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The influence of digital educational technology on improving digital skills: An exploratory study of teacher candidates in the context of Kazakhstan

Aziza Zhunusbekova[1] ✉
Assel Akpayeva[2]
Dinara Sadirbekova[3]
Almagul Ardabayeva[4]
Gulnara Omarova[5]


(✉ Corresponding Author)

[1,2,3,4,5]*Abai Kazakh National Pedagogical University, Almaty, Kazakhstan.*
[1]*Email: a.zhunusbekova@abaiuniversity.edu.kz*
[2]*Email: akpayeva@mail.ru*
[3]*Email: diko82-@mail.ru*
[4]*Email: a.ardabayeva@abaiuniversity.edu.kz*
[5]*Email: gulnar-aidos@mail.ru*

Abstract

Numerous issues with Kazakhstan's higher education system have been revealed by the digital advancement of the country. First, universities still have inadequate levels of digitization despite it being a significant component of the wider digitalization of education. The presence of organizational and legal barriers in the educational environment does not contribute to the digitalization of education. The issue of collaboration between teachers and students emerges in the context of educational digitalization. The study was conducted at Abai University and Almaty University of Humanities and Economics (Almaty, Kazakhstan). The experiment included 163 participants. The study revealed a lack of knowledge of digital literacy and motivation among learners for creating a digital environment and providing feedback. The use of cloud computing, video hosting and the coordination of offline and online activities on the internet were found to provide challenges for maintaining the security and privacy of personal information. This study demonstrates that significant advances in students' digital literacy have occurred following the introduction and testing of the author's academic program with EG participants to develop digital skills. Data from this study can serve as the foundation for creating strategies for digital skills development in universities and as a methodological basis for adapting educational programs for digital skills development.

Keywords: Development, Digital educational technology, Digital skills, Exploratory, Influence, Students.

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Contents

Contribution of this paper to the literature
This study adds to the existing literature by examining the effect of digital educational technologies on improving teacher candidates' digital skills and determining how digital educational learning technology develops digital skills in future teachers as a necessary condition for successful professional self-realization.

1. Introduction

1.1. Digital Transformation of Kazakhstan

Head of State Tokayev said that digitalization is one of the ways to solve systemic problems in society and pointed out that our country should become the digital center for most of Eurasia. This is the reason why digitalization in the education industry is such an important issue in the modern world.

The process of digitization of education in Kazakhstan has led to the need for new approaches to be developed in order to optimize and implement this process (Almunawaroh, 2020; Dhawan, 2020; Niyazova, Saparkhojayev, Bazarbaeva, & Azybayev, 2022; Yelubayeva, Tashkyn, & Berkinbayeva, 2023). The search for answers cannot be postponed because understanding the transition to digital reproduction technologies and updating knowledge is the foundation of developing countries' competitive advantages.

A new generation of teachers that can adjust to diverse digital environments and learning technologies is especially needed in the modern digital economy and society (Haleem, Javaid, Qadri, & Suman, 2022; Kaputa, Loučanová, & Tejerina-Gaite, 2022; Leal Filho et al., 2024; Marin, 2022). A comprehensive digital transformation of specialized training systems has commenced to achieve the necessary educational objectives and customize the learning experience (Asad et al., 2021; Reis-Andersson, 2023).

A comprehensive change in university and school curricula is part of the governmental programme "Digital Kazakhstan" (Burmistrova & Makoelle, 2023). One of the experimental programmes for digital education is the national open education platform. It is a hardware and software complex consisting of distance learning systems, teleconferencing and webinars, educational courses, online courses, object-oriented programming, robotics, 3D modeling and printing, remote delivery and examination. The teacher is always in focus due to the radio marker on him that can track his location in space. The system's unique feature is the simultaneous broadcast of educational and methodological material, an interactive whiteboard, a classroom and high-resolution smart cameras. Such a system allows for video conferencing, open classes and proctoring online exams. Another important factor in the hardware and software complexity is the command execution of the task. Let's give an example of a computer science class. Students in the class are composed of programmers, 3D designers and systems engineers. Systems engineers are responsible for creating a mechanism, 3D designers translate it into a computer program and programmers solve problems to automate it. The final mechanism is tested virtually on an interactive panel after which the parts are printed using a 3D printer. The control panel is integrated and software is loaded to finally turn the virtual mechanism into a real one.

Universities will adopt the smart university model. This involves developing EdTech digital services, creating a student's digital profile or "student life track" and optimizing processes using innovative digitalization trends.

The number of courses offered by Coursera and EdX has already increased. Work is being done to finalize online contracts with other platforms. Coordination of the digital transformation plan in higher education will continue with the establishment of a digital officer role at each university. Additionally, online seminars and workshops are organized where lecturers provide remote explanations of various topics in order to establish a variety of servers for training (Abduvakhidov, Mannapova, & Akhmetshin, 2021).

1.2. Problem Statement

The country's digital advancement has exposed a number of issues with Kazakhstan's higher education system (Kalolo, 2019). First of all, universities still have an insufficient level of digitization which is a crucial component of the broader digitalization of education. Additionally, there are institutional and regulatory impediments to the digital transformation of education in the educational environment (Gkrimpizi, Peristeras, & Magnisalis, 2023; Jakoet-Salie & Ramalobe, 2023).Third, there is an issue of collaboration between educators and learners in the context of educational digitalization. Modern students are members of the new generation and have already mastered digital thinking. The majority of teachers are aged, sometimes referred to as the "analogue thinking generation," who have been compelled by objective circumstances to adjust to the digital environment (Martin, Gezer, Wang, Petty, & Wang, 2022; Prasetiyo, Sumardjoko, Muhibbin, Naidu, & Achmad, 2023). As a result, there is a contradiction in education between localization and globalization. At the same time, universities must create educational programs that meet modern standards for training competitive specialists in the digital economy. The main skill that can ensure such competitiveness is the ability to work with modern digital technologies.

