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The Impact of Pedagogical Approaches for Forming Digital Competence in Students

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ABSTRACT: The digital revolution in education has fundamentally transformed teaching methods in higher education. Fostering students' digital competencies is vital for equipping them with the skills needed in our rapidly evolving technological landscape. This article focuses on formulating effective pedagogical strategies and methods for enhancing the digital competence of part-time students. It aims to provide measurable outcomes in terms of students' improved digital skills. The methodology developed combines traditional and digital teaching methods and underscores the teacher's pivotal role in its implementation, clarifying the concept of "digital competence." Employing specific quantitative and empirical research methods, ensures the methodological rigor of this study. The resulting methodology is designed to establish a digital ecosystem within higher education, enabling students to thrive in the digital age and contributing to the broader academic discourse on digital competence.

Keywords: Digital Competence, Digital Skill, Part-Time Study, Digitization of Education, Digital Didactics, Educational Trends.

I. INTRODUCTION

1. *PROBLEM STATEMENT*

The rapid digitalization of society and the integration of Information and Communication Technologies (ICT) have transformed various sectors, including education [1]. They have become a frequently discussed topic in recent years because of their influence on ways of conducting classes, teaching and studying in novel ways [2-4]. The widespread use of ICT in education has transformed traditional teaching and learning methods, necessitating the development of new skills for students to thrive in this digital era [5-7].

This particular set of skills can be named ‘Digital literacy’ or ‘Digital competence’. To maintain digital literacy, the foundation of digital competencies that evolve alongside technological advances must be consistently revised. This ongoing process is critical to acquiring the competencies needed to succeed in a variety of life situations, whether in education, employment, or leisure [8-10].

One institution campaigning for the promotion of digital literacy is The European Digital Citizens Competence Framework, known as DigComp. It serves as a valuable tool for improving the digital competence of individuals of all ages. Initially introduced in 2013, DigComp has since become the standard by which digital competence initiatives are measured not only at European level, but also in individual EU member states.

Since the second decade of the 21st century, there has been an increase in scientific research on digital literacy and digital competence. Research by Yu Zhao et al. [11], provides an overview of digital competence research from 2015 to 2021 in the context of higher education regarding the definition of digital competence.

Ananiadou and Claro [12] delve into the implications of these findings, with a particular focus on how ICT plays a pivotal role in fostering and enhancing these skills and competencies. Concerning the level of digital

competence development, a study conducted by Sales et al. [13] showed that even when digital tools are available, part-time students often struggle with time management and balancing work, family, and education commitments. However, students also had positive perceptions of their own digital competence, as reported by Ortega-Sánchez et al. [14]. Still one of the key challenges faced by educators today is fostering digital competence among students, which includes the ability to use digital tools effectively for problem-solving, content creation, communication, and information management [15-17]

In the work of Alessandro Brolpito [18], the student's digital competence consists of sections such as (information and media literacy, communication, content creation, responsible use, problem solving). Digital competence is considered in Carretero, Vuorikari & Punie [19] in terms of a) information and data literacy, b) communication and collaboration, c) digital content creation, d) security and e) problem solving.

While it being so, Ryhtä et al. [20] noted that educators often faced uncertainty when it came to effectively integrate digital technologies into their teaching practice. It is unclear for them whether it would benefit the educational process or cause complications in comprehension for students. Particularly acute issue lies in digital competence development for part-time students, as they have less time to interact and get accustomed to the educational ICT compared to full-time learners.

A variety of teaching strategies have been proposed to foster digital competence in students [21]. Project-based learning [22], blended learning [23], and gamification are frequently highlighted in the literature as effective methods for engaging students with digital tools and encouraging active learning. For example, Tolmachev et al. [24] argue that blended learning, which combines traditional in-person instruction with online learning resources, is particularly effective in promoting digital competence. However, there is limited research on how these strategies can be specifically tailored to the needs of part-time students.

Since that, the focus of this research centers on developing and refining effective pedagogical strategies to enhance the digital competence of part-time students within the rapidly digitizing educational landscape. Unlike full-time students, part-time students often face unique constraints, such as balancing education with professional work, familial responsibilities, and other personal obligations. This limited availability means they may struggle to keep up with the fast-paced advancements in digital tools and platforms commonly used in modern education. Consequently, these students require flexible, adaptive learning methods that align with their schedules while still providing the depth and rigor necessary to develop essential digital competencies.

Effective pedagogical strategies in this context involve the design and implementation of flexible, targeted educational approaches that cater to the specific needs of part-time students. These strategies might include the use of online learning modules that allow for self-paced study, interactive digital tools that encourage collaborative learning, and project-based assignments that focus on practical, real-world application of digital skills.

