# Enhancing the professional competencies of future teachers through practice in schools

## Mejorar las competencias profesionales de los futuros docentes a través de la práctica en las escuelas

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## Abstract

The article aims to explore the development of professional competencies in future teachers through school practice, focusing on its effectiveness. Employing methods such as observation, comparison, and performance coefficient calculations, along with the Whitney-Wilk criterion, the study achieved its objective. It found that practical skill acquisition during school practice is highly effective (42%), enhancing understanding of teaching methods. The authors propose four learning mechanisms to adapt theoretical materials to practical education systems and introduce innovative lesson organization approaches. Interactive technology use in education was facilitated through LearningApps.org, Mova, Mozaik applications, improving communication between learners and instructors. These mechanisms significantly boosted efficiency in future Ukrainian language teachers (64%) and Chemistry/Natural Science teachers (60%). The study results indicate that student skills in independence and innovative thinking were notably developed, impacting the teacher's ability to provide linguistic and communicative functions. This study's

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practical significance lies in its efficient mechanisms that aid future teachers in acquiring practical skills during school practice, reflected in the overall efficiency of trainees across junior, middle, and senior grades.

**Keywords:** adaptation of theoretical materials, communication with learners, differentiation, individualization, innovative approach.

## Resumen

El objetivo del artículo es investigar el desarrollo de competencias profesionales en futuros docentes a través de la práctica escolar, enfocándose en su efectividad. Utilizando métodos como observación, comparación y cálculos de coeficientes de rendimiento, junto con el criterio de Whitney-Wilk, el estudio alcanzó su objetivo. Se encontró que la adquisición de habilidades prácticas durante la práctica escolar es altamente efectiva (42%), mejorando la comprensión de los métodos de enseñanza. Los autores proponen cuatro mecanismos de aprendizaje para adaptar materiales teóricos a sistemas prácticos de educación e introducir enfoques innovadores en la organización de lecciones. El uso de tecnología interactiva en la educación se facilitó a través de aplicaciones como LearningApps.org, Mova y Mozaik, mejorando la comunicación entre alumnos e instructores. Estos mecanismos aumentaron significativamente la eficiencia en futuros docentes de lengua ucraniana (64%) y docentes de Química/Ciencias Naturales (60%). Los resultados del estudio indican que se desarrollaron notablemente habilidades de independencia y pensamiento innovador en los estudiantes, impactando en la capacidad del docente para proporcionar funciones lingüísticas y comunicativas. La importancia práctica de este estudio radica en sus mecanismos eficientes que ayudan a los futuros docentes a adquirir habilidades prácticas durante la práctica escolar, reflejado en la eficiencia general de los practicantes en niveles junior, medio y senior.

**Palabras claves:** adaptación de materiales teóricos, comunicación con los estudiantes, diferenciación, individualización, enfoque innovador.

## 1. Introduction

The development of professional knowledge among prospective educators ought to be rooted in a deliberate methodology that fosters the acquisition of practical skills. The process of training should be integrated into professional activity to cultivate educators of exceptional skill. Achieving this objective necessitates the organization of practical classes for students to gain the necessary experience directly in educational institutions. This approach enables competitive professionals to demonstrate the relevance of their chosen research topic.

The development of students' professional competence through practice in schools of prospective teachers contributes to training a specialist who is focused on innovations in the labor market (Essalih et al., 2023). Accordingly, this is related to the possibility of forming flexibility in students and adaptation to dynamic changes. Lane and Sorby (2022) hold that since the development of practical skills is aimed at finding independent solutions for conducting classes, the format of teaching and learning, so while carrying out their professional tasks, future teachers ensure the development of practical skills due to the individualization of education. Students during their practice should autonomously resolve problematic situations that arise during their lesson, thereby fostering a personalized approach to comprehending practical information (Silva et al., 2023). At school sessions, students modify their means of conveying information and devise novel educational frameworks that subsequently impact their comprehension of the importance of specific assignments. In such a way, students can consolidate the acquired theoretical knowledge in practice, which facilitates the understanding of approaches to their utilization. This method contributes to strengthening of students' proficiency.

The direct acquisition of practical skills among school learners fosters the development of active thinking. As a result, this enables the generation of novel ideas while promoting freedom in decision-making (Kurz, Piva & Bedin, 2019). The approach holds a favorable meaning not only for the prospective instructor, but also for learners with innovative thinking. The utilization of differentiation techniques in education can lead to attaining an elevated level of professional proficiency. Given the above, differentiation pertains to segmenting the pedagogical process into constituent elements. According to Kolesnik et al., (2023), this can be realized due to the distribution of approaches to the presentation of theoretical information for the learners. This can be manifested in the creation of trainee groups to master a separate topic. In this connection Petrovych et al. (2021) maintain that focusing on further discussion in the classroom and the prospective teacher's search for more specialized information that is not in the textbook fosters professional self-improvement of prospective educators, intended to explore novel avenues for their career advancement. As noted by Silva, Silva and Bilessimo (2020), engaging in school-based practice enhances the ongoing education of prospective teachers and facilitates the attainment of more proficient expertise by providing insight into authentic teaching methods.

Upon studying the theoretical material, it was discerned that engaging future educators in practical experiences within schools is a prevalent approach. This method aims to enhance the quality of education and cultivate a comprehensive understanding of the school education system during the training process for prospective teachers. However, examining approaches to the adaptation of learning mechanisms in schools, the development of appropriate methods is not sufficiently disclosed. Hence, the objective of the current study is to discern the most advantageous methodologies for cultivating the professional competencies of prospective teachers via practical experience in academic institutions while considering the efficacy of the school learners' education.

The objectives of the present study were as follows:

- to determine the most favorable approach to ensure the acquisition of practical knowledge by pre-service teachers;
- to develop training mechanisms that will ensure the training of pre-service teachers in the Ukrainian language and Chemistry / Natural science;
- to evaluate the efficacy of the implemented training protocols for pre-service teachers and their learners who have undergone instruction in Ukrainian language and Chemistry / Natural science;
- to reveal the formed skills of pre-service teachers' professional competence as a result of observation during the educational process.

