

# Enhancing Digital Competence Among Pre-Service Teachers: The Role of Personalized Learning Plans in Teacher Education

Norbert Beták<sup>1\*,2</sup>

*1\* Apor Vilmos Catholic College, Schuszter Konstantin tér 1-5., 2600 Vác, Hungary, [betak.norbert@avkf.hu](mailto:betak.norbert@avkf.hu)*

*2 Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 01 Nitra, Slovakia, [nbetak@ukf.sk](mailto:nbetak@ukf.sk)*

---

## Abstract

*The increasing digitalisation of education necessitates a focus on developing digital competencies among pre-service teachers, a topic selected due to its relevance to 21st-century educational demands. The theoretical grounding of the paper was established through a comprehensive literature review covering digital literacy, Pedagogical Digital Competencies (PDC), and personalised learning. This study aims to explore the role of personalised learning plans in enhancing digital competencies, presenting a novel approach to curriculum design that integrates individualized development programs. A quantitative research method was employed using a structured questionnaire to assess pre-service teachers' self-perceived digital competence and attitudes toward its importance in teaching. The findings reveal a significant gap between current digital skills and expected standards, as well as key barriers to technology integration. The study concludes that personalised learning plans can effectively support digital competency development. The research offers both theoretical contributions to the discourse on digital pedagogy and practical implications for teacher education programs.*

*Keywords: digital literacy; 21st century skills; personalized learning plan; self-assessment*

---

## 1. Introduction

One of the most acceptable ways of learning being surfaced nowadays is learning through digital technology. Technology is constantly acting as a catalyst to revolutionize the education, and for education to keep pace with the rapidly changing technology it is imperative to make technology an integral part of educational system. Individuals with a strong foundation and enhanced understanding of digital technology and innovative processes can be poised for success in 21st century global society (Srivastava & Dangwal, 2021). Teachers' digital competence is a multifaceted and essential aspect of modern education. It affects the quality of teaching and learning and shapes students' readiness for the digital world. The development and assessment of teachers' digital competence is therefore crucial to ensure the effectiveness and relevance of education in the digital age (Kiryakova & Kozhuharova, 2024).

The significance and character of digital competence are emphasised in European-level documents. The OECD programme (2005), for instance, underscores the significance of interactive tool usage as a fundamental competence for achieving a successful life and a well-functioning society. In this context, Ilomaki et al. (2011) discusses the ability to use technology with other people for communication, for working, for playing etc., which requires an

---

awareness of new ways in which an individual can use technologies in his/her daily life. An individual should have the ability to make use of the potential of ICT to transfer the way of working, to access information, and to interact with others. The Council of the European Union (2019) lists the digital competence among the eight key competences and mentions that it involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.

The Digital Education Action Plan (2020) as a policy initiative of the European Union also fits in with the issue of the importance and development of digital competences. The Action plan sets out fourteen actions to support the following strategic priorities:

- Priority 1: Fostering the development of a high-performing digital education ecosystem
- Priority 2: Enhancing digital skills and competences for the digital transformation

The growing importance of digital literacy in education has become evident as the world of digital technology now pervades not only the workplace, but also our personal relationships, our civic and other activities, and thus our everyday lives.

For these social, economic and personal reasons students will need digital technology skills if they are to contribute successfully in a knowledge-based society and to play an effective social, economic and political role in society. Higher education institutions around the world put their efforts to restructure classroom facilities for their higher education programs (Ghayyur & Mirza 2021).

Adequate digital education is at the core of vocational training and lifelong learning. Digital competences are an essential element of the European Competence Reference Framework and one of the eight competences needed to improve personal development, active citizenship, social inclusion and employability (Tsankov & Damyanov, 2019). The digital transformation of education has brought about a pressing need for teachers to continuously develop their digital competencies. It is obvious that formal seminars, such as one-day training workshops in how to use ICT, are not sufficient and effective to develop teachers' digital competences. In order to be able to plan and design suitable education training measures for teachers initially requires a systematic approach for the professional development of teachers at vocational schools (Seufert & Scheffler, 2016).

---

The question arises as to whether the personalized learning plan can contribute to the development of digital literacy of pre-service teachers and thus prepare them for their future profession.

The development of digital skills as part of professional development is a process that has the potential to make a significant contribution to active teaching practice. The personalized approach could be essential to equip pre-service teachers with the skills, confidence, and adaptability they need to thrive in diverse educational contexts and embrace technology as an integral part of their teaching practice. Furthermore, it is essential not only to cultivate current technical knowledge and skills, but also to foster the capacity for ongoing development of digital competence, enabling future teachers to continuously adapt and expand their own digital proficiency.

The idea of personalized learning rests on the foundation that humans learn through experience and by constructing knowledge. It is heavily influenced by a learner's prior experiences and is accomplished via language and social interaction. In general, personalized-learning models seek to adapt to the pace of learning and the instructional strategies, content and activities being used to fit best each learner's strengths, weaknesses, and interests (Shemshack & Spector, 2020).

All in all, we consider the introduction of a personalised learning plan for digital competences in teacher education to be important, mainly because:

- pre-service teachers can enter teacher training program with different levels of digital literacy,
- personalization ensures that each individual's strengths and weaknesses are addressed, enabling effective skill development,
- learning plans that align with individual goals and interests encourage sustained motivation and engagement,
- technology in education is constantly evolving and personalized plans help pre-service teachers stay current and develop skills that are relevant to their unique career goals.
- the development of digital competences is also necessary in a lifelong learning perspective.