Therefore, higher education establishments in Kazakhstan must deal with the following problems: how to help students acquire the skills they require and how to design instructional technologies that help students acquire these abilities (Cabaleiro-Cerviño & Vera, 2020). The learning trajectory has to be personalized because students' personal growth is the primary objective. Consequently, this fact causes the learning process to change: it is broken down into manageable chunks (called modules) and students are given the freedom to select their own courses (called tracks) that specialize in certain areas and help them develop specific skills.

Our country needs organised methods to assess present levels of digital skills and plan for future requirements as the quantity and complexity of digital skills rise. In this context, there is a great deal of discussion on digital skills in the official publications of prominent organisations among experts worldwide and at the national level of government.

Prominent Kazakhstani institutions have been using individual trajectories for more than a year in the classroom enabling them to create a student portfolio at the conclusion of their studies. According to both employers and teachers of leading universities, a graduate's developed capabilities are more usefully disclosed in a portfolio than they are in a diploma.

Thus, there is a need for a thorough enhancement of the learning environment at the macro, meso and micro levels inside the educational institution itself.

Further research is needed to find out using the example of various areas of student preparation, what digital skills (general and specific) are integrated into student learning and what the ratio of normatively and practically developed skills is to better guide teacher training programs.

1.3. Questions for Research

Q1: How does digital educational learning technology develop digital skills among future teachers?

1.4. Objectives

The primary objective is to assess the effect of digital educational technologies on improving teacher candidates' digital skills as a prerequisite for their successful professional self-realization.

This study intends that the inclusion of digital educational technology in the training process of teacher candidates will improve their digital skills as a necessary condition for successful professional self-realization.

2. Theoretical Framework

The digital transformation of education requires advanced preparation of future teachers to work in digital educational environments, mastering modern pedagogical technologies and developing readiness to use digital tools and resources (McCarthy, Maor, McConney, & Cavanaugh, 2023; Quaicoe, Ogunyemi, & Bauters, 2023). However, the transition to digital education has highlighted the problems of universities based on their level of readiness and the teachers' level of competence. According to Bolatov, Seisembekov, Askarova, and Pavalkis (2021) most teachers in Kazakhstan are not adequately prepared to use digital technologies (41% are not ready for any independent actions in this direction).

The digital transformation of the educational process makes it possible to solve significant social and pedagogical problems at a new level (individualization and differentiation of learning) increasing the efficiency of the formation of knowledge and skills (Mattar, Ramos, & Lucas, 2022; Sillat, Tammets, & Laanpere, 2021; Zhao, Llorente, & Gómez, 2021).

Some theoretical and practical difficulties are still unknown despite numerous studies. The following are the most significant obstacles: (1) There is no relationship between the various stages of an educational organization's life cycle and the specific types of breakthrough digital technologies used. (2) There are no set indicators for implementing measures to introduce and use digital technologies. (3) There are no mechanisms in place to evaluate the impact of digital innovations on the educational system. (4) There is inadequate legislative regulation of digital education as well as its targeted and fragmented nature (Aditya, Ferdiana, & Kusumawardani, 2021; Shahi & Sinha, 2020).

However, Barboutidis and Stiakakis (2023); Lucas et al. (2022) and Roll and Ifenthaler (2021) view the existence of these hurdles as essentially an inappropriate external environmental issue for the educational organization (Ainscow, 2020). We believe that institutional impediments are a natural part of higher education itself. In particular, these include a lack of digital educational resources, a low level of use of cloud computing and artificial intelligence as well as an insufficient level of personnel qualifications in the field of digital technologies.

There is a lack of work on the topic of pedagogic assistance for digital literacy among college students with an emphasis on enhancing personal cognitive experiences as opposed to imparting pertinent knowledge as the basis of competencies. According to an analysis of study data, digital skills as a component of professional abilities are not new but Kazakh researchers have not yet explored the issue of developing digital skills in high-tech production to a sufficient level. The majority of authors on the new educational environment built within digital skills tools concentrate on tools, modes of activity, communication and information sources. However, they contribute insufficient attention to examining the content of students' digital literacy and shifting social orientations (Zhang, 2023). Consequently, the goal of the educational environment is to achieve conventional educational outcomes while supporting and enhancing the efficacy of traditional methods and pedagogical tools (Cheung, Kwok, Phusavat, & Yang, 2021; Marie, 2021).

However, future teachers' preparation in a university context is still behind schedule which casts doubt on how skillfully and professionally they will integrate digital technology into their planned teaching activities. Educational plans have not yet been restructured to ensure the sufficient competence of graduates in issues of teaching methods using digital technologies. Knowledge of such technologies and their use in their educational activities does not yet guarantee future teachers their successful use in professional activities.

3. Method

3.1. Research Method

Qualitative and quantitative methods aim to answer the same question. Various techniques are applied simultaneously with equal importance and the analysis of the data collected aims to combine or compare trends found with their assistance (Busetto, Wick, & Gumbinger, 2020; Dawadi, Shrestha, & Giri, 2021).This instance included grouping things based on a quantitative evaluation parameter to analyse verbal data about highly distinct and comparable objects independently. An integrated analysis of these two groups of data determined the criteria that the participant used when making this or that assessment of similarity and showed that the participants' strategies for describing similar and different objects were different. It means that both kinds of data proved to be mutually beneficial: 1) Different description strategies were used because the psychophysical assessment of the similarity of objects was different or 2) the psychophysical assessment of the similarity of different objects differed because different description strategies were required for their verbal comparison. This is a typical example of a "convergent explanatory" design.

3.2. Collection of Research Samples

The study took place at Abay University and Almaty Humanities-Economics University (Almaty, Kazakhstan). According to the purpose of the experiment, two groups were determined through random sampling: one group was the control group (hereinafter CG) CG and the other group was the EG. Students in the experimental group (EG) (n = 82) and the control group (n = 81) had digital skill evaluations prior to the commencement of the experimental trial. The primary goal of the first stage of the diagnostic study is to demonstrate that both compared

groups (control and experimental) are balanced in all indicators relevant to the study before the experiment is conducted. The experiment covered 163 respondents studying in the direction "6B01303: Primary Education with Information and Communication Technologies." The advancement of digital skills among EG participants is carried out within the framework of several information and technology disciplines specifically "digital literacy " and "New Digital Technologies (DT) in subject teaching" in which students take classes in the third and fourth semesters following the curriculum.