## 2. Literature Review

From the contemporary perspective, it is feasible to ensure the use of academic and vocational training for the future teachers to acquire practical skills. The pedagogical methodology facilitated the formation of self-esteem among prospective educators, as well as enhancing their analytical faculties towards a descriptive-interpretative disposition. According to Martins et al., (2023), the aforementioned approach to learning is an enriching experience that is reflected in the development of professional skills. The development of professional competences during training is of crucial importance for sustainable development during hands-on professional activity. Moreover, it is indispensable for future teachers' formation of professional competences and development of their motivation. The findings indicate that primary school educators exhibit greater proficiency in social and substantive domains, but are less adept in pedagogical expertise. Nonetheless, the favorable impact on cultivating professional competencies facilitates the enhancement of practical skills (Ammoneit, Turek & Peter, 2022). Enhancing the preparation of future educators can be accomplished by fostering hands-on competencies via incorporating the fundamental principles of professionalism in educational institutions. This will facilitate the cultivation of critical thinking skills among prospective teachers, enabling them to scrutinize their pedagogical practices

and assess their efficacy. During the training period, future teachers can acquire knowledge and skills to foster personal growth; the prospective educators will also understand approaches to the development of professional and creative activity (Arbia et al., 2021).

Having probed into the conventional method of preparing prospective educators, certain competencies proved challenging to attain. The findings stem from a study involving 25 instructors, where it was deduced that insufficient pedagogical skills were obtained during their professional endeavors. As emphasized by Aktan, Toraman and Koşan (2021), the knowledge acquired at universities proved insufficient in instilling the necessary managerial aptitudes. The selected system of training future teachers has a direct impact on the students' performance level. To enhance the proficiency of prospective educators, it is imperative to reconsider pedagogical approaches. Simultaneously, significant emphasis must be placed on comprehending the fundamentals of educational process management and fostering teacher autonomy. Urbani (2020) maintains that instruction should prioritize cultivating both formal and informal competencies that will facilitate the learning experience. In order to attain an elevated standard of professionalism, prospective educators must be granted the opportunity to instruct within educational institutions. To facilitate this process, significant emphasis should be placed on refining pedagogical methodologies, enhancing learning modalities and optimizing evaluative techniques. Management strategies ought to concentrate on inspiring the trainees in their academic pursuits - an approach that according to Sabbah et al., (2022) can positively impact the feasibility of integrating digital technologies into the teaching and learning experience.

Employing a creative approach in education fosters the cultivation of vocational expertise and pedagogics. Such an approach facilitates the development of professional skills and didactics. This methodology enables the cultivation of ingenuity, development of pedagogic identity, as well as personal advancement. A creative approach to learning engenders a sense of autonomy, enhances introspection and communication (Meltzer & Schwencke, 2020). Prospective educators must cultivate their creative abilities, attain fundamental literacy, and understand the principles of the learning environment. Drawing from the insights of instructors who have utilized goDesign software, it is feasible to guarantee an exploration for novel approaches in delivering hands-on classes. The use of innovative methods will ensure successful training, focusing on the development of professional competencies (Wright et al., 2020).

A critical takeaway from the conducted literature review made it possible to determine that for the development of professional competencies of prospective teachers it is imperative to prioritize the possibility of using interactive technologies. However, the issues of ensuring future teachers' participation in the educational process at school are addressed by the scholars superficially, excluding the description of particular mechanisms.

## 3. Methods

### Research Procedure

Throughout the present study, the authors distinguished three principal stages. The first stage of the research consisted in comparing different approaches to the acquisition of practical skills by prospective teachers. Among the approaches, the division into the following subsequent groups:

– acquisition of practical knowledge in the conditions of classroom sessions;
– acquisition of practical knowledge in the classroom with further consolidation in schools during pedagogical practice;
– acquisition of practical knowledge mainly in classrooms (70%) and partially during the pedagogical practice (30%);
– acquisition of practical skills in schools.

An evaluation was conducted to determine the efficacy of four different learning methodologies implemented throughout the academic year among prospective educators, who were subjected to these pedagogical approaches. Based on the established results, the second stage consisted in creating learning mechanisms for students to acquire practical skills directly in school institutions. The mechanisms were aimed at future teachers of the Ukrainian language, Chemistry / Natural Science teachers for instructing junior, middle and high school students, which entailed the participation of prospective educators in instructing students at the primary, intermediate, and secondary levels. The mechanisms were aimed at the development of professional competencies of future teachers, in which a greater emphasis was placed on the development of linguistic and communicative competencies, since they enable prospective educators to deliver accurate educational information presentations for effective student learning. They are also aimed at receiving feedback from teachers, which contributes to the continuity of learning and students' understanding of a particular topic. The training program spanned a duration of four months during the year 2023.

The third stage of the research consisted in determining the overall effectiveness of training, the relationship between the level of acquired knowledge of prospective teachers as well as their learners of different grades. At this stage of the research, limitations that may arise in prospective students' learning during practice in schools, were determined. Furthermore, an assessment was conducted to ascertain the proficiency level in professional competencies among prospective educators.

**Formation of the Sample**

Various cohorts of participants were engaged in the research. Cohort 1 (consisting of 56 individuals) comprised prospective teachers specializing in diverse areas, who conducted practical classes in schools. Cohort 2 (consisting of 127 individuals), comprised learners from grades 4 to 10. Their lessons were conducted by prospective teachers and they had undergone this form of instruction for a year alongside the first cohort. The study's prerequisite was that all participants must have completed their training through practical experience in schools across diverse grades of learners.

The second category of respondents comprised students (prospective teachers) and learners who had previously undergone traditional schooling. Cohort 3 was composed of 154 students who graduated from the Balta Pedagogical College, Ternopil National Pedagogical University named after Volodymyr Hnatyuk, and Volyn National University. Further, cohort 4 consisted of junior (3-4 grades; 67 individuals), middle (7-9 grades; 83 individuals), and senior (10-11 grades; 80 individuals) school learners. The sample size for this category was limited due to the lack of students gaining practical knowledge directly in school classrooms. Also, the learners involved in the study were to be enrolled in schooling in accordance with the traditional education system. All learners, as well as their parents gave written consent to participate in the study.

**Methods**

The value of a particular approach to learning for the performance of future teachers and learners was based on the use of a general theoretical observation method (Hyseni Duraku et al., 2022). The comparative approach facilitated the identification of the theoretical strengths and weaknesses inherent in each of the suggested methodologies (Ortogero, Barcarse & Ray, 2022). The performance of students and learners of different grades due to the implementation of a distinct methodology for attaining practical skills by future teachers was also compared. The results were obtained from the analysis of university and school data obtained after a year of training, based on various methodologies utilized in the study.