By addressing time constraints and resource limitations, these pedagogical strategies should foster the digital competence necessary for success in both educational and professional settings.

Based on this focus, the following hypothesis is proposed: Part-time students who participate in a blended learning environment that combines traditional teaching with flexible, self-paced digital modules will demonstrate a greater improvement in digital competence.

With regards to that, the purpose of this article is to present comprehensive effective pedagogical strategies and methods of forming the digital competence of a part-time students in the context of digitization of education.

The study was guided by the following research objectives:

- To define the value of digital competence.
- To develop a digital competence formation algorithm within the framework of digital education.
- To create methods and pedagogical strategies for fostering digital competence among part-time students.

These objectives collectively aim to enhance digital competence among part-time students, thereby equipping them for success in an increasingly digitalized world.

II. METHODS

1. RESEARCH DESIGN

The development and assessment of the strategy of improving part-time students' digital competence took place M. Utemisov West Kazakhstan University in 2022-2023 academic year. The study was conducted in stages of needs analysis, literature review, curriculum design, instructional design, implementation, and evaluation.

Based on the aim of the study, the methods of theoretical synthesis based on literature review, as well as student survey were employed.

2. THEORETICAL REVIEW

Review of current literature on digitization of education and formation of digital competences of part-time students allowed for identification of the current traditional and digital teaching methods. The chosen literature was specified to employ keywords 'digital competence', 'digital education', 'traditional learning' and to be published no earlier than 10 years ago. Comparison between the pedagogical characteristics of the two teaching methods, as well as analysis of digital education particularities aided in creating a comprehensive teaching tactic

3. PROPOSED MODEL

To form the digital competence of the student, the teacher must be digitally competent. The digital competence of the teacher was determined by Ryhtä et al. [20] divided it into professional knowledge, digital resource, teaching, assessment, student empowerment, and support for student digital competence.

Huang et al. [25] concluded that integrating traditional and digital technology in learning has the potential to enhance students' digital competencies, but effective implementation requires careful consideration of pedagogy, technology infrastructure, and support systems. They recommended that institutions invest in technology infrastructure, provide professional development for faculty, and foster collaboration between instructors and instructional designers. This work was based on the development of digital competence of teachers based on continuous learning.

Mollerup and Levinsen [26] identified three main categories of digital competence formation in the course of their research. In particular, pedagogical competence, technical competence and didactic competence. The authors proposed a holistic approach to building digital competence aimed at building all three competencies. Digital pedagogical competence, which refers to the skills, flexibility and knowledge that teachers must acquire to carry out their educational work, is derived from the concept of digital competence [27-29].

The considered scientific works were supplemented and taken as a basis during the research

4. NEEDS ANALYSIS

The first stage of the study involved a comprehensive needs analysis to identify the digital competencies required by part-time students. Interviews were conducted as part of the work of the admissions committee with 150 part-time applicants who intend to study at the bachelor's level and have a document of professional education. Among them, the fraction of college graduates amounted to 10%, people with higher education – 90%.

5. CURRICULUM DESIGN

A curriculum was developed that combined traditional and digital learning approaches to teach the identified digital competencies. There, the duration of study was determined according to the competences formed in students. In particular, subjects necessary for the development of competences in subjects studied at college or university have been introduced. In the educational program "6B01506-informatics", the subject "Methodology of teaching informatics" was taught, and now the elective subjects "Digital technologies in education", "Methodology of creating graphic reports in the school course of informatics", "New approaches to teaching and criterion evaluation" have been added.

6. INSTRUCTIONAL DESIGN

A curriculum was designed that in a way that includes learning materials and activities that meet the diverse learning styles and preferences of students. Teaching methods were shown there. For example, in the teaching of the topic "Resources for distance learning of computer science", methods of teaching using Internet resources (Padlet [30], WorldWall [31], Jamboard [32], Zoom [33], etc.) were demonstrated.

7. IMPLEMENTATION

Curriculum and learning materials have been implemented using appropriate technologies and tools. The educational process was implemented using traditional and digital technologies of education. Part-time students were taught traditional lectures, interactive press conference, round table and distance learning using online communication and online blackboard, practical lessons were conducted with strategies of critical thinking technology. Students' original works were presented on the basis of chat and forum. Video lectures and

observational work of the course "Innovative technologies of education" placed in the open educational space formed the digital skills of students.