The aim of this study is to explore and introduce a way of implementing the topic of effective personalized learning plans to enhance digital competence on college education. In accordance with the aforementioned points, the article delineates the environment and the primary steps involved in upgrading the Information technology (IT) course for the Teaching for Primary

---

Degree programme at Apor Vilmos Catholic College in Hungary. The article expounds upon the concept of introducing the themes of self-development and self-evaluation in the process of ensuring continuous learning and development. The results of the implementation, including a critical evaluation of the benefits and shortcomings of the training course so designed, will be the subject of another article, as the implementation phase is currently still in progress.

## **2. Literature Review**

The 21st-century educational landscape is manifested by the key concept of digital competency of professionals in the knowledge area. Education and training, therefore, need to be at a premium, and the role of teachers being very important in imparting education and constructing learning experiences need to be continuously trained and updated (Srivastava & Dangwal, 2021). The development of digital competences is necessary both for the academics to take advantage of the opportunities offered by technological advancement and to create strategies for their professional development. It is also necessary so that academics can help the improvement of the digital competence of the students themselves (Inamorato Dos Santos et al., 2023). The development of digital competences in the professional direction for future pedagogical specialists focuses on the application of digital resources and tools in the educational process, in communication and collaboration with colleagues and students, in selecting and creating learning content, working with different platforms to track student activity, achievements and commit feedback to learners, create opportunities for their active participation and increase their digital competence (Tsankov & Damyanov, 2019).

The European Union has recognized the importance of digital competence, and has developed the European Reference Framework for Key Competences for Lifelong Learning, which identifies digital competence as one of the essential skills for the 21st century (Karsenti et al., 2020). This framework provides a comprehensive guideline for the development of digital competence, and has the potential to be adapted to the specific needs of various educational settings.

Despite the growing recognition of the importance of lifelong learning, there is a significant gap in understanding how to effectively personalize learning experiences to meet the diverse and evolving needs of individuals throughout their lives. Traditional educational methods often fall short in providing the flexibility and adaptability required for lifelong learning. This gap necessitates the exploration of innovative solutions to enhance the personalization of learning experiences (Bayly-Castaneda et al., 2024). One promising approach to fostering digital skills is the implementation of personalized learning paths. In a study by Caena & Vuorikari (2021)

---

it is mentioned that the field of teacher education is undergoing a remarkable transformation, as educators and policymakers strive to better prepare the next generation of teachers for the evolving demands of the 21st-century classroom. One key aspect of this transformation is the growing emphasis on personalized, student-centred learning paths for aspiring teachers.

Bayly-Castaneda et al. (2024) found the research on personalization of learning and the use of AI in lifelong learning as a vital area and argues that AI offers a range of innovative tools that revolutionize the concept of personalized learning.

Personalized learning paths involve tailoring the learning experience to the unique needs, abilities, and goals of each individual student, enabling them to progress at their own pace and focus on areas of greatest need or interest.

In this context, the concept of personal learning paths has emerged as a promising approach to support teachers' self-development in digital competences. This approach recognizes that each teacher has unique learning needs, preferences, and circumstances, and therefore, a one-size-fits-all professional development program may not be effective. By adopting individual learning paths, teachers can tailor their professional growth to their specific requirements, drawing on a variety of resources and learning opportunities.

A fundamental element of the proposed approach is the emphasis on the practices of self-assessment and reflection. Teachers are encouraged to regularly evaluate their own digital competencies, identify areas for improvement, and develop personalized learning plans to address their needs. As Indu (2018) also states, self-assessment promotes learning, in plain and simple manner. It gives learners training in evaluation that results in benefits to the learning process. It gives raised level of awareness of perceived levels of abilities to students as well as teachers. Training in self-assessment, motivates learners to look at course content in a more perceptive way. It motivates the teachers towards the goal-orientation. In brief, Self-evaluation can assist a teacher in many ways by.

### **3. The Programme of Creating Personal Development Plans for Pre-services Teachers**

The topic of personal self-development plans is being introduced at the Apor Vilmos Catholic College in Hungary as part of an internal development programme. The development within the framework of the programme is intended to renew the Information technology curricula for Teacher Education (BA – Bachelor Degree). The development activities of the programme are carried out in four sections, with the current (third) section being the implementation of the pre-prepared activities into the teaching process (Figure 1). The implementation process has been

initiated during the summer semester of the school year 2024/25, with a total of 63 students taking the course, divided into 3 working groups.

The primary objective of the internal project is to initiate the development of a programme for the enhancement of digital competencies based on self-assessment and self-development. The programme is designed to facilitate the development of the digital competencies of pre-service teachers, encompassing the identification and assessment of their digital skills. Furthermore, the programme aims to assist students in the development and delineation of a personalised development plan. The successful completion of this pathway is expected to empower students to engage in their future pedagogical work in the context of digital education.