Table 1 presents the demographic details of the learners.

Table 1. Demographic details of the learners.

Groups	Signs	N	%
EG	Abay university	82	50
	Male	8	26.48
	Female	74	73.52
CG	Almaty humanities-economics university	81	50
	Male	5	24.62
	Female	76	75.38
Total		163	100

3.3. Research Approach

The experiment consists of several stages:

1. Carrying out the preparatory stage.
2. Testing was used to determine the starting point for the digital skills development of study participants (the ascertaining stage).
3. Participants' digital skills in EG (formative stage) are evaluated stage by stage.
4. Assessment of the current state of the digital skills of participants at the final stage.
5. Selection of statistical methods for evaluating the results of the experiment.

At the preparatory stage, a sample of students was identified in groups and assessment and diagnostic tools were presented.

The methodology for developing digital skills in students based on modern digital technologies includes four blocks: (1) target (prerequisites and purpose), (2) theoretical (approaches and principles of teaching), (3) technological (conditions, organizational forms, content, methods and means of teaching) and (4) evaluative-effectual (evaluation criteria and indicators and learning outcomes). We identified the following criteria by examining the elements that comprise a university student's digital skills: *Motivational-personal*, *cognitive activity-based and reflective-evaluative.*

3.4. Research Instrument

Several tools were used to evaluate students' digital skills (see Table 2).

Table 2. Techniques for assessing learners' progress in digital skills.

Criterion	Assessment methods and techniques
Motivational-personal	Techniques for diagnosing the educational motivation of students.
Cognitive activity-based	Average score in the discipline “digital literacy,” “New digital technologies in subject teaching.” Questionnaire for determining types of thinking and levels of creativity.
Reflective-evaluative	Techniques for “ diagnosing reflexivity”

We employed the student's t-test to evaluate the statistical significance of the obtained study findings.

4. Results

The research results of EG and CG in determining the educational motivation of students in the preparation stage (see Table 3 and Figure 1).

Table 3. Determining the educational motivation of learners.

Predominant scales	EG (n=82)		CG (n=81)	
	Quantity	%	Quantity	%
Communication motives	14	16.31%	17	22.07 %
Avoidance motives	9	11.33%	6	6.92%
Motives of prestige	3	3.44%	0	0.00%
Professional motives	4	5.13%	3	3.62%
Motives for creative self-realization	10	12.5%	15	18.39%
Educational and cognitive motives	18	21.52%	17	23.31%
Social motives	24	29.77%	23	25.69%
∑	82	100.00	81	100.00

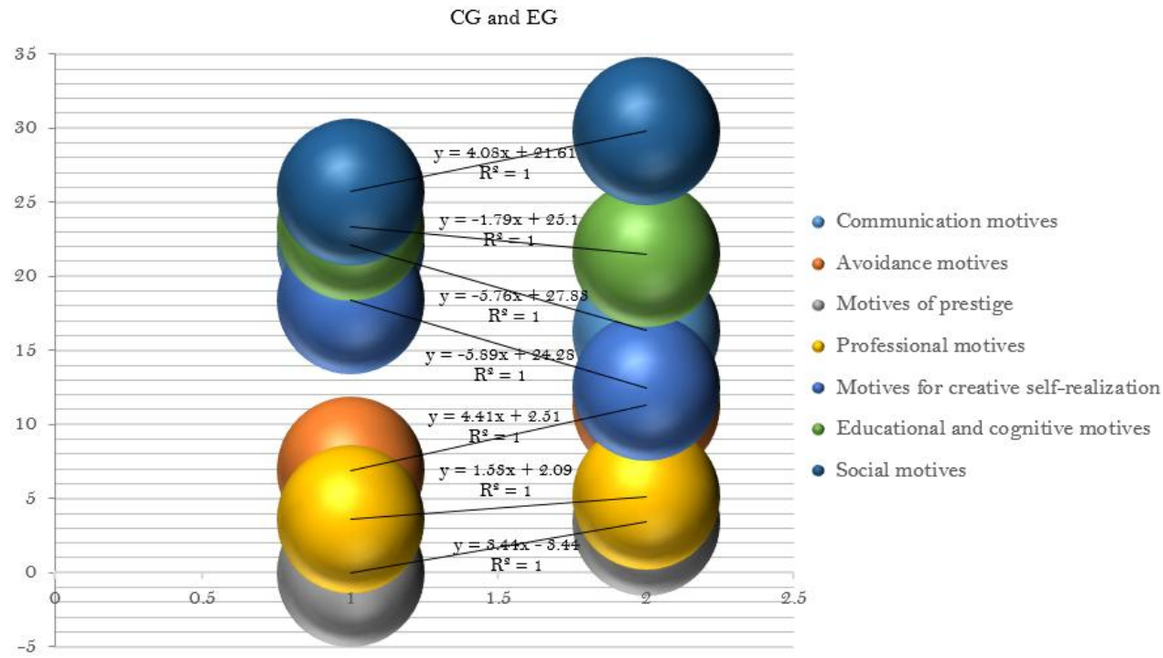

Figure 1. Determining the educational motivation of students.

In the testing results, we can note that the leading teaching motives of the participants are social motives (EG: 29.77% and CG: 25.69%), educational and cognitive motives (EG: 21.52% and CG: 23.31%) and communicative motives (EG: 16.31% and CG: 22.07%).

Table 4 and Figure 2 show the average score of participants in the disciplines "digital literacy " and "new DT in subject teaching ."

Table 4. The average score of participants in the disciplines "digital literacy" and "new digital technologies in subject teaching".