Assessment: Student learning was assessed using a range of assessment methods that measure students' digital competencies. Several assessment methods can be used to measure the effectiveness of the methodology of forming the competence of the student studying in the digitalization of education. They are: questionnaires, tests ("MasterTestov"), word puzzles (OnlineTestPad), mutual evaluation (padlet), feedback (miro), group evaluation (ZOOM). In our case assessment of knowledge of part-time students was organized through online testing, online oral response, feedback (padlet, pollev). The observation work presented on each topic was carried out through an open educational space. Subject monitoring in the open educational space was conducted with current assessment, while the final exam was conducted in the form of a test. The teacher checked how many video lectures the student watched and the performance of the task from his personal office. At the end of the course, the certificate was kept in the student's office.

8. TEACHER TRAINING

The effectiveness of the methodology largely depends on the role of teachers in its implementation. Methodological seminars and trainings were organized for teachers, they were taught to work with digital resources, create online courses, work with subject information. The teacher independently participated in special courses and master classes and improved his qualifications. "Methodology and technology of distance learning" (72 hours, BKU named after M.Otemisov), "Using innovative technology in the educational process" (72 hours, KazNU named after al-Farabi), "Designing digital educational resource and video montage" (80 hours, KazNUPU named after Abay), "Innovative Educational Technologies and Didactic Models" (72 hours, HiEdTech, L. Gumilev State University) courses had a great influence

9. DATA ANALYSIS

The interview data were analyzed using thematic analysis to identify common challenges faced by part-time students in developing digital competence. Survey responses were statistically analyzed to measure improvements in digital skills. Descriptive statistics, such as means and percentages, were used to summarize the assessment results, while comparative analysis was conducted to evaluate differences in digital competence before and after the implementation of the curriculum.

III. RESULTS

Result of the admission's office interview illustrates the primary reasons why part-time students decided to pursue their education part-time. This data reflects the diverse motivations for part-time study, highlighting the importance of providing flexible educational opportunities for such students (Figure 1).

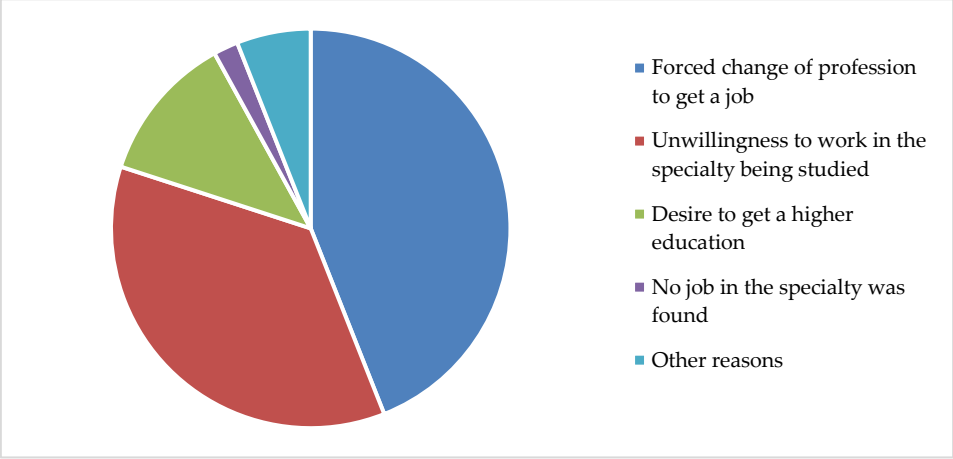

FIGURE 1. Reasons for choosing part-time study among interviewed students.

The methodology developed as a result of the research is designed to solve the challenges of digitalization of higher education, while at the same time taking advantage of the opportunities it offers. The proposed

methodology blends traditional and digital teaching methods to shape student competence within the context of educational digitization. Traditional learning relies on face-to-face teaching and learning, while digital learning emphasizes the integration of technology and digital tools. Nevertheless, it's important to note that there are also similarities between traditional and digital learning, as illustrated in Table 1.

Table 1. Comparative analysis of traditional and digital learning.

	Traditional training	**Digital training**
Features	a traditional way of teaching and learning that has been used for centuries. It involves face-to-face interaction between teachers and students in classrooms. Some features of traditional didactics: - the teacher is the main source of knowledge and experience, and students passively read ready-made material. - teaching is mainly carried out through lectures, and students take notes and ask questions. - educational materials are textbooks, handouts and other resources in print format.	refers to the use of digital tools and technologies to support teaching and learning. It involves integrating digital resources and technologies in a classroom or online learning environment. Some characteristics of digital didactics include: - the student is in the center of the educational process, and the teacher acts as an assistant and guide. - learning is interactive and collaborative, students use digital tools to interact with each other and the learning material. - digital learning materials are offered in digital format such as e-books, online articles and multimedia resources.
Similarities	- teaching methodology: traditional and digital teaching and learning methods are used. -focuses on learning outcomes: both methodologies aim to achieve specific learning outcomes for students. -requires preparation: teachers are prepared for traditional and digital didactics by creating a syllabus and teaching materials.	
The difference	Method of conducting: face to face Learning Styles: Traditional learning favors passive students. Resource Formats: Traditional teaching relies on printed materials.	Mode of delivery: delivered online or through digital technologies Learning Styles: Suitable for interactive and collaborative learners. Resource formats: rely on digital resources and technologies