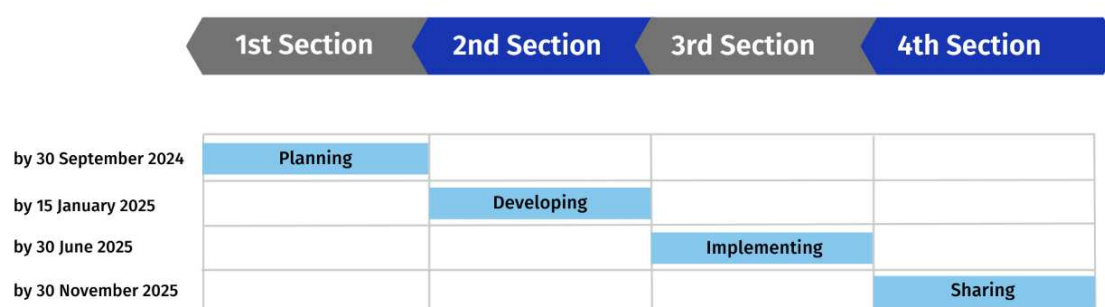


Figure 1. Timeline of the development programme

As a fundamental research and development objective, a complex programme plan for self-development is to be implemented. This programme is based on a self-reflective digital competence assessment of pre-service teachers. During the available research and development period, a number of activities will be implemented to support the self-assessment and self-development of pre-service teachers' digital competence skills.

A further objective is to emphasise the significance of self-reflection and the identification of individual self-development pathways in the context of digital competences, and along this line, to prepare student teachers to assess, identify and develop their individual needs as they arise.

The programme is predicated on the European Framework for Digital Competences for Educators (DigCompEdu), with a focus on the 22 competences delineated as the foundation for the project's implementation phases, namely the self-assessment of students. This is followed by a phase of identification and interpretation of the results achieved, also within the framework of the subject innovation, which will serve as a basis for the implementation of the subsequent phases, in particular the elaboration of the self-development plan. The aim of the self-development plan is to provide teachers with a structured framework for assessing their own digital competences and concrete steps for their future development. The plan will take into

account the individual needs of the teacher-educator candidates, thus ensuring continuous professional development in the field of digital education.

Consequently, the following principal five activities will be undertaken in the context of the programme within the Information technology course:

1. Self-assessment of students' digital competences;
2. Definition of individual self-assessment levels and evaluation of the results achieved;
3. Development of an individual self-development plan;
4. Identification and selection of supporting materials and tools;
5. Presentation of an individual self-development plan.

The activities listed above and illustrated on the Table 1 are preceded by a session on the concept, role and development potential of digital competences, which introduces and provides a grounding in the field and the topic.

Table 1. Course-innovation activities

Activity	Title	Duration (min)
1	Digital competencies - Introduction	1x45 in-person, 1x45 distance
2	Self-Assessment	1x45 in-person
3	Identifying individual self-assessment levels	1x45 in-person
4	Developing individual self-development plan	1x45 in-person, 2x45 distance
5	Identifying supporting materials and tools	1x45 in-person, 1x45 distance
6	Presenting individual self-development plan	2x45 in-person

#### 4. Research Methodology and Results

Prior to the introduction of the course innovations, we mapped the current status of the course and at the same time prepared a structured questionnaire for pre-service teachers. The main objective of the research, which involved data collection through a questionnaire, is to analyse the level of digital skills of pre-service teachers and to identify the differences between the current level of digital skills and their own self-reflection, thus contributing to the development of digital skills through the creation of an individual learning development plan.

The structured questionnaire was divided into two sections: a) self-reflection on digital skills; b) the role of digital skills in teaching practice.

In the aforementioned sections, respondents were invited to respond to questions that reflected the specific objectives of the questionnaire. These objectives were as follows:

1. To ascertain the expected level of digital competences

2. To encourage pre-service teachers to engage in self-reflection with regard to their digital competence
3. To explore the views of pre-service teachers on the need to develop digital competencies
4. To explore which digital competencies pre-service teachers consider most relevant to their future practice

The questionnaire was conducted in the 2024/2025 school year and a total of 206 students of Apor Vilmos Catholic College participated.

The collected data were analysed using descriptive statistics to determine the distribution of responses, mean values, and median scores. Specifically:

- **Frequency and percentage distributions** were used to assess overall trends.
- **Mean (M), median, and mode** provided insight into the central tendency of responses.
- A **comparative analysis** was conducted between self-assessment scores and the perceived importance of digital competencies to identify competency gaps.
- The relationship between self-perceived digital competence and concerns about digital technologies was examined to detect potential barriers to digital readiness.

The majority of the sample was female (93.7%), which is in line with the typical gender structure observed in the teaching profession. As demonstrated in the table 2 and figure 2, the majority of respondents were from the field of elementary education (40.3%), while the least were from the field of preschool education (10.7%).

Table 2. The study programme of the respondents

<b>Study program</b>	<b>Number of respondents</b>	<b>Frequency (%)</b>
<b>Elementary pedagogy</b>	83	40,3
<b>Social pedagogy</b>	49	23,8
<b>Preschool pedagogy</b>	22	10,7
<b>Early Childhood Education</b>	52	25,2
<b>Total</b>	<b>206</b>	<b>100</b>