Scores	EG (n=82)		CG (n=81)	
	Quantity	%	Quantity	%
87-100	21	15.00%	19	12.87 %
74-86	46	74.8%	48	78.92%
61-73	15	10.2%	14	8.21%
41-60	0	0.00%	0	0.00%
∑	82	100.00	81	100.00

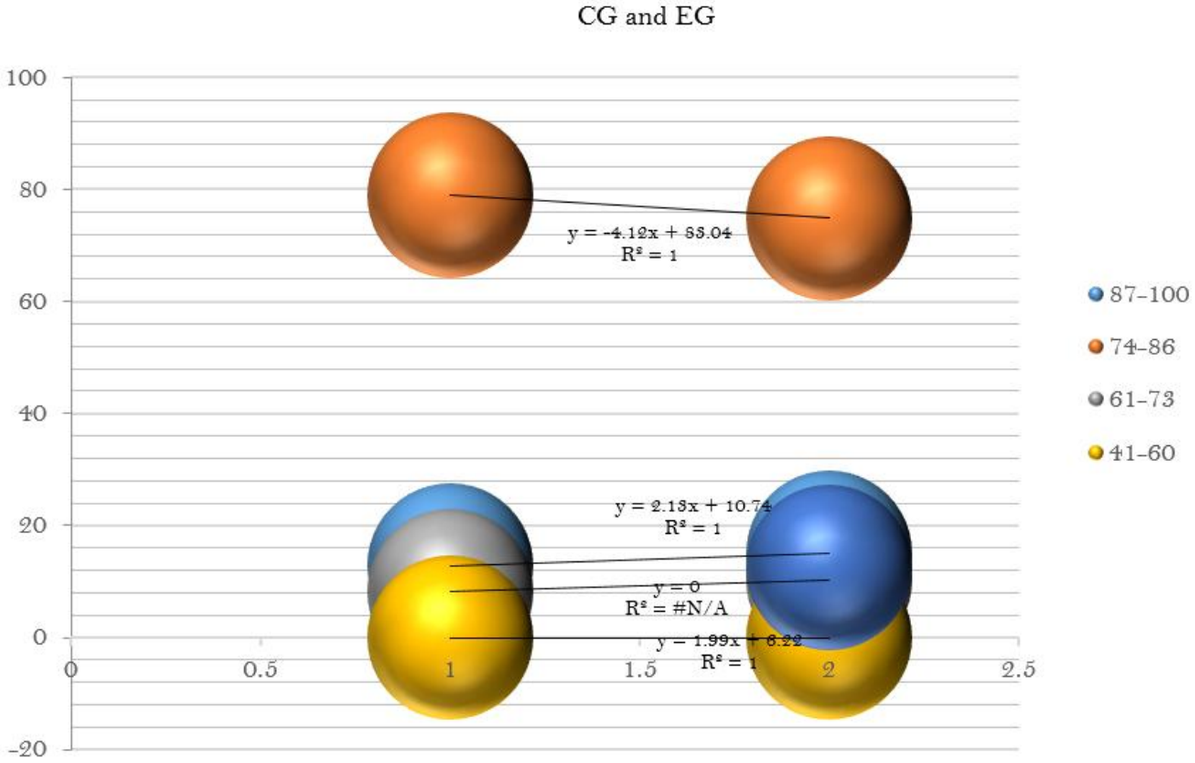

Figure 2. The average score of participants in the disciplines "digital literacy" and "new digital technologies in subject teaching".

According to the performance results of students from the EG and CG in the disciplines, students have a good average score (74-86). The performance of the learning scores of EG and CG in disciplines is approximately equal (one of the conditions for team formation).

The results of diagnosing the prevailing type of thinking and level of creativity among students from the EG and CG during the ascertaining study are summarized in Table 5 and Figure 3.

Table 5. The prevailing type of thinking and level of creativity of learners.

Thinking type		EG (n=82)		CG (n=81)	
		Quantity	%	Quantity	%
Subject thinking		12	11.42%	8	10.30%
Symbolic thinking		9	10.85%	12	11.92%
Sign thinking		13	16.6%	16	19.36%
Imaging thinking		48	61.13%	45	58.42%
∑		82	100.00	81	100.00
Creativity	Low level	9	11.5%	8	9.50%
	Average level	68	83.71%	66	82.48%
	High level	5	4.79%	7	8.02%
∑		82	100.00	81	100.00

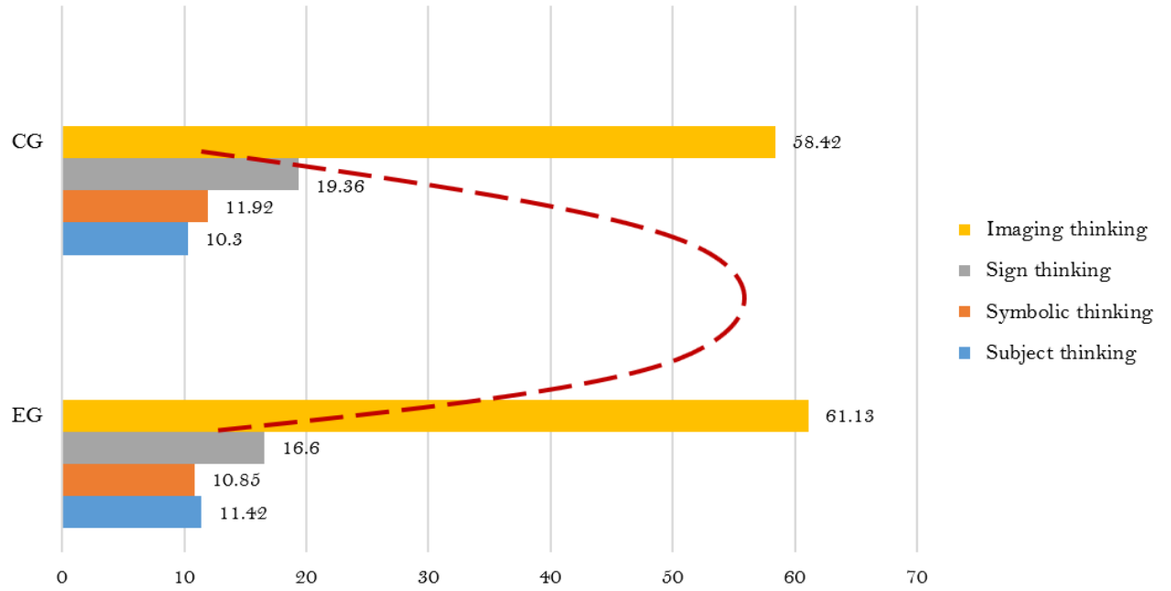

Figure 3. The predominant type of thinking among students from the EG and CG.