Overall, traditional and digital learning are two different learning methodologies with some similarities but significant differences. While traditional learning focuses on face-to-face communication and printed resources, digital learning emphasizes the use of digital technologies and resources to support learning. It follows that digital learning is not a "digital alternative to traditional learning".

During training at a modern higher educational institution, the formation of key competence of students follows the pattern "knowledge → flexibility → skill → competence", and the formation of digital competence follows the pattern of "information literacy → information-communicative flexibility → digital skill → digital competence" [30, p. 36]. That was taken into account when developing several methods that can be used to effectively build part-time students' digital competence:

- Online Learning: One of the most effective ways to build digital competence among part-time students is to offer online learning courses that are available anytime, anywhere. This includes self-paced modules, webinars or virtual classes.
- Collaborative Learning: Encouraging part-time students to work in groups or with a partner is a useful way to foster collaboration and mutual learning. This can be facilitated by online discussion forums or group assignments.
- Gamification: Using game-based learning techniques such as badges, points, or leaderboards makes learning fun and motivating for part-time students.
- Project-based learning: assigning specific projects that require the use of digital tools and skills is a practical and effective way to build digital competence among part-time students. It included elements of STEAM education. For example, from the subject "Innovative technologies of education" project topics were proposed,

which include the connections of computer science, physics, pedagogy, psychology ("Peculiarities of teaching physical processes using digital resources in the 9th grade"). Students determined ways to implement the project in groups.

- Personalized learning: Providing a personalized learning experience tailored to the needs and interests of part-time students can be a powerful way to engage them in the learning process and help them build their digital competence. They can learn the study material anytime, anywhere in offline mode.
- Support and feedback: Providing ongoing support and feedback to part-time students will help them stay motivated and on track. This includes online coaching, virtual office hours or peer mentoring.

Collectively, these methods helped build the digital competence of part-time students by making learning accessible, engaging, and relevant to their needs and interests. These methods were actively used in the courses posted in the open educational space (www.edtime.kz). In particular, "Innovative technologies of education", "Physical representation of the world", "Online Technologies in Education" (https://stepik.org/course/95565) employed a blend of the methods.

Successful results were achieved when the methodology of forming the competence of part-time students was harmoniously connected with the traditional teaching methodology in the context of digitization of education. Its advantages included:

- Improved Digital Literacy: The part-time students became more fluent in digital technologies and has demonstrated proficiency in using digital tools and resources to enhance the learning experience.
- Increasing activity and motivation: Integration of digital tools and resources into the traditional teaching methodology can increase student activity and motivation and improve learning progress. Stepik.org, video lectures on the YouTube channel influenced the free learning of educational materials. In the course "Innovative technologies of learning" in the open educational space, students used LearningApps, EduCandy, WordWall, the electronic library and created resources in their environment. As a result, students' motivation to study as well as their activity increased.
- Enhanced Collaborative Learning: Using digital tools and resources facilitates collaborative learning among part-time students, allowing them to share ideas and work together more effectively. GoogleDoc is a shared document, and by developing a team presentation in the Canva environment, students have shared their ideas and contributed to the creation of a shared document.
- Flexibility and Convenience: Integrating digital tools and resources into traditional teaching methods provides greater flexibility and convenience to part-time students, allowing them to learn at their own pace and on their own schedule. Each student studied and worked with the study material at a convenient time.

When comparing the teaching results based on traditional didactics in the 2021-2022 academic year with the combination of traditional and digital didactics in the 2022-2023 academic year, a notable improvement in the quality of education was observed. Specifically, in the subject "Methodology of Informatics," the quality of education increased from 45% in the 2021-2022 academic year to 50% in the 2022-2023 academic year. Furthermore, the academic performance saw a substantial rise, maintaining a 100% improvement across both years. This indicates that the integration of digital teaching methods alongside traditional didactics has positively impacted students' academic performance and overall quality of education.