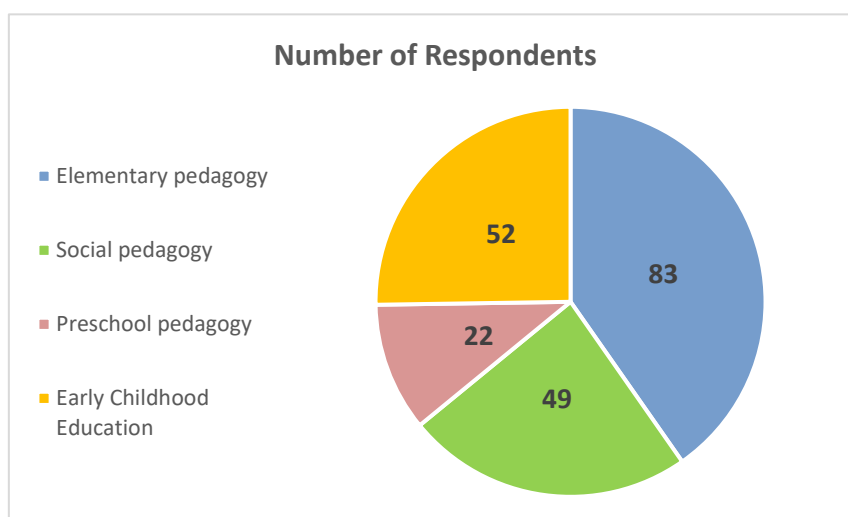


Figure 2. Study programmes and number of respondents

The vast majority of respondents were external students (90.8%), and at the higher education institution where the research was carried out, the number of external students is considerably larger than the number of full-time students. However, it should be noted that the tertiary ratio may also reflect practitioners' interest in upskilling within the educational sciences, and that it may also influence access to digital technologies and education in general, and thus have an impact on the research findings.

In the subsequent section, an analysis of the results obtained from the questionnaire research is presented.

The majority of respondents (84.5%) perceived the necessary level of digital competences as high (4 or according to the Likert scale). The results demonstrate that none of the respondents considered a very low level (1 or 2 according to the Likert scale) to be sufficient in terms of teaching practice.

In response to the invitation to engage in self-reflection, the majority of respondents (43.7%) indicated a medium level of agreement (3 on a Likert scale) in terms of their self-estimated digital competencies (Table 3 and Figure 3). A mere 5.3% of respondents attributed themselves to the highest level of digital competence, a proportion that aligns with the 34.5% of respondents who deemed this level to be essential. The mean self-assessment score (3.42) falls short of the expected level (4.19), thereby pointing to an evident competence gap.

As for other statistical indicators, the mean for expected competences is 4.19, while for current competences it is only 3.42. Both the median and the mode were one number higher (4) for the expected competencies compared to the actual competencies.

Table 3. Comparison of the expected and current levels of digital competences

Level on the Likert scale	Expected competencies (%)	Current competencies (%)	Difference
1 (Very poor)	0	1,9	+1,9
2 (Below average)	0	7,8	+7,8
3 (Average)	15,5	43,7	+28,2
4 (Above average)	50	41,3	-8,7
5 (Excellent)	34,5	5,3	-29,2

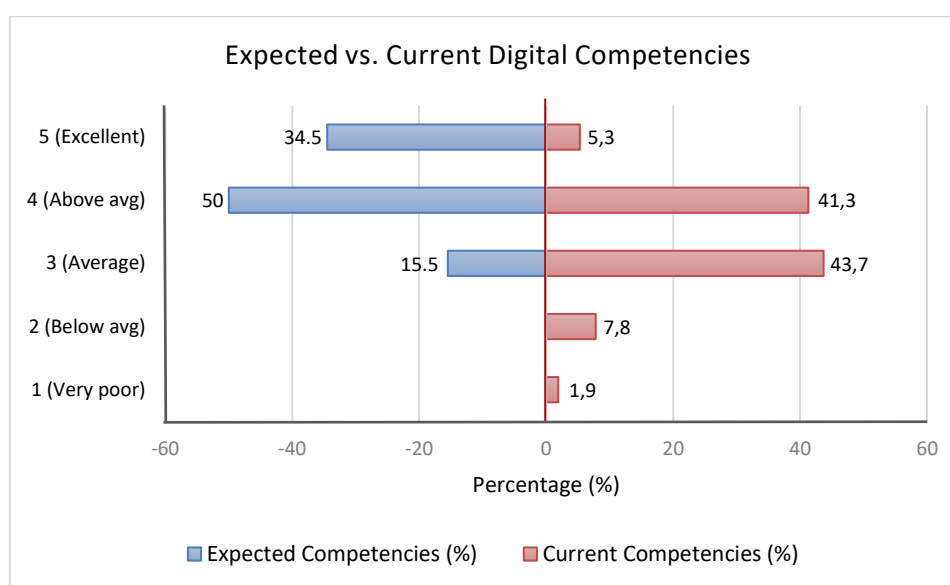


Figure 3. Data visualisation – Competency gap

The data presented in the table indicates a substantial deficit at level 5 (-29.2%), suggesting that only a limited proportion of respondents perceive themselves to be adequately prepared to address the challenges associated with digital learning. Additionally, the findings reveal that a significant proportion of respondents regard their state digital competencies as average, despite the expectation being that they should be higher. This finding is further corroborated by the fact that the self-assessment at level 3 (43.7%) is significantly higher than the expected level 3 (15.5%), with up to 84.5% of respondents expressing the opinion that digital competences should be at level 4 or level 5.