According to the findings, imaginative thinking is demonstrated by most students in EG and CG (61.13% and 58.42%) followed by sign thinking (16.6% and 19.36%).

Diagnostics of the level of creativity among students from the EG and CG are shown in Figure 4.

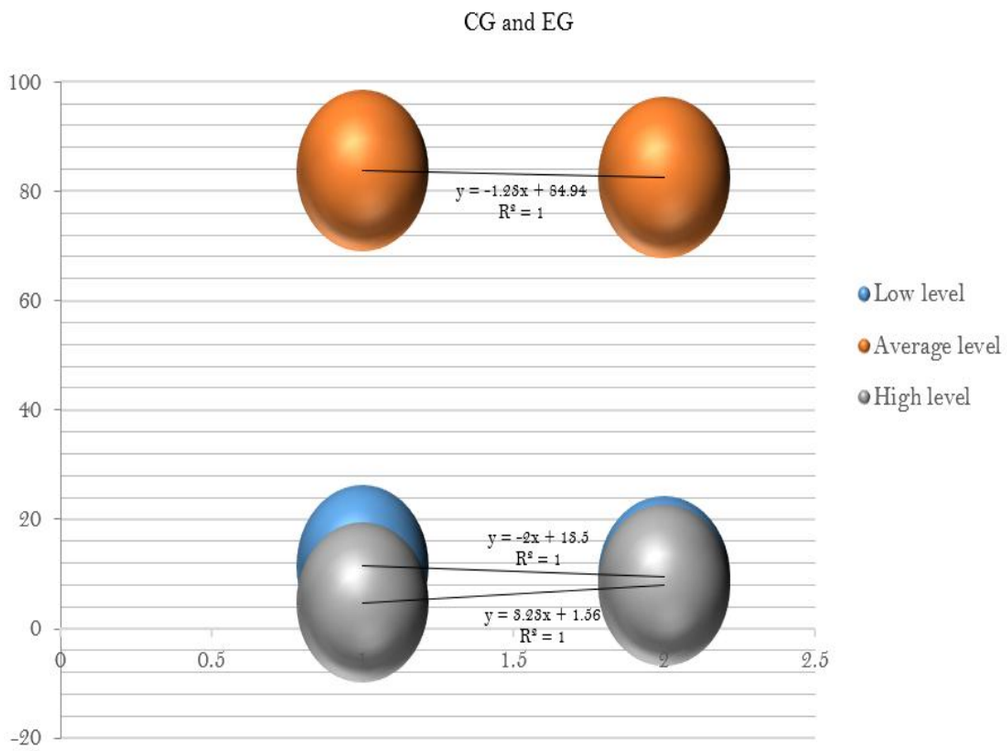

Figure 4. The level of creativity among students from the EG and CG.

The findings of the creativity test showed that more students had an average level of creativeness (EG: 83.71% and CG: 82.48%). Students with a high level are rare.

The results of diagnosing the reflection of students from the EG and CG during the ascertaining experiment (see Table 6 and Figure 5).

Table 6. Diagnosing the reflection of students from the EG and CG.

Level	EG (n=82)		CG (n=81)	
	Quantity	%	Quantity	%
High level	10	12.16%	9	11.77 %
Average level	66	82.22%	64	81.12%
Low level	6	5.62%	8	7.11%
∑	82	100.00	81	100.00

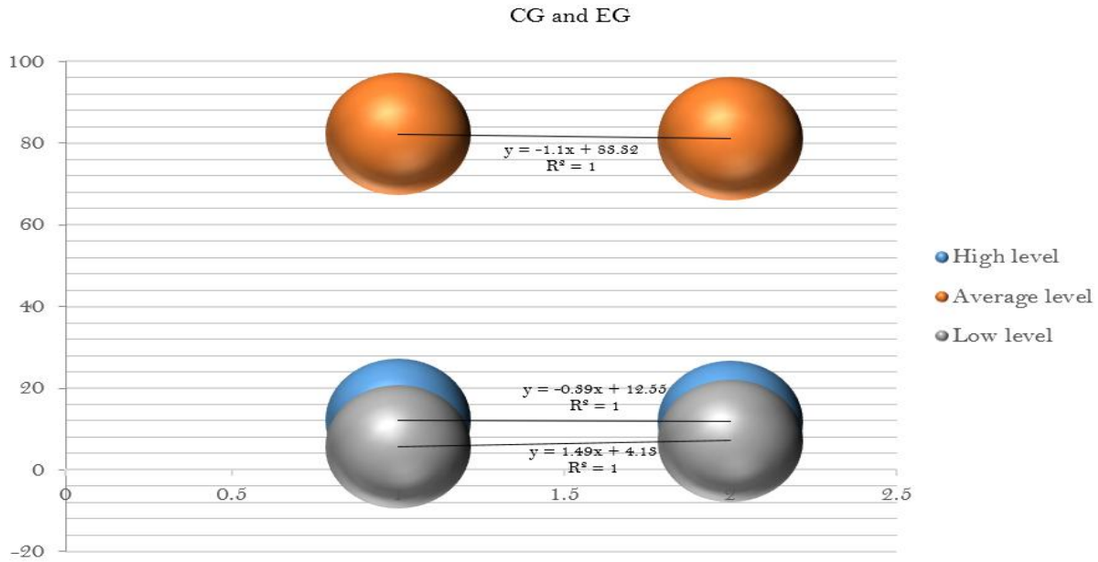

Figure 5. Diagnosing the reflection of the EG and CG.