The development of learning mechanisms provided for the opportunity for prospective teachers to acquire practical knowledge during school classes. The mechanisms were aimed at the possibility of studying the

Ukrainian language and Chemistry / Natural science for learners of junior, middle, and senior school grades. The development of learning mechanisms was based on the identification of the most effective learning approaches drawing upon evaluation of current educational frameworks (Palacios Ortega, Pascual & Moreno, 2022; Myrzatayeva, Almetov & Tazhmukhanova, 2023; Ventista & Brown, 2023; Perrotta, 2023). According to the methodology of Palacios, Pascual and Moreno (2022) provided for the use of STEM technologies, the method of Myrzatayeva, Almetov and Tazhmukhanova (2023) was based on the development of critical thinking, which involved the use of system integration to develop the individual's potential. Drawing upon the methodology of Ventista and Brown (2023), when developing practical skills, it is expedient to focus on both systematic development and professional development. Perrotta's (2023) system is intended to provide ambitious education, which facilitates focusing on the content of the curriculum, the development of research skills. That being said, to implement learning mechanisms, it was also indispensable to involve digital technologies such as LearningApps.org, Mova, Mozaik. With that in mind, to select digital technologies, the functionality of 30 applications was thoroughly examined, which made it possible to choose the most effective ones for the proposed training system.

To address the research objectives, corresponding calculations were made to determine the correlation between the level of attained knowledge of prospective teachers and their learners. Determining the level of practical knowledge gained by the pre-service teachers became possible as a result of calculations of the prospective teachers' effectiveness coefficient, which was elaborated by the authors of the present article (Formula 1):

$$p_t = \frac{r_i + y_i + h_i}{r_i(m-1)}, \qquad (1)$$

$r_i$ – the level of variation of theoretical information in practice;
$y_i$ – level of communication with learners;
$h_i$ – the level of creativity in conducting classes;
$m$ – the overall level of attainable knowledge.

To determine the level of knowledge attained by the prospective teachers, their learners' performance coefficient was calculated. The coefficient was elaborated by the authors of the present article (Formula 2):

$$k_l = \frac{(f|i| + g_i) \times l}{p_{ov}}, \qquad (2)$$

$f_i$ – assessment for understanding the subject;
$g_i$ – homework assessment;
$l$ – diligence coefficient (equalling from 0.1 to 0.3);
$p_{ov}$ – overall performance indicator.

The gaps in the proposed methodology were identified through the examination of the educational system by prospective teachers, thereby enabling the development of strategies to bridge them. Moreover, the observation skills made it possible to identify formed professional competences among future teachers. The level of professional competences was determined as a result of a comparison of learners' primary skills and those acquired after training.

## Data Analysis

To confirm the obtained results and the possibility of conducting an accurate analysis thereof during the study, statistical calculations of the Whitney-Wilk test were carried out (Du Plessis et al., 2023) (Formula 3):

$$U = n_1 \times n_2 + \frac{n_x \times (n_x + 1)}{2} - T_x, \quad (3)$$

$n_1$ и $n_2$ – critical parameters of calculated indicators;
$n_x$ – number of criteria for calculation;
$T_x$ – the reliability of the criteria determined in the table.

The ratio of the criteria will be observed if the calculated indicators are less than the values in the table. If the calculated indicators are lower than the values in the table, in such case they are characterized by the established ratio between them. However, it should be taken into account that the smaller the calculated value of the criterion, the higher the probability that the calculated indicators do not correlate with each other.

## Ethical Criteria

The research was based on compliance with ethical standards in accordance with The Norwegian National Committee for Research Ethics in Science and Technology (2016). The authors confirm the provision of equal conditions for all study participants, which were agreed at the beginning. In accordance with ethical norms, it was intended to preclude any potential infringement upon the interests of all research participants. The authors confirm that these participants gave written consent to participate in the study.

## 4. Results

At first, the most efficacious approaches for acquiring practical skills were distinguished. The research aimed to ascertain how a specific approach influences information perception and attainment of appropriate levels of knowledge (Table 1).

**Table 1**.
*The effectiveness level of different approaches to learning to attain practical skills*

| Variety of learning approaches | Value of learning approach | Performance of future teachers, scores | Performance of learners | Variety of attained professional competencies |
|---|---|---|---|---|
| **Acquisition of practical knowledge in the classroom** | 9% | 3.7 | - | Advancement of memory, creative approach |
| **Acquisition of practical knowledge in the classroom with further consolidation in schools during pedagogical practice** | 18% | 3.9 | 4.2 | Logical thinking, memory advancement |
| **Acquiring practical lessons mainly in classrooms (70%) and partially in practice (30%)** | 31% | 4.3 | 4.4 | Logical thinking, communication, management skills |
| **Acquisition of practical skills in schools** | 42% | 4.7 | 4.6 | Independence, creativity, enhancing comprehension of the authentic pedagogical framework. |

It was established that the most expedient approach to attaining practical skills is to ensure the study of practical skills directly in school institutions. The advantage of the said approach is related to the possibility to ensure active interaction of future teachers with their learners, which Expands to a comprehensive understanding of pedagogical methodologies. The above approach contributes to the inseparability of the educational process with real professional activity. This makes it possible to ensure the integration of the educational process into the existing pedagogical system, focusing on purposefulness, self-actualization, and socialization of students. Furthermore, it ensures the development of individuality of future teachers for professional activities. From this perspective, conducting practical classes in schools has a comparatively greater effectiveness both for prospective teachers as well as for their learners. This is attributable to the potential for transformation and diversification of the pedagogical process, which manifests in the alteration of the educational framework. For instance, when learning a language, trainees can perceive different approaches to learning, which is reflected in their engagement.

The authors believe that the acquisition of practical skills by prospective teachers primarily in the academic setting (70%) and partially in practice (30%) has numerous advantages over academic instruction only. The results are related to the possibility of immersion in the real educational process, which allows to expand the idea of pedagogical activity. Furthermore, conducting partial practical classes at school will enable future teachers to consolidate their understanding of theoretical concepts and explore novel strategies for addressing specific problems. Consequently, conducting practical classes in the classroom has the least effectiveness, since future teachers do not understand the very mechanisms of practically implementing the process of conducting classes. Moreover, it precludes any means of engaging in discourse with students, leading to a lack of comprehension when attempting to tackle some specific issues. While situational modeling can be ensured during in-person instruction, devising effective solutions may prove divergent from theoretical approaches.