In accordance with another specific objective of the questionnaire (To explore views on the need to develop digital competences), respondents were invited to express their opinions on the importance of enhancing the emphasis placed on cultivating digital competencies within higher education programmes. The analysis of the responses reveals a predominant sentiment in favour of such an emphasis, with 73.8% of respondents (calculated as the sum of responses 4 and 5 on

the Likert scale) expressing agreement with the statement that higher education programmes should place greater emphasis on digital competences. The results also demonstrate a significant degree of uncertainty among the respondents (Table 4 and Figure 4), with 20.4% expressing a neutral stance on this issue. This finding may also indicate a necessity for a more comprehensive awareness campaign emphasising the importance of digital skills in pedagogical practice.

Table 4. The need for greater emphasis on the development of digital competences.

Level on the Likert Scale	Frequency (%)
1 (Strongly disagree)	1,0
2 (Disagree)	4,9
3 (Undecided)	20,4
4 (Agree)	43,2
5 (Strongly agree)	30,6

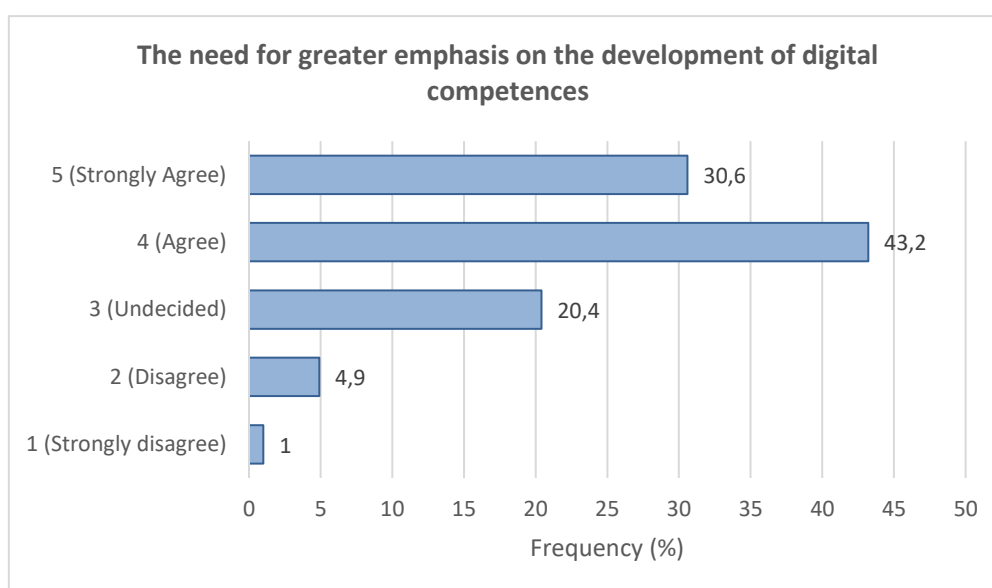


Figure 4. Data visualisation – Emphasis

In the course of the questionnaire, respondents were also invited to express their concerns regarding the integration of digital technologies within conventional teaching practices (Table 5 and Figure 5). This particular inquiry is intricately linked to the preceding question, thereby providing a more comprehensive representation of respondents' perspectives on the digital competencies of educators. The distribution of respondents' answers to this question is relatively even, with 27.7% (levels 1 and 2) expressing low levels of concern, while 47.1%

(levels 4 and 5) report higher levels of concern. A neutral response (level 3) was chosen by 25.2% of respondents, indicating uncertainty or mixed feelings towards the topic.

However, a significant proportion of the student body (47.1%) has expressed concerns regarding the integration of digital technologies in teaching methodologies. This observation is of considerable significance for the enhancement of innovation in teacher training programmes, as it may be indicative of a paucity of practical experience and/or a deficiency in the confidence to utilise digital technologies in pedagogical contexts.

In previous analyses, it was ascertained that respondents acknowledged the significance of digital competencies; nevertheless, their self-perceived levels of digital proficiency were found to be suboptimal. This incongruity may manifest in feelings of insecurity and apprehension about the future use of digital technologies in teaching practice.

Table 5. Barriers in the use of digital technologies

Level on the Likert Scale	Frequency (%)
1 (Strongly disagree)	16,5
2 (Disagree)	11,2
3 (Undecided)	25,2
4 (Agree)	25,7
5 (Strongly agree)	21,4