According to the reflection test results, more students were identified as having an average level of creativity (EG: 82.22% and CG: 81.12%), a high level (EG: 12.16% and CG: 11.17%) and a low level (EG: 5.62% and CG: 7.11%). Lack of self-knowledge, inability to analyse one's own behaviours, lack of understanding of how the image of "I" is represented in the past, present and future, and other issues are all indications of low reflection development in students.

At the final stage, we re-diagnosed the components of digital skills in the EG and CG. We employed the same instruments as in the ascertaining research to determine dynamics.

The research results of EG and CG in determining the educational motivation of students in the final stage are summarized in Table 7 in Figure 6.

Table 7. Determining the educational motivation of students (final stage).

Predominant scales	EG (n=82)		CG (n=81)	
	Quantity	%	Quantity	%
Communication motives	11	12.24%	15	19.77 %
Avoidance motives	4	7.43%	5	7.12%
Motives of prestige	5	3.34%	3	3.00%
Professional motives	9	10.23%	5	2.42%
Motives for creative self-realization	21	32.54%	21	21.31%
Educational and cognitive motives	15	15.98%	12	17.39%
Social motives	17	18.24%	20	28.99%
∑	82	100.00	81	100.00

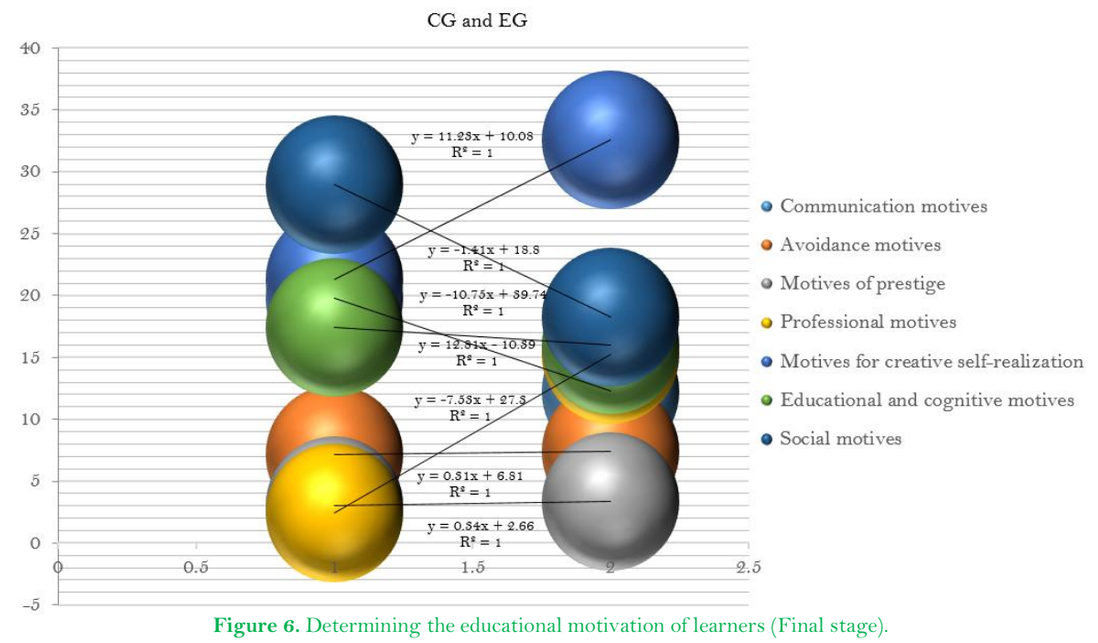

Figure 6. Determining the educational motivation of learners (Final stage).

We can see notable improvements in students' motivation from the EG on the following measures when we compare the dynamics: professional motives (5.13%/10.23%) and creative self-realization (12.05%/32.54%). The main motives for learning among the participants in the EG were social (29.77%) and educational-cognitive (21.52%). The CG does not demonstrate any clear dynamics.

Table 8 and Figure 7 show the average score of participants in the disciplines "digital literacy" and "new digital technologies in subject teaching " (final stage).

Table 8. The average score of participants in the disciplines "digital literacy" and "new digital technologies in subject teaching" (Final stage).

Scores	EG (n=82)		CG (n=81)	
	Quantity	%	Quantity	%
87-100	27	19.00%	20	13.87 %
74-86	45	73.8%	47	77.92%
61-73	10	7.20%	14	8.21%
41-60	0	0.00%	0	0.00%
∑	82	100.00	81	100.00

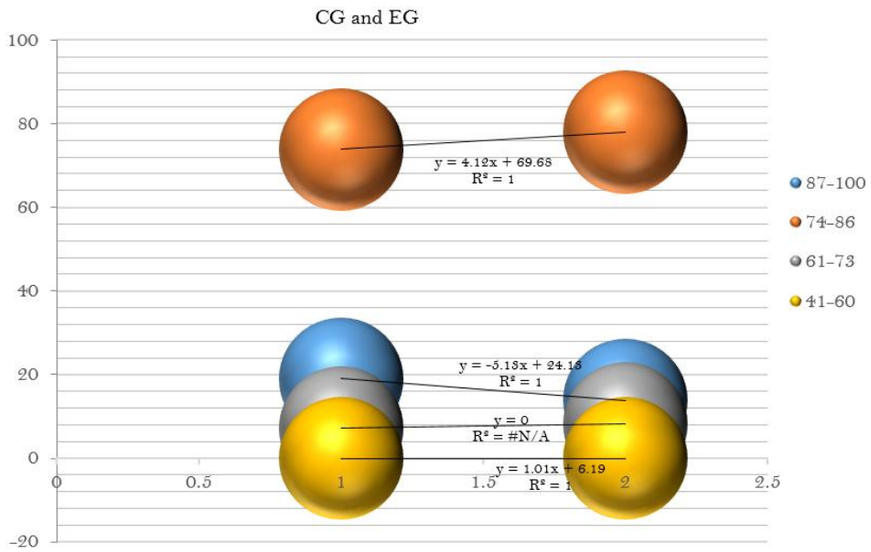

Figure 7. The average score of participants in the disciplines "digital literacy" and "new digital technologies in subject teaching" (Final stage).