Gaining relevant expertise in classroom instruction augmented by practical application during pedagogical training yields benefits over traditional classroom-only learning. However, this educational approach fails to guarantee a practical comprehension of any given subject matter. This deficiency is manifested in the overall grasp of teaching fundamentals within the school system. The efficacy of this approach is limited as it solely fosters a general comprehension of the pedagogical process, failing to facilitate an in-depth understanding of the intricacies involved in learning. Furthermore, students' academic performance may significantly deteriorate as they engage in pedagogical practice, which can divert their attention from the subject matter. Similarly, during the adaptation phase, students may encounter distractions that impede their ability to effectively structure lessons owing to a dearth of practical knowledge on the topic at hand.

Since in the conditions of the first stage of the research it was established that the development of practical competences has the greatest effectiveness as a result of school practice. As per findings of the initial stage of the study, it was determined that practical competencies yield maximum efficacy through school-based practice. Therefore, the second stage of the research involved the development of mechanisms to ensure the possibility of learning practical skills in schools. The said mechanisms were aimed at training future Ukrainian language teachers and Chemistry/Natural science teachers. In order to elicit high-quality results from learners, it is imperative to establish a channel of communication between the instructor and a learner. Therefore, the focus in devising mechanisms was geared towards fostering linguistic and communicative proficiency (Figure 1).
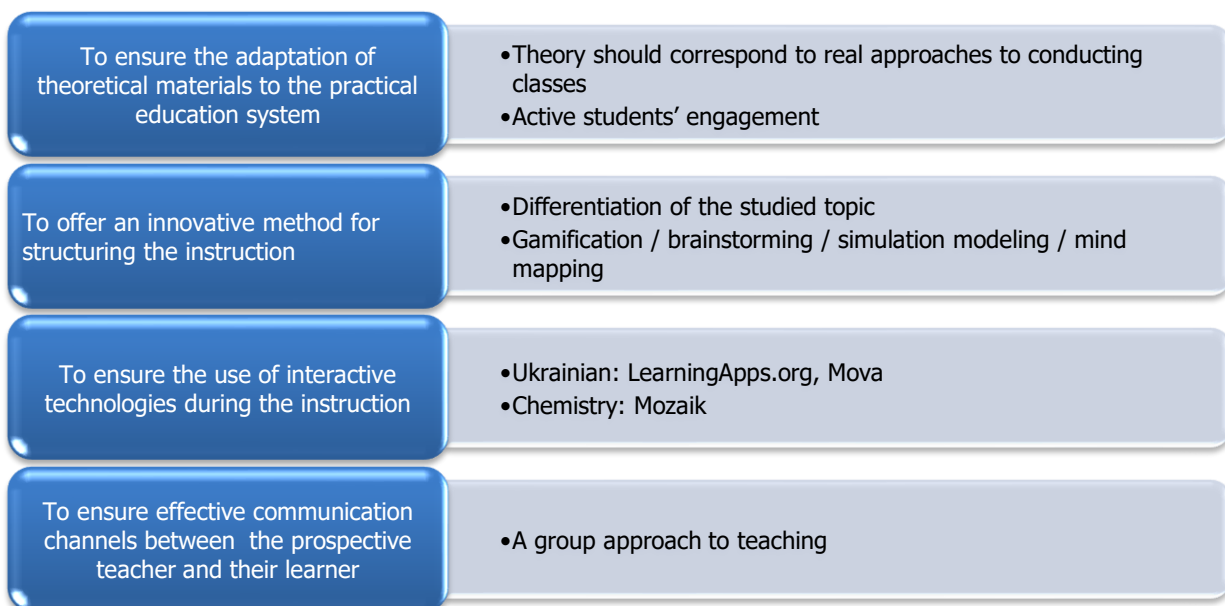
| To ensure the adaptation of theoretical materials to the practical education system | • Theory should correspond to real approaches to conducting classes<br>• Active students' engagement |
|---|---|
| To offer an innovative method for structuring the instruction | • Differentiation of the studied topic<br>• Gamification / brainstorming / simulation modeling / mind mapping |
| To ensure the use of interactive technologies during the instruction | • Ukrainian: LearningApps.org, Mova<br>• Chemistry: Mozaik |
| To ensure effective communication channels between the prospective teacher and their learner | • A group approach to teaching |

**Figure 1.** Mechanisms for training future teachers for the development of professional competencies, including linguistic and communicative.

With all the mentioned aspects, it cannot be denied that in order to enable the development of practical professional competences of future teachers, first and foremost it is necessary to ensure the adaptation of theoretical materials to the practical system of education. The theoretical material presented in classrooms should clearly correspond to real approaches to conducting lessons. The study of the theory should be based on the search for more detailed and in-depth information. This will foster gaining more professional knowledge, delving deeper into the existing laws and exceptions in the Ukrainian language or in Chemistry / Natural science. Consolidation of theoretical knowledge should draw upon the active involvement of the trainees, which opens up opportunities for independent learning. Furthermore, it is expedient to ensure the development of interpersonal relationships, which will allow the elaboration of group work principles. Accordingly, this is aimed at the development of language and communication competence, since the presence of a theoretical base will allow to ensure productive communication between learners and teachers.

Before commencing to acquire professional skills in practice, future teachers should determine an extraordinary approach to the organization of lessons. This will make it possible to form learners' interest in studying the material and ensure compliance with linguistic and communicative competence. The learning process can be based on differentiation regarding the study of a specific topic. This can consist of dividing a single topic into additional subtopics that can be studied by different groups of learners. During the training process, it is feasible to implement a gamified approach that can effectively identify a select cohort of learners who achieved a more profound understanding of the subject matter. Moreover, it is expedient to ensure the possibility of visualizing the learned information, for instance displaying experiments in Chemistry or studying the rules of the Ukrainian language. This will also allow students to develop their thinking and creativity as a result of adapting the source information to an innovative learning approach. A lesson rooted in fantasy has the capacity to enhance the trainees' engagement with learning, thereby promoting their comprehensive understanding of a specific issue. Simulation modeling will allow to provide individualization in the subject for the study of the problem-oriented tasks. Such lessons are bound to form the extraordinary thinking of learners and students who have to respond professionally to the former questions, thus enhancing their competence or practice mind-mapping which is an interactive way

to learn information. The process is based on the memorization of a specific topic due to the creation of interactive approaches that are better perceived by learners in a video image than in spoken words.