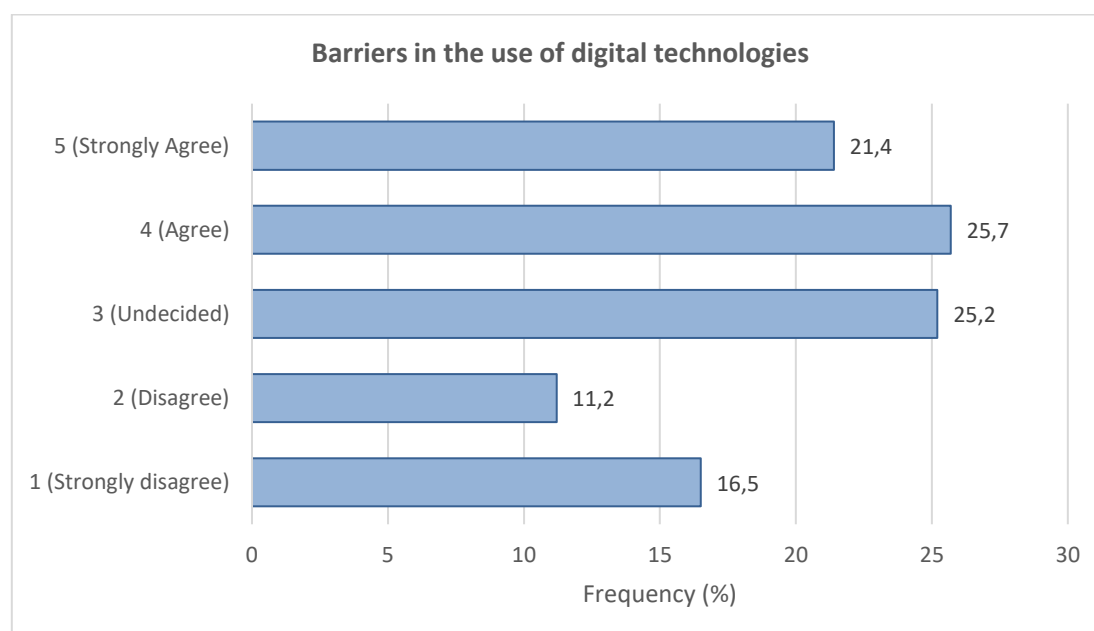


Figure 5. Data visualisation – Barriers

---

## 5. Discussion

The findings of this study reveal a significant relationship between pre-service teachers' perceptions of digital competencies and their actual proficiency in this domain. The majority of respondents recognize digital competencies as essential for effective teaching and advocate for their more systematic integration into undergraduate education. However, nearly half of the participants expressed concerns about their ability to apply these skills in practice, highlighting a gap between the perceived necessity of digital competencies and the technological preparedness of future educators.

A particularly notable finding is that many respondents acknowledge deficiencies in their own digital competencies, likely due to limited hands-on experience with digital technologies during their academic studies. This observation is supported by the high proportion of students who rate their digital proficiency as average or below. The discrepancy between expected and actual competencies may contribute to uncertainty and apprehension when transitioning into professional teaching roles.

From the perspective of curriculum innovation in teacher education, these findings emphasize the need for a comprehensive re-evaluation of current training programs. A key challenge is ensuring that strategies for developing digital competencies effectively align with the needs of pre-service teachers, equipping them for a rapidly evolving educational landscape.

The results of this study align with previous research. For instance, Amir (2023) found that teachers' professional preparation experiences significantly influenced their perceptions of ICT use in classrooms and helped overcome disciplinary barriers. Additionally, Dinc (2019) identified that pre-service teachers face both external and internal barriers to technology integration, with internal barriers—such as lack of knowledge and lack of confidence—having a particularly negative impact. These findings further underscore the importance of addressing both skill development and psychological readiness in teacher training programs.

When designing innovations in digital education courses, particularly in IT related courses and educational technology, it is crucial to identify both strengths and weaknesses in digital competencies to support continuous professional development. Based on our findings, we recommend the implementation of a structured development plan that provides pre-service teachers with extended practical training in digital technologies, ensuring their integration into everyday teaching practice.

---

Future research should focus on exploring how pre-service teachers perceive digital technologies in teaching and what barriers hinder their effective use. A deeper understanding of these challenges will contribute to the development of evidence-based strategies that better prepare teachers for the demands of digital education. A potential future research area could also be the identification of the role and possible applications of AI within the context of individual development pathways.

## 6. Conclusion and Recommendation

In modern educational systems, the role of pedagogical assessment is undergoing a fundamental transformation. The continuous monitoring and evaluation of the teaching-learning process are essential for the effective operation of education and training systems (Karl, 2024). Teachers' self-evaluation plays a crucial role in their professional development, particularly in the domain of digital literacy, which has become an integral aspect of contemporary teaching. Developing digital competencies within teacher education is not only a means to enhance current knowledge and skills but also an opportunity for professional growth, renewal, and lifelong learning.

This study introduced a program for personalized digital competency development, implemented through an internal call at the Apor Vilmos Catholic College. Currently, we are in the third phase of this initiative, where course innovations are being applied in practice based on the initial planning. The development of personalized learning plans for digital competencies is a gradual process, but initial implementations within course structures indicate promising potential for enhancing students' digital skills.

To further advance the digital competence development of pre-service teachers, we propose two key curricular innovations in IT-related courses:

1. Integration of digital competencies into the course's core topics, ensuring that digital literacy becomes an essential component of teacher education.
2. Implementation of a personalized self-development plan, enabling students to assess their competencies and tailor their learning trajectories accordingly.

Looking ahead, we plan to analyze the outcomes of these innovations, evaluate their effectiveness, and refine the framework for developing personalized digital competency plans. Additionally, we recognize the potential of artificial intelligence (AI) in personalized learning and assessment, a topic already explored by several researchers (Zhang et al., 2023; Holman et al., 2024; Nyaaba et al., 2024; Karataş & Yüce, 2024). As noted by Katonáné Gyöngyörű

---

(2024), Intelligent Learning Pathways (ILP) – powered by AI and data analytics – can dynamically adapt content, pacing, and learning styles to optimize educational outcomes. Such AI-driven personalized learning approaches have significant potential for improving engagement and effectiveness in both educational and professional training environments.