The average score of participants in the disciplines "digital literacy " and "new digital technologies in subject teaching " in the experimental class increased significantly: the percentage of learners who received 87-100 scores increased from 21 to 27 (19 percent), the percentage of learners who received 74-86 scores decreased slightly from 46 to 45 (73.8 percent) and the percentage of learners who received 61-73 scores decreased from 15 to 10 (7.20 percent). Participants in the CG who received 74-86 scores increased from 19 to 20 (13, 87%). The number of students who got 74-86 scores decreased from 48 to 47 (77, 92 percent) while those who got 61-73 scores remained at the same level, 14 to 14 (8, 21 percent).

Table 9 and Figure 8 show the dynamics of creativity levels among students from the EG and CG based on the results of the formative program. The most critical option we had was to assess only creativity since thinking is a relatively stable form.

Table 9. The dynamics of creativity levels among students from the EG and CG (Final stage).

The levels of creativity		EG (n=82)		CG (n=81)	
		Quantity	%	Quantity	%
Creativity	Low level	6	6.87%	8	9.48%
	Average level	67	81.90%	67	84.29%
	High level	9	11.23%	6	6.23%
∑		82	100.00	81	100.00

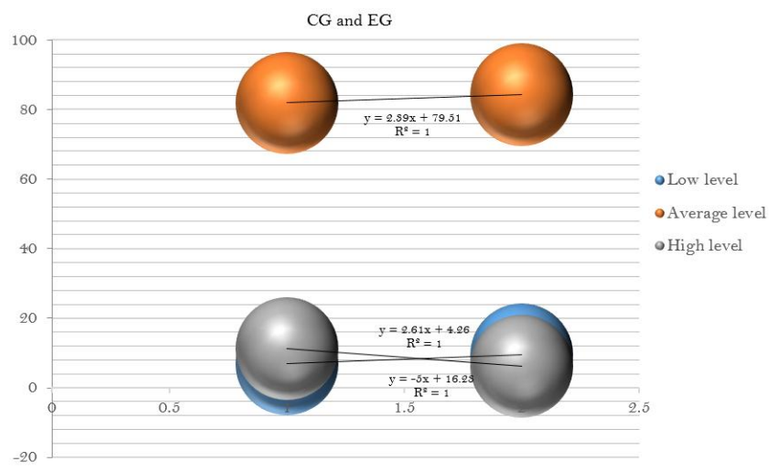

Figure 8. The level of creativity among students from the EG and CG (Final stage).

We can notice a statistically significant and positive dynamic in the level of creativity development of EG students (4.79%/11.23%). We explain this through the specific abilities of our respondents. No significant dynamics have been observed among students in the CG.

The results of diagnosing the reflection of students from the EG and CG during the final stage are summarized in Table 10 and Figure 9.

Table 10. The reflection of students from the EG and CG (Final stage).

Level	EG (n=82)		CG (n=81)	
	Quantity	%	Quantity	%
High level	18	20.38%	10	10.07 %
Average level	64	79.62%	62	80.32%
Low level	0	0.00%	9	9.61%
∑	82	100.00	81	100.00

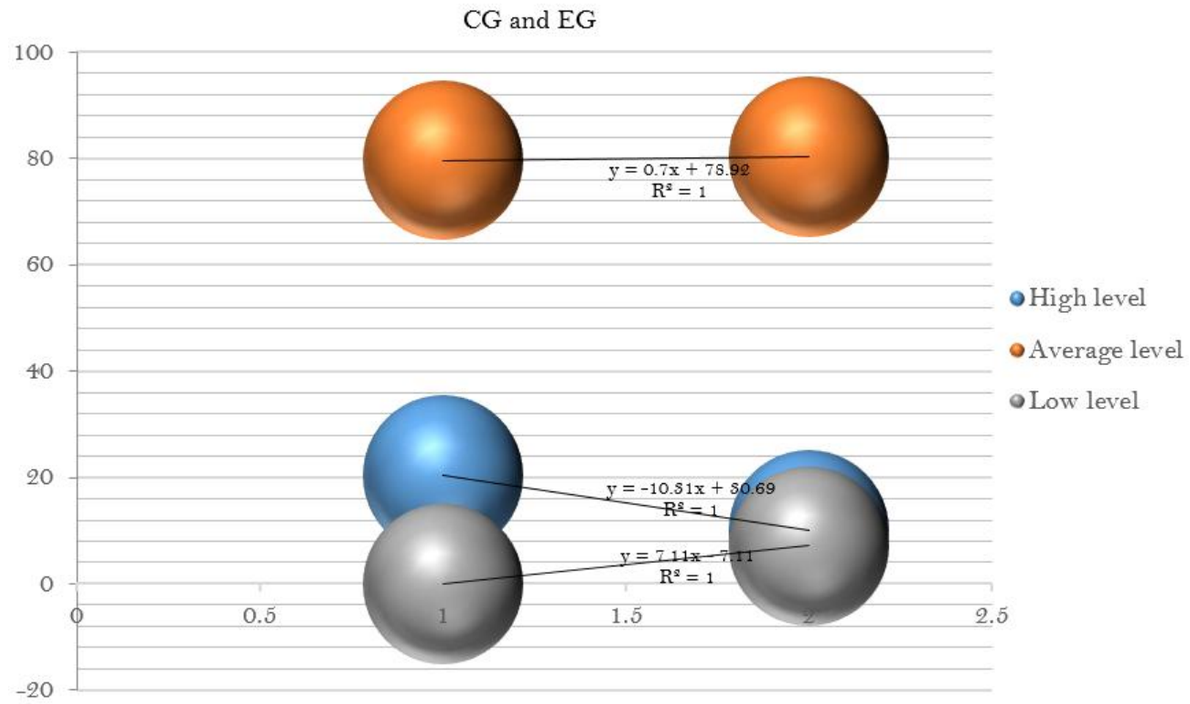

Figure 9. The results of diagnosing the reflection of students from the EG and CG (Final stage).