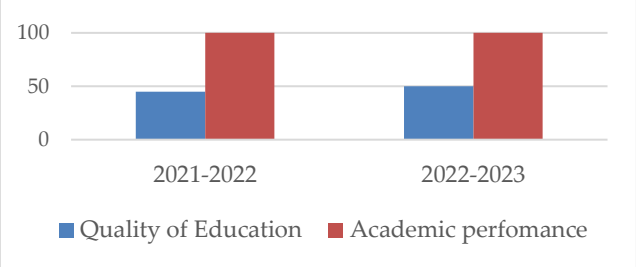

FIGURE 2. Comparison of educational quality and academic performance between 2021-2022 and 2022-2023.

IV. DISCUSSION

In general, in the context of the digitalization of education, the methodology of forming the competence of the student who studies in real-time, combined with the traditional teaching methodology, leads to an increase in educational progress and digital competence.

One of the most important aspects of building digital competence in students is integrating technology into the classroom. This integration can take many forms, from using digital resources to implementing online learning platforms. By providing students with access to technology and digital resources, teachers can help students become proficient users of them [31-33].

The findings of this study on the development of digital competence among part-time students align with several existing studies that have explored digital competence from various perspectives. The study examined multiple aspects of digital competence, including the levels of digital competence among students, the influence of external and internal factors, the pedagogical methods applied, and the effectiveness of tools used for enhancing these competencies. These findings are consistent with the conclusions drawn in other research that emphasize the growing importance of digital competence in higher education.

For example, the study by Zhao, Llorente, and Gómez [11] reviewed 61% of scientific articles on digital competence, underscoring the wide-ranging interest in this topic and the recognition of its importance for students in higher education [11].

The results of this study correspond closely with the European Commission's definition of digital skills, which underscores the necessity for students to possess the flexibility to search, evaluate, store, and process information, as well as to communicate effectively and collaborate using digital tools. The findings of our research support the assertion that such competencies are essential for student success, particularly in higher education where these skills mature and later translate into professional capabilities [34].

Furthermore, the study by Guo et al. [35] emphasizes that digital competence is multifaceted, comprising more than mere technical proficiency. It includes the ability to adapt, engage in critical thinking, and foster creativity within digital contexts. The comprehensive approach to digital competence proposed by Guo et al. aligns with the methodology used in this study, which integrates a variety of educational strategies, such as technology-enhanced learning, digital literacy initiatives, and experiential learning opportunities.

Thus, the findings of this research confirm the hypothesis that blended learning approach not only improves academic performance but also fosters significant growth in digital competence among part-time students. An integrated pedagogical strategy, which combines digital and traditional teaching methods, is essential for fostering a broad range of digital competencies. The improvements in academic performance and digital skill acquisition observed in this study suggest that part-time students particularly benefit from a flexible, adaptive learning environment.

V. CONCLUSION

Based on the research, several key conclusions can be drawn regarding the methodology for developing students' digital competence:

- Digital competence is vital in the era of modern society's digitization.
- The methodology effectively integrates traditional and digital learning technologies.
- The approach to building students' digital competence includes the incorporation of online learning, collaborative learning, gamification, project-based learning, personalized learning, as well as support and feedback methods.
- The methodology for fostering student digital competence involves a series of well-defined steps, including needs analysis, theoretical review, curriculum design, instructional design, implementation, and evaluation.
- Developing students' digital competence considers the enhancement of technical skills (flexibility in using technology and tools), pedagogical skills (digital and professional competence of the teacher), and didactic skills (digital content creation and the ability to use digital resources).

The proposed methodology provides a comprehensive basis for the formation of student competence in the context of digitization of education. Combining traditional and digital learning approaches, the methodology aims to equip students with the digital competencies needed to succeed in the 21st century.

The role of teachers in the implementation of this methodology is very important and it is important to provide them with the necessary training and resources to overcome the challenges of digitization.

The outcomes of this research serve as a valuable starting point for further investigations into the methodology for cultivating students' digital competence within the context of educational digitization. Future research may focus on the effectiveness of the methodology in building students' competencies in different educational settings.

The findings of this research have significant implications for both educational institutions and policymakers. The study highlights the need for institutions to adopt blended learning methodologies that integrate both traditional and digital approaches to foster digital competence. As the demands of the modern workforce evolve, higher education must continue to adapt its teaching methods to provide students with the skills required in a digital economy. Additionally, continuous professional development focused on digital pedagogy is important for the success of such initiatives.

Future research should focus on testing the effectiveness of the proposed methodology in different educational contexts, particularly in various countries and educational settings. More attention should be given to how digital competence can be tailored to specific disciplines and how it impacts career progression after graduation. Context.

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Data Availability Statement

The data and code can be provided upon request.

Author Contribution

All authors made an equal contribution to the development and planning of the study.

Conflict Of Interest

The authors declare no conflicts of interest.

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