Furthermore, it is also necessary to mention dilemmas that are relevant to the findings and themes of the study. One central dilemma lies in the discrepancy between perception and proficiency; while pre-service teachers recognize digital competencies as essential, many report a lack of confidence in their actual skills. It is evident, that pre-service teachers enter programs with varying levels of access to and familiarity with digital tools as a result of which inequalities are created. Additionally, regarding to the topic of implementation of digital tools in pedagogy, many pre-service teachers face psychological barriers such as low confidence and fear of failure. In addition to the above, in line with the principle of lifelong learning, it is desirable that the current level of digital competence is verified and opportunities for further development are subsequently identified. These dilemmas underscore the complexity of fostering digital competence in teacher education and highlight the potential of personalized learning plans as a strategic response to these multifaceted challenges.

In conclusion, fostering digital competencies in teacher education requires a structured, individualized approach that aligns with the evolving demands of the digital age. By integrating personalized learning pathways, AI-driven assessment tools, and targeted curriculum innovations, teacher education programs can better equip future educators with the necessary skills to confidently integrate digital technologies into their teaching practice.

## References

Amir, A. (2023). A Holistic Model for Disciplinary Professional Development—Overcoming the Disciplinary Barriers to Implementing ICT in Teaching. *Educ. Sci.* 2023, 13, 1093. <https://doi.org/10.3390/educsci13111093>

Bayly-Castaneda, K., Ramirez-Montoya, M., Morita-Alexander, Schrader, P.G., & Awidi, I.T. (2024). Crafting personalized learning paths with AI for lifelong learning: a systematic literature review. *Frontiers in Education*.

Bala, I. (2018). Self Evaluation: a Tool to Improve the Quality of Teacher Education. 6. 199-202.

---

Bayly-Castaneda K., Ramirez-Montoya M.S., & Morita-Alexander A. (2024) Crafting personalized learning paths with AI for lifelong learning: a systematic literature review. *Front. Educ.* 9:1424386. doi:10.3389/feduc.2024.1424386

Caena, F. & Vuorikari, R. (2021). Teacher learning and innovative professional development through the lens of the Personal, Social and Learning to Learn European key competence. *European Journal of Teacher Education.* 45. 1-20. 10.1080/02619768.2021.1951699.

Dinc, E. (2019). Prospective Teachers' Perceptions of Barriers to Technology Integration in Education. *Contemporary Educational Technology*, 10(4), 381-398.

<https://doi.org/10.30935/cet.634187>.

European Commission. (2020). Digital Education Action Plan 2021-2027. Retrieved April 18, 2025, from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52020DC0624>.

European Commission. (2019). Directorate-General for Education, Youth, Sport and Culture. *Key competences for lifelong learning*. Publications Office. Retrieved April 18, 2025, from <https://data.europa.eu/doi/10.2766/569540>.

Ilomäki, L., Kantosalo, A. & Lakkala, M. (2011). What is digital competence? In *Linked portal*. Brussels: European Schoolnet. Retrieved April 15, 2025, from <http://hdl.handle.net/10138/154423>

Inamorato Dos Santos, A., Chinkes, E., Carvalho, M. A. G., Solórzano, C. M. V. & Marroni, L. S. (2023). The digital competence of academics in higher education: is the glass half empty or half full?. *International journal of educational technology in higher education*, 20(1), 9. <https://doi.org/10.1186/s41239-022-00376-0>

Ghayyur, T. S. & Mirza, N. A. (2021). Exploring TPACK skills of prospective teachers and challenges faced in digital technology integration in Pakistan. *Journal of Development and Social Sciences* ,2(4),226-241, doi:10.47205/jdss.2021(2-IV)19

Karataş, F., & Yüce, E. (2024). AI and the Future of Teaching: Preservice Teachers' Reflections on the Use of Artificial Intelligence in Open and Distributed Learning. *The International Review of Research in Open and Distributed Learning*, 25(3), 304–325. <https://doi.org/10.19173/irrodl.v25i3.7785>

Karl, É. (2024). Examining the Relationship Between the WTCAi System and Student Background Data in Modern Educational Assessment. *Journal of Applied Technical and Educational Sciences jATES*. Vol. 14, No. 3, <https://doi.org/10.24368/jatesZ>

---

Karsenti, T., Kozarenko, O., & Skakunova, V. (2020). Digital Technologies in Teaching and Learning Foreign Languages: Pedagogical Strategies and Teachers' Professional Competence. *Education & Self Development*, 15, 76-88. 10.26907/esd15.3.07.

Katonane Gyonyoru, I. (2024). The Role of AI-based Adaptive Learning Systems in Digital Education. 14. 1-12. 10.24368/jates380.

Kiryakova, G. & Kozhuharova, D. (2024). The Digital Competences Necessary for the Successful Pedagogical Practice of Teachers in the Digital Age. *Educ. Sci.* 2024, 14, 507. <https://doi.org/10.3390/educsci14050507>

Kenneth Holman, Marino, M., Vasquez, E., Taub, M., Hunt, J., & Tazi, Y. (2024). Navigating AI-Powered Personalized Learning in Special Education: A Guide for Preservice Teacher Faculty. *Journal of Special Education Preparation*, 4(2), 90–95. <https://doi.org/10.33043/5b2xqcb3>

Nyaaba, M. (2024). Transforming Teacher Education in Developing Countries: The Role of Generative AI in Bridging Theory and Practice. 10.48550/arXiv.2411.10718.