Future teachers should be provided with the possibility of conducting lessons with the help of interactive technologies. Digital technologies can serve as a means for both the acquisition of theoretical knowledge and the facilitation of hands-on instruction. It is expedient to ensure the use of the most relevant technologies, which will allow to eliminate problems in education, will ensure intrapersonal connections. Furthermore, digital technologies will make it possible to form an inseparable connection between future teachers and students to master certain topics, practising communication skills, receiving feedback. Digital technologies should eliminate tension in learning, and be aimed at activating thinking, individualizing learning. Given the above, it is feasible to ensure the use of the interactive resource LearningApps.org while learning the Ukrainian language. The resource is aimed at the possibility of creating interactive tasks, which help to conduct classes in a gamified format. The digital resource contributes to the consolidation of knowledge and the formation of engagement in learning. Using the Mova application will allow perceiving the rules of spelling, study idioms, synonyms, exceptions to general rules, etc. The study of Chemistry can be based on the use of the Mozaik software complex, which allows learners to focus on digital and 3D lessons. The application allows the use of various tools for creating lessons, screening videos and educational images, which contributes to the visual perception of the subject.

By adopting a group-oriented approach during classes, it is feasible to facilitate communication between learners and their instructors. This can be manifested in the discussion with the teacher of a relevant topic that forms the linguistic and communicative competence of future teachers. Additionally, providing a personalized approach to each student, discussing the topic with each student will allow the prospective teachers to form a strong bond. Consequently, this will allow students not to be afraid to seek for help from their instructors when solving individual tasks. Further, the participants of the educational process will freely express their opinion, which will assist in increasing the effectiveness of the educational process.

Further, the work determined the relationship between the level of acquired knowledge of students and learners of junior, middle, and senior grades. The results were obtained as a result of calculating the training effectiveness coefficients of future teachers and learners. Calculations of the Whitney-Wilk test were used for comparison (Table 2).

**Table 2.**
*Training effectiveness of teachers and learners of different grades after the practice*

| Indicator of the attained knowledge level | The attained knowledge level of future teachers of the Ukrainian language | The attained knowledge level of future teachers of Chemistry/ Science | Junior learners | | Middle school learners | | Senior learners | | $U$ (0,4920 – tabular value) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Ukrainian | Science | Ukrainian | Chemistry | Ukrainian | Chemistry | |
| High | 0.75 (64%) | 0.73 (60%) | 0.6 (57%) | 0.57 (46%) | 0.58 (47%) | 00.54 (48%) | 0.6 (53%) | 0.53 (43%) | 0.1389 |
| Sufficient | 0.6 (31%) | 0.61 (34%) | 0.43 (35%) | 0.44 (44%) | 0.41 (42%) | 0.48 (38%) | 0.43 (39%) | 0.41 (47%) | 0.1926 |
| Average | 0.52 (5%) | 0.48 (6%) | 0.31 (8%) | 0.33 (10%) | 0.37 (11%) | 0.32 (13%) | 0.39 (8%) | 0.36 (10%) | 0.2375 |
| Low | - | - | - | - | - | 0.21 (1%) | - | - | - |

It was established that after completing the school practice, future teachers of the Ukrainian language and Chemistry / Natural science were mostly able to achieve a high level of knowledge. This is related to the acquisition of the necessary professional skills as a result of conducting practical classes during the pedagogical school practice. Students were able to acquire knowledge on the intricacies of educational process administration, understood the mechanisms of interpersonal communication among students to facilitate the facilitation of instructional sessions. Moreover, during practical classes, students were able to vary the acquired theoretical knowledge, which affected the quality of the educational process. Accordingly, high scores were obtained by the majority of schoolchildren as a result of ensuring a well-thought approach to learning. The use of digital technologies allowed the learners to achieve the highest level of knowledge. The most advanced comprehension of the Ukrainian language was achieved by students in the lower grades. This allowed students to master the softening consonant sounds, the spelling of prefixes. During their studies, schoolchildren also gained knowledge regarding word formation, which allowed them to correctly parse words according to their structure (e.g., determining the root, ending, etc.). Middle school students achieved knowledge of the Ukrainian language and Chemistry at an almost equally high level. High school students achieved the highest results when composing dialogues, which was reflected in the correct construction of sentences. The students also gained knowledge about the correct use of punctuation marks in dialogue. While studying Chemistry, students gained the highest level of knowledge as a result of examining the valency of chemical elements, which was reflected in the possibility of composing chemical formulas. Also, the learners mastered the skill of creating ion exchange reactions. Likewise, high school students were able to achieve higher mastery of the Ukrainian language as a result of writing essays on the given topics. A small number of future teachers demonstrated average performance, which had a corresponding effect on the performance of the learners.

During the study, the authors identified limitations that may affect the overall approach to learning. Also, these restrictions are aimed at the possibility of ensuring the development of linguistic and communicative competence of future teachers, which contributes to a better approach to the students' mastery of the applicable material (Figure 2).
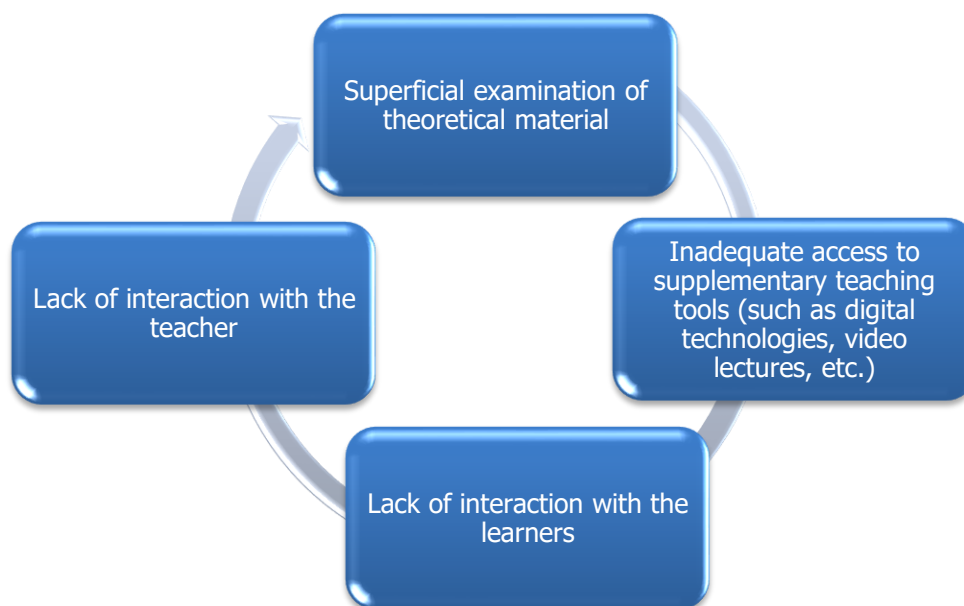


*Figure 2*. Limitations arising during the study of theoretical information by future teachers via direct exposure at school.

