due to rethinking approaches to foreign language teaching. The use of a situated approach in studying ensures the creation of real-like situations for students. This is reflected in interaction with representatives of different cultures, which affects the development of communication competence (Red'Ko et al., 2023).

Comparison of published articles with our work demonstrated significant differences in the studied material. The published works were mainly directed at the use of digital technologies in education or orientation toward cultural differences, which contributes to learning new words. The efficiency of the developed project-oriented approach to learning the Ukrainian language as a foreign language for the development of communication skills was determined in our work. Based on the specific studying approaches, the influence of the most significant factors on communication skills formation was determined. The strengths and weaknesses of the proposed approach were detected using SWOT analysis.

### *Limitations*

Limitations of the work are related to the engagement of the students of only one year to the study. This does not allow tracing the dynamics of the influence of developed project-oriented mechanisms on the formation of communication skills among different groups of students. However, limitations are not significant under the conditions of this study. Participation of students of different specialities in the study enabled receiving correct data concerning the efficiency of the study for the development of communication skills.

### *Recommendations*

Project-oriented studying ensures a positive influence on students, as it considers their previous knowledge and possibilities. Such an approach on the basis of different mechanisms has a positive influence on the achievement of the required knowledge level. This affects students' motivation to study.

## 5. Conclusion

The previously presented aim was achieved by the authors in the process of the study. The development of project-oriented approaches to learning the Ukrainian language as a foreign language enabled studying their efficiency for the development of communication skills. The process of studying provided for the dubbing of all disciplines in two languages. The use of the online platform Prezi contributed to the conduction of this stage of the study, which influenced the meaningful perception of the theme. The formation of theoretical language knowledge was oriented on learning language rules and the development

of interaction between students. The development of dialogue communication ensured the possibility of expressing one's own opinion, with consideration of grammar accuracy in foreign language communication. Writing skills development was formed in particular by the use of the Duolingo application. This expanded practical knowledge in foreign language competence.

Such an approach to studying was found to contribute to achieving an advanced level of communication skills in 82% of students. The studying process has a positive influence due to the use of different approaches which contributed to the development of foreign language competence and understanding of a separate discipline. The study found that the development of communication skills was possible due to the active engagement of students (3,7), and interactive technologies use (3,6). Video and film review (3,4), brainstorming method (3,3), and independent research activity also had a positive influence (3,3). This is related to the possibility of conscious information perception, which expands professional skills. Conducted SWOT analysis enabled the determination of the strengths of the developed project-oriented approach, which is the possibility of ensuring a more detailed study of the studying materials. It also contributes to active interaction among students, the use of innovative approaches, application of bilingualism in the process of studying for better material mastering. The weaknesses are not significant, and their elimination is possible with the use of organised studying strategies.

The practical significance of the study is related to the extension of possibilities for learning the Ukrainian language as a foreign language due to the use of project-oriented approaches. Perspectives of further research should be directed to studying possibilities of formation of approaches to the development of foreign language competence in elementary school students and senior students.

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ONLINE ISSN: 2665-0223
PRINT ISSN: 1856-7576