OECD. (2005). The OECD Program Definition and Selection of Competencies. The definition and selection of key competencies. Executive summary. Retrieved April 15, 2025, from <http://www.oecd.org/dataoecd/47/61/35070367.pdf>

Rashidi, M.N., Begum, A. R., Mokhtar, M. & Pereira, J.J. (2023). The Conduct of Structured Interviews as Research Implementation Method. *Journal of Advanced Research Design*, 1(1), 28–34. Retrieved from <https://www.akademiabaru.com/submit/index.php/ard/article/view/4779>

Seufert, S., & Scheffler, N. (2016). Developing Digital Competences of Vocational Teachers. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, 7(1), 50-65. <https://doi.org/10.4018/IJDLDC.2016010104>

Shemshack, A., & Spector, J.M. (2020). A systematic literature review of personalized learning terms. *Smart Learn. Environ.* 7, 33. <https://doi.org/10.1186/s40561-020-00140-9>

Srivastava, S., & Dangwal, K. L. (2021). Digital Competence: Where do the Higher Education Teachers Stand? *Universal Journal of Educational Research*, 9(10), 1765 - 1772. DOI: 10.13189/ujer.2021.091005.

Tsankov, N., & Damyanov, I. (2019). The Digital Competence of Future Teachers: Self-Assessment in the Context of Their Development. *International Journal of Interactive Mobile Technologies (iJIM)*, 13(12), pp. 4–18. <https://doi.org/10.3991/ijim.v13i12.11068>

Zhang, C., Schießl, J., Plöbl, L., Hofmann, F., & Gläser-Zikuda, M. (2023). Acceptance of artificial intelligence among pre-service teachers: a multigroup analysis. *International Journal of Educational Technology in Higher Education*, 20.

### **About Authors**

**Norbert BETÁK** is an Associate Professor at Apor Vilmos Catholic College (Hungary) and Constantine the Philosopher University in Nitra (Slovakia). He obtained his PhD in Disciplinary Didactics from the Slovak University of Technology in Bratislava in 2014. His academic research is focused on two principal areas. Firstly, the integration of emerging digital technologies in education. And secondly, the development of digital competencies.

---

## Appendix A

### DIGITAL COMPETENCE LEVEL - SELF-ASSESSMENT

**1. How do you rate your own digital competences in general?**

- 1 (Lowest level) – 5 (Highest level)

**2. I am satisfied with my own level of digital competence.**

- 1 (I totally disagree) – 5 (I totally agree)

**3. I am ... in creating digital learning materials.**

- a. very poor
- b. poor
- c. average/fair
- d. good
- e. very good

**4. I am ... in using digital tools in the classroom** (*e.g. interactive whiteboard, robots, tablets, etc.*)

- a. very poor
- b. poor
- c. average/fair
- d. good
- e. very good

**5. I am ... in digital communication** (*e.g. digital communication with parents, students, online meetings, etc.*)

- a. very poor
- b. poor
- c. average/fair
- d. good
- e. very good

**6. My knowledge of digital security issues is ...** (*e.g. virus protection, data safety, etc.*)

- a. very poor
- b. poor
- c. average/fair
- d. good
- e. very good

**7. I am ... with digital information issues** (*e.g. searching, identifying, information processing, etc.*)

- a. very poor

- 
- b. poor
  - c. average/fair
  - d. good
  - e. very good

**8. Most of my digital literacy development has taken place at ...**

- a. elementary school
- b. secondary school
- c. College/University
- d. outside an educational institution
- e. workplace
- f. further education/training
- g. other

**9. In the future, I would like to seek employment in a position that aligns with my academic background.**

- 1 (I totally disagree) – 5 (I totally agree)

**10. What do you think are the most important areas for the labour market? (Please select at least 1 and up to 3 options)**

- a. Quick information search
- b. Digital materials - storing and organising learning materials
- c. Using digital technologies for collaboration
- d. Communicating effectively across social platforms
- e. Digital curriculum development and content creation
- f. Knowledge of new digital tools
- g. Protecting data and information online
- h. Ergonomic use of digital tools
- i. Other:

## **THE ROLE OF DIGITAL LITERACY IN PEDAGOGY**

**1. The knowledge of the professional use of digital tools is essential in modern pedagogy.**

- 1 (I totally disagree) – 5 (I totally agree)

**2. Digital literacy development is a key element in education.**

- 1 (I totally disagree) – 5 (I totally agree)

**3. What comes to mind when you hear the term "digital pedagogy"?**

**4. Digital technologies are expected to have an even greater impact on education in the future.**

---

- 1 (I totally disagree) – 5 (I totally agree)

**5. What level of digital competences do teachers need nowadays?**

- 1 (Lowest level) – 5 (Highest level)

**6. In your opinion, what level of digital competences do teachers have in public education?**

- (Please draw on your experience)

- 1 (Lowest level) – 5 (Highest level)

**7. The digital competences of teachers in public education are at the expected level.**

- 1 (I totally disagree) – 5 (I totally agree)

**8. In teacher training, more emphasis would be placed on developing digital competences.**

- 1 (I totally disagree) – 5 (I totally agree)

**9. I am concerned that in the future digital tools will transform the current form and methods of education (e.g. through artificial intelligence).**

- 1 (I totally disagree) – 5 (I totally agree)

**11. I am concerned about having to use digital tools in education in the future.**

- 1 (I totally disagree) – 5 (I totally agree)