The aforementioned limitations can be resolved through proper training organization and detailed comprehension of all educational processes. Furthermore, prospective teachers ought to maintain consistent communication with their colleagues in order to select the most relevant methods for conducting classes tailored to learners' needs.

In the course of future teachers' practice at school, the authors determined what professional competencies they acquired, which are related to the effective development of language and communication competencies (Figure 3).

The results of the study showed that the motivation of future teachers as a result of teaching in schools became a crucial component in the cultivation of professional skills. First and foremost, students developed independence as a result of individualization in acquiring practical skills. Focusing on the independence of future teachers allows to ensure the most advantageous strategies for establishing relevent communication between learners. Innovative thinking is an operational component, which is reflected in the search for non-standard, differentiated approaches to presenting the material, which is necessary for the formation of linguistic and communicative competence. Furthermore, future teachers mastered professional communication skills, which was reflected in interaction with learners of different grades. This skill allowed mastering professional vocabulary for the development of linguistic and communicative competence. In addition, managerial skills were also developed among future teachers, but at a lower level than other professional skills, as during the lessons preparation students were guided by the advice of university professors.
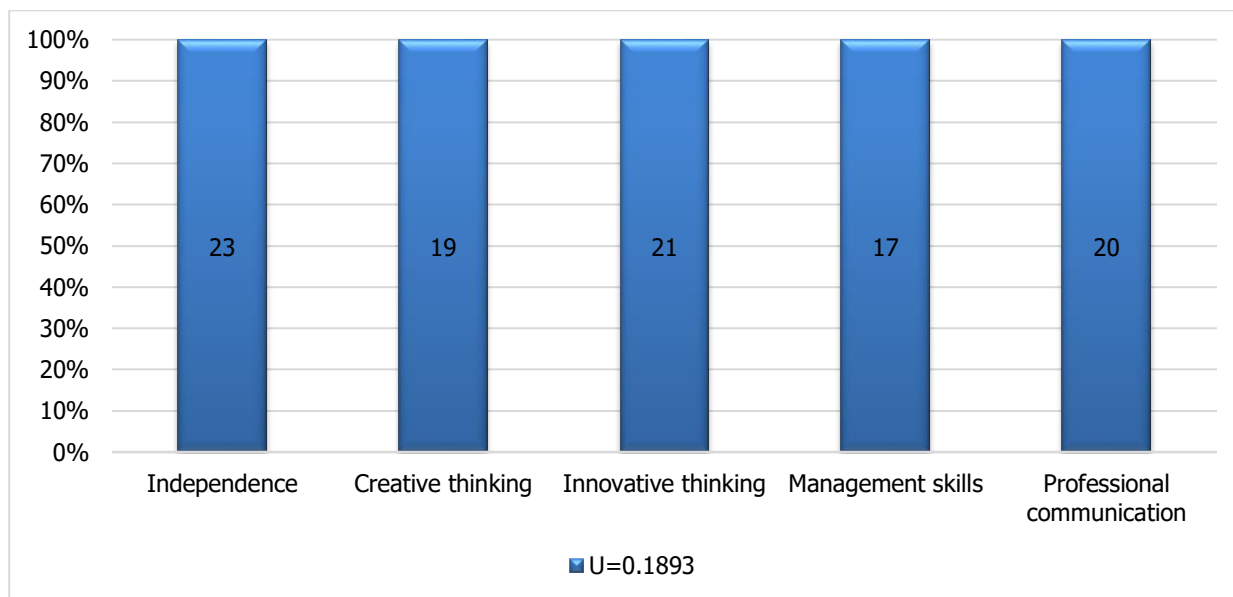


*Figure 3*. Professional competences acquired by future teachers after the practice.

## 5. Discussion

The development of professional competencies of future teachers is possible due to the use of STEM technologies. With the help of STEM technologies, it is possible to ensure a profound understanding of the relevant educational processes, to form the necessary level of skills and thinking. During the training process, it is imperative to rigorously adhere to evidence-based methodologies in order to establish a high-quality learning experience (Zhou et al., 2022). In this light, modeling processes can be used to develop the professional competence of future teachers. The effectiveness of modeling is related to ensuring the possibility of reproducing educational content, understanding the learning process, and ensuring continuous

access to materials. The implementation of modeling in education enables one to direct their attention towards the continual refinement of competencies, as well as the capacity to deliberately oversee the pedagogical procedure (Ammoneit, Reudenbach & Peter, 2023). The formation of practical skills of future philology teachers can be achieved as a result of the use of gamification technologies. Elements of gamification make it possible to develop systematic resources for creating motivating educational strategies. The effectiveness of information assimilation is achieved as a result of utilizing the methods of creative practice-oriented project activity. As emphasized by Petrovych et al. (2023), consistency should be maintained during the training, which will increase student motivation therein. In contrast to the published articles, in our work the emphasis was placed on the use of interactive technologies as one of the efficiency elements. For the formation of professional competences, the authors elaborated four mechanisms that contributed to the acquisition of knowledge of the Ukrainian language and Chemistry / Natural science.