We see positive dynamics in the development of reflection among the participants of the EG based on the results of the formative program (high level 12.16%–20.38; low level 5.62%–0.00%).

5. Discussion

The purpose of this study is to enhance teacher candidates' digital abilities which are essential for effective professional self-realization by integrating digital educational technology into their training based on the research findings. The study's main finding was that (1) there are not enough widely available, effective digital technologies and tools in universities that students already use in a variety of other activities. (2) Educational organizations do not use the opportunities of digital technologies to personalize learning (choice of trajectory, variety of educational materials and help with learning difficulties), increase student motivation (interactive educational materials and educational games) and facilitate the routine activities of teachers and managers (monitoring, reporting and checking work). These findings are in line with those reported by other researchers (Cheng, Sun, & Zarifis, 2020; ElSayary, 2023; Ng, Leung, Su, Ng, & Chu, 2023).

This study's results showed that participants had low levels of professional motivation and creative self-actualization motivation which was due to the unconscious choice of study direction and the fact that not all participants saw themselves in that career which is consistent with other findings (Bureau, Howard, Chong, & Guay, 2022; Urhahne & Wijnia, 2023; Wigfield & Koenka, 2020).

The results of the identification phase showed that an academic programme for the author should be created using digital instructional technologies in order to build digital skills and test the programme with EG participants. The following curriculum changes were required for program implementation:

(1) The curriculum includes practice that allows students from EG to achieve the required initial level of digital skills at the general user level.

(2) For EG participants, the discipline "information technologies in education" was replaced by "digital literacy " and "new digital technologies in subject teaching."

Some topics have been incorporated into the curriculum to promote the development of digital skills such as "methods for developing online courses" and "development of educational web resources." The formation of motivational-personnel, cognitive activity-based and reflexive-evaluative components was carried out in practical classes. Students have been given access to electronic educational resources during the learning process including during extracurricular hours.

The primary focus of instructional practice involves tasks related to text, tabular and multimedia information processing, using Internet services to guarantee the secure operation and privacy of personal data on the Internet, cloud computing; hosting videos and planning offline and online activities on the Internet with the goal of combining digital skills, knowledge and motivation for building a digital learning environment and offering

feedback. Students prepared a portfolio titled "My achievements in digital skills" both during class and during instructional practice under the teacher's methodological guidance. The portfolio allows for the saving of documentary evidence of the student's achievements in digital skills during educational practice to further use them in professional activities.

Control form: Students can gain 10 to 16 points each week on a single topic. It is necessary to finish SRS within the allotted time. Midterm control1 (MC), midterm control2 (MC) and midterm examination (ME) are assigned based on a cumulative assessment that takes into account the portfolio's delivery over the previous period. The final exam is administered as a test. A 100-point scale is used to assess the exam based on the specified descriptions.

The final comprehensive assessment is calculated using the following formula: $(MC1 + MC2) * 0.3 + ME * 0.1 + Ex * 0.3$.

The results of the present investigation confirm the decisive role of digital technology in the professional training of future education teachers (Akour & Alenezi, 2022; Selwyn, Hillman, Bergviken Rensfeldt, & Perrotta, 2021). Furthermore, according to our research, students' digital abilities have significantly improved as a result of digital instructional technology. These findings are in line with those of other scholars Pratolo and Solikhati (2021); Rinekso, Rodliyah, and Pertiwi (2021); Tejedor, Cervi, Pérez-Escoda, and Jumbo (2020) and Reddy, Chaudhary, and Hussein (2023).

6. Conclusion

This study aims to determine how digital educational technologies affect the digital abilities of teacher candidates which are necessary for effective professional self-realization. According to the degree of digital technology integration into the educational process, our research identified four stages of these modifications: substituting conventional pedagogical instruments, enhancing pedagogical instruments, altering teaching activities and completely changing teaching activities. Second, the results show that traditional teaching techniques cannot be used to implement the requirements of professional standards. It is unavoidable to improve future teacher training methods in digital schools and to change the educational structure of university courses. In this study, we used the general capabilities of digital technologies (multimedia, interactive, cloud, etc.) to improve future teacher training. Digital technologies enabled the development of independence, the stimulation of academic interest, the enrichment of social experiences and the intellectual development of EG participants. Third, according to our research, the digital environment fosters the development of thinking, attention, memory and volition. Interactive and multi-media services increased the diversity and accessibility of teacher training by providing knowledge through numerous channels. This study shows that when the author's academic programme was introduced and tested with EG participants to build digital abilities, there were notable improvements in students' digital literacy. The results of this study can provide a methodological basis for modifying educational programmes to enhance digital skills development as well as the basis for developing strategies for developing digital skills in universities.

7. Limitations and Additional Future Directions

This study assessed the impact of digital educational technology on improving teacher candidates' digital skills as a prerequisite for their successful professional self-realization. The findings of this study can be used to develop strategies for digital skill development in universities as well as a methodological foundation for adapting educational programs for digital skill development. However, many of its aspects require further investigation.

1. Further research could focus on clarifying the criteria and indicators of future teachers' readiness to use digital educational resources and services to organize and support schoolchildren's educational activities.

2. Future researchers could study the issue of developing digital skills during the learning process of students trained in various fields at universities. It is necessary to explore specific skills relevant to specific areas of training and cross-cutting general digital skills developed outside of areas of training related to the IT industry.

3. It would be advantageous for research to identify the capabilities of modern digital technologies as well as the training models and technological capabilities implemented by educational institutions.

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