The practical skills of future teachers should be formed as a result of the correct organization of the educational process. This can be achieved as a result of understanding the relationship between pedagogical and technological knowledge, integrating digital technologies into the educational process. This approach will ensure changes in teaching methods, in particular it is expedient to constantly monitor possible changes in education to ensure relevant ways of presenting information (Bedin, Marques & das Graças Cleophas, 2023). During the acquisition of practical skills of future teachers, constant monitoring of the educational process should be ensured. This will allow to identify gaps in knowledge, as well as to identify mechanisms for increasing the future teachers' strengths. The reverse learning methodology fosters the enhancement of cognitive abilities, flexibility, advancement of cognitive retention. and understanding of future teaching strategies. It will also allow to provide interpersonal communication skills, which can impact the enhancement of communication between the teachers and their trainees (Barraza & Rodríguez, 2023). The acquisition of practical knowledge of future educators as a result of teaching in schools can contribute to reducing the gap between the acquired knowledge of pre-service teachers and the curriculum. A positive influence on the development of the education system is formed due to the presence of feedback from the learners, which affects the quality of the educational process. Enhancing the educational process yields a positive impact on the efficacy of professional competencies' cultivation (Orosz, Recino & Ochoa, 2023). In contrast to the analyzed works, in our article the emphasis is placed on choosing the most favorable mechanisms for the development of future teachers' practical skills, focusing on ensuring the efficiency thereof as well as the efficiency of learners.

Acquisition of practical skills of future teachers should be based on innovation and development of creative thinking. Achieving a high level of professional competence is possible as a result of ongoing discussion of the educational process with peer teachers, which will allow choosing the most effective mechanisms. This impacts the comprehension of the theoretical structure, which in turn affects the development of potential value. Moreover, this procedure will manifest in the prospect of establishing systematicity and scientific rigor throughout the educational process (Lane, Mcgarr & Nicholl, 2023). Innovative digital practices contribute to the development of professional skills of future teachers. With their help, it is possible to form awareness in the learning process, which affects the implementation of highly effective learning using active learning tools. A systematic approach to learning will allow the enhancement of professional skills and knowledge, which will be reflected in the pre-service teachers' individual characteristics (Keengwe, 2023). The analysis of literary works revealed that the acquisition of practical skills by prospective teachers can be achieved through knowledge sharing with their peers. The use of digital technologies can also contribute to this process. In our work, emphasis is placed on the possibility of developing professional competencies as a result of acquiring practical knowledge of future teachers via direct classroom exposure, since as a result of our study it was established that such an approach has the greatest effectiveness. During the presentation of the educational material, the future teachers had to ensure the practical implementation of theoretical materials within the educational system, to form an innovative approach to the organization of lessons. Additionally, it was necessary to foster the use of interactive technologies during the shool practice and establish effective teacher-learner communication. Such an approach to education influenced not only

high performance among the trainees, but also contributed to the formation of future teachers' professional competence skills.

## 6. Conclusions

The authors successfully achieved the outlined research objectives. An evaluation of diverse methodologies for obtaining practical skills revealed that future educators were able to acquire such competencies upon conducting classes within school institutions. Such an approach to instruction had the greatest effect on the effectiveness of future teachers (4.7) as well as learners (4.6). This pertains to the facilitation of personalized instruction as regards how pre-service teachers perceive information. The second most significant aspect pertains to the methodology utilized in acquiring practical skills predominantly in academic setting (70%) and partially during practice at school (30%). This methodology enables us to comprehend the genuine process of acquiring knowledge (31%).

In order to ensure the implementation of the aforementioned approaches in the educational process, the authors elaborated applicable learning mechanisms. The latter were intended to ensure the adaptation of theoretical materials to the practical system of education, which affected the consistency of the educational process. The innovative approach to the organization of lessons was aimed at forming the learners' interest in mastering the material. Conducting lessons with the help of interactive technologies involved intensification of thinking as well as individualization of learning. To learn the Ukrainian language during classes, the future teachers were encouraged to use the interactive resources of LearningApps.org and Mova. The study of Chemistry was based on the use of the Mozaik application. The school practice also provided for establishing communication between learners and the future teacher. It was established that the use of such an approach in education was reflected in the learners' overwhelming attainment of a high level of knowledge. A profound level of expertise for future educators of the Ukrainian language was attained among 64% of teachers, whereas Chemistry / Natural science teachers comprised 60%. Further, it was established that trainees also achieved high results. After completing the training, prospective teachers succeeded in acquiring skills that contribute to the development of professional competence. Among them are independence (23%), innovative (21%) and creative (19%) thinking, professional communication skills (20%) and management skills (17%).

The practical significance of the research lies in the possibility of introducing effective mechanisms for the development of practical skills in pre-service teachers of the Ukrainian language and Chemistry / Natural science. Research perspectives may be related to comparing the effectiveness of the future teachers expertise as a result of their practice in secondary and higher educational institutions.

## 7. Bibliographic references

Aktan, O., Toraman, Ç., & Koşan, A. M. A. (2021). I have a letter to my faculty! *Pegem Journal of Education and Instruction,* 11(1), 1–48. https://doi.org/10.14527/pegegog.2021.001

Ammoneit, R., Reudenbach, C., & Peter, C. (2023). Developing geographic computer modeling competencies in higher education. *Journal of Geography in Higher Education,* 1-23. https://doi.org/10.1080/03098265.2023.2250991

Ammoneit, R., Turek, A., & Peter, C. (2022). Pre-service geography teachers' professional competencies in education for sustainable development. *Education Sciences,* 12(1), 42. https://doi.org/10.3390/educsci12010042

Arbia, A., Kouchou, I., Kaddari, F., Hour, R. H., & Elachqar, A. (2021). Evaluation of the analysis of classroom practices of future moroccan teachers. *International Journal of Engineering Pedagogy*, 11(3), 99-115. https://doi.org/10.3991/ijep.v11i3.20493

Barraza, P., & Rodríguez, E. (2023). Executive functions and theory of mind in teachers and non-teachers. *Heliyon,* 9(9), e19915. https://doi.org/10.1016/j.heliyon.2023.e19915

Bedin, E., Marques, M., & das Graças Cleophas, M. (2023). Research on the content, technological, and pedagogical knowledge (TPACK) of chemistry teachers during remote teaching in the pandemic in the light of students' perceptions. *Journal of Information Technology Education: Research*, 22, 1-24. https://doi.org/10.28945/5063

Du Plessis, A. E., Wheeley, E., Klieve, H., Gramotnev, D. K., Gramotnev, G., & Park, E. (2023). The out-of-field phenomenon: Perceptive consequences and Support Needs Through the Lens of graduating second career preservice teachers. *Journal of University Teaching and Learning Practice,* 20(1), 9. https://doi.org/10.53761/1.20.01.09

Essalih, S., Kouchou, I., Ourahay, M., & Khzami, S. (2023). Development of critical thinking: issues and challenges to overcome at the Moroccan Primary Schools. *Education*, 3-13, 1-12. https://doi.org/10.1080/03004279.2023.2223544

Hyseni Duraku, Z., Blakaj, V., Shllaku Likaj, E., Boci, L., & Shtylla, H. (2022). Professional training improves early education teachers' knowledge, skills, motivation, and self-efficacy. *Frontiers in Education,* 7, 980254. https://doi.org/10.3389/feduc.2022.980254

Keengwe, J. (2023). *Innovative Digital Practices and Globalization in Higher Education.* Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-6684-6339-0

Kolesnik, K., Oliinyk, N., Komarivska, N., Kazmirchuk, N., & Imber, V. (2023). Future-teacher soft skills development in the context of Ukraine's integration into the European higher education area. *International Journal of Learning, Teaching and Educational Research,* 22(2), 413-431. https://doi.org/10.26803/ijlter.22.2.23

Kurz, D., Piva, L., & Bedin, E. (2019). Conceptions and perceptions pre-service teachers on the use of paradidactic books in chemistry teaching. *Acta Scientiae,* 21(5), 62-80. https://doi.org/10.17648/acta.scientiae.5233

Lane, D., Mcgarr, O., & Nicholl, B. (2023). Unpacking secondary school technology teachers' interpretations and experiences of teaching 'problem-solving'. *International Journal of Technology and Design Education*, 33(1), 123-142. https://doi.org/10.1007/s10798-022-09731-8

Lane, D., & Sorby, S. (2022). Bridging the gap: Blending spatial skills instruction into a technology teacher preparation programme. *International Journal of Technology and Design Education,* 32(4), 2195-2215.

Martins, R., Paulo, E., Noronha-Sousa, D., Costa, E., & Pascoinho, J. (2023). Professional skills developed in a E@D Practicum. *In Advances in Tourism, Technology and Systems: Selected Papers from ICOTTS 2022, Volume 2 (pp. 1-10).* Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-19-9960-4_1

Meltzer, C., & Schwencke, E. (2020). Arts-based learning in vocational education: Using arts-based approaches to enrich vocational pedagogy and didactics and to enhance professional competence and identity. *Journal of Adult and Continuing Education,* 26(1), 6-24. https://doi.org/10.1177/1477971419846640

Myrzatayeva, G., Almetov, N., & Tazhmukhanova, N. (2023). Systematic training of future teachers for developing critical thinking of schools pupils in Kazakhstan. *Cogent Education*, 10(2), 2202103. https://doi.org/10.1080/2331186X.2023.2202103

Orosz, A., Recino, U., & Ochoa, M. C. (2023). Demo lessons and peer observation to enhance student teachers' competencies and exit profiles. *International Journal of Learning, Teaching and Educational Research,* 22(6), 638–658. https://doi.org/10.26803/ijlter.22.6.32

Ortogero, S. P., Barcarse, T. O., & Ray, A. B. (2022). Developing the knowledge and mentoring skills of future special education leaders. *Rural Special Education Quarterly,* 41(4), 211-226. https://doi.org/10.1177/87568705221092765

Palacios Ortega, A., Pascual, V., & Moreno, D. (2022). The role of new technologies in STEM education. *Bordon Revista de Pedagogia*, 74(4), 11-21. https://doi.org/10.13042/Bordon.2022.96550

Perrotta, K. (2023). Stuck in a box: Elementary teacher education students' perspectives of the impact of edTPA on social studies instruction. *Journal of Social Studies Research,* 47(1), 3-14. https://doi.org/10.1016/j.jssr.2022.01.005

Petrovych, O. B., Vinnichuk, A. P., Krupka, V. P., Zelenenka, I. A., & Voznyak, A. V. (2021). The usage of augmented reality technologies in professional training of future teachers of Ukrainian language and literature. *CEUR Workshop Proceedings*, 2898, 315-333.

Petrovych, O., Zavalniuk, I., Bohatko, V., Poliarush, N., & Petrovych, S. (2023). Motivational readiness of future teachers-philologists to use the gamification with elements of augmented reality in education. *International Journal of Emerging Technologies in Learning*, 18(03), 4-21. https://doi.org/10.3991/ijet.v18i03.36017

Sabbah, K., Kobari, S., Ahmad, M. A., & Daher, W. (2022). The Effect of education for future program on teachers' competencies in a public school. *Universal Journal of Educational Research,* 8(7), 2890-2897. https://doi.org/10.13189/ujer.2020.080716

Silva, A. S., Cavalcanti, J., Rodrigues-Carvalho, J., Nogueira, J., Oliveira, R., & Martins, R. (2023). Active Methodologies in Higher Education: An Interdisciplinary Project Applied to Teachers' Education. In Perspectives and Trends in Education and Technology: Selected Papers from ICITED 2022 (pp. 749-758). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-19-6585-2_66

Silva, J. B., Silva, I. N., & Bilessimo, S. M. S. (2020). Technological structure for technology integration in the classroom, inspired by the maker culture. *Journal of Information Technology Education: Research,* 19, 167-204. https://doi.org/10.28945/4532

The Norwegian National Committee for Research Ethics in Science and Technology. (2016). *Guidelines for Research Ethics in Science and Technology*. Available at: https://acortar.link/63VU62

Urbani, C. (2020). Teacher continuing professional development and team-working competences: A case study from Italy. *International Journal for Research in Vocational Education and Training,* 7(2), 237-255. https://doi.org/10.13152/IJRVET.7.2.6

Ventista, O. M., & Brown, C. (2023). Teachers' professional learning and its impact on students' learning outcomes: Findings from a systematic review. *Social Sciences and Humanities Open,* 8(1), 100565. https://doi.org/10.1016/j.ssaho.2023.100565

Wright, N., Miller, E., Dawes, L., & Wrigley, C. (2020). Beyond 'chalk and talk': Educator perspectives on design immersion programs for rural and regional schools. *International Journal of Technology and Design Education,* 30, 35-65. https://doi.org/10.1007/s10798-018-9487-7

Zhou, D., Gomez, R., Wright, N., Rittenbruch, M., & Davis, J. (2022). A design-led conceptual framework for developing school integrated STEM programs: The Australian context. *International Journal of Technology and Design Education*, 32(1), 383-411. https://doi.org/10.1007/s10798-020-09619-5