The Role of Digital Technologies in Increasing the Students' Involvement in the Educational Process

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Abstract: - The level of students' professional education can be increased through motivation. This study aims to determine the role of digital technologies in increasing students' involvement in the educational process. The aim of the work was achieved by conducting a pedagogical experiment before and after training, a general theoretical method of observation, and a sociological survey. The efficiency ratio, the comparison coefficient, and the standard deviation coefficient were also calculated. The results showed that the highest level of motivation was achieved due to the perception of the general learning process (29%), and the development of creative skills (25%). It was established that digital technologies had a greater influence on knowledge of laws and methods of practical application of theoretical information (0.96). High results are associated with a variety of interactive technologies that were used during training. It was found that motivation in training influenced the in-depth study of the topic (1.6), and the search for new digital technologies for training (1.2). The use of non-standard approaches in education (1.5), structuring of material when doing homework (1.1), and participation in university knowledge contests (1.8) also had an impact. The academic novelty of the work consists in increasing the interest of future teachers in the educational process due to the combination of various digital technologies, which are aimed at the development of theoretical and practical skills, as well as creative thinking. The practical significance is the creation of new learning mechanisms (development of creative thinking using Emaze, and Storyjumper applications) for the development of student motivation using digital technologies. The prospects for further research may be related to the comparison of the achieved level of motivation among students and schoolchildren because of using the developed approaches to learning.

Key-Words: - Digital Twin, student motivation, digital systems, differentiation of educational material, Twiddla, Storyjumper, Emaze.

Received: April 29, 2023. Revised: November 28, 2023. Accepted: December 27, 2023. Published: February 19, 2024.

1 Introduction

The search for approaches to the development of the educational process is related to setting goals to increase the effectiveness of education, the development of state programs, and the expansion of professional knowledge. The improvement of new approaches can relate to the use of digital technologies, which ensure the improvement of the organization of training, and the delivery of high-quality educational material. It also affects the use of non-standard approaches to the educational process, [1]. Such advantages contribute to ensuring students' learning motivation, which will later be reflected in their performance level. The identified advantages of digital technologies emphasize the relevance of the issue under research.

Digital technologies represent a system that is based on methods of coding and information transmission, which contributes to the universality of assignments in the shortest possible time, [2]. Digital technologies are common tools in education, which can be represented by various multimedia, interactive programs. Digital technologies have influenced a change in approaches to learning, which has contributed to greater access to a variety of information, [3]. Digital technologies also influence greater independence of learning, thereby expanding existing knowledge. Digital technologies have advantages in working with a group of students, which contributes to the expansion of independence, and creative activity to achieve the necessary educational goals. This approach to learning allows for logical, consistent presentation of information. Digital technologies help to provide visualization of educational material, to ensure interactivity of perception, [4]. The multidisciplinary nature of digital technologies allows for the study of a topic with an orientation to different subjects, which contributes to the combination of various aspects of learning, and the expansion of knowledge. Students' learning motivation may be related to teachers' monitoring of current trends in education, which is associated with the development of professional competencies, [5]. According to other studies, [6], [7], the interest in learning is also formed because of providing virtual practical and laboratory assignments. Learning occurs because of providing a visual display of educational processes, conducting experiments, and using unlimited approaches to explaining complex concepts. The research cognitive digital technologies should be used for a better perception of information, which will contribute to productive information assimilation, [8].

The use of Digital Twin is currently a common approach to learning, which enhances active student participation. The approach of using digital dual technologies provides the possibility of visualizing the physical classroom, tracking students' performance, and their interaction with the surrounding environment, [9]. Dual digital technologies facilitate individualized learning of a particular aspect of a topic through visual elements, [10]. Virtual technologies (e-books, video materials) facilitate the learning process. This approach makes it possible to ensure the use of various educational scenarios, which allows for the interactive completion of assignments. Digital Twin facilitates the creation of virtual classrooms, which allows for the simulation of various situations for learning topics of different complexity levels, [11], [12]. This is because with the help of interactive technologies it is possible to ensure the conduct of complex experiments and monitor the quality of learning the material and the performance of classes, [13].

The study of the theoretical material determined the gaps in ensuring the organized use of digital technologies in the educational process. The aim of the work is related to the study of the role of digital technologies in increasing students' involvement in the educational process.

The research objectives were to:

- Develop a structural model of education, which includes the possibility of using digital technologies in the educational process;
- Determine the element of training that had the greatest impact on the development of motivation;
- Determine the overall effectiveness of training, as well as directions of students' educational activities that were developed during training.

2 Literature Review

Digital technologies are important for improving the quality of education, which has a positive effect on students and teachers. Digital learning developed at the fastest pace during the pandemic. However, learning problems may be related to weak training of teachers and, the use of necessary software. The problems can be related to infrastructure and administrative support, [14]. The use of digital technologies in education enables solving complex problems, which is associated with the development of thinking, creativity, and communication skills. Digital technologies contribute to the search for new tools for structuring the educational process. This approach also has the effect of increasing the level of accessibility for the perception of the material, [15]. Digital technologies are important tools that

contribute to improving the quality of education. The use of 3D interfaces is reflected in the possibility of using software games, and simulated computer laboratories. This facilitates the visualization of learning, which improves the practical acquisition of relevant knowledge, [16]. Digital learning management systems have become quite common over the past 30 years. The convenience of students' perception of information with the help of digital systems can affect the creation of additional problems for teachers. Problems may manifest themselves in understanding the specifics of their application for the educational process. The Canvas program provides tests to assess students' knowledge, [17]. Educational programs for mobile devices enhance students' interest in the perception of materials. The Delphi application created automated knowledge tests for checking actual knowledge due to the clarity of the presentation. This program also verifies the value of digital applications for use in the educational process, [18].

Digital materials can influence the creation of a learning environment using tablets and interactive whiteboards. Multimedia applications contribute to the improvement of students' performance and affect the results of testing. Interactive tests and creative programs contribute to the greatest motivation in learning. Digital technologies ensure an individual style in learning, [19]. The involvement of digital technologies in education can contribute to the solution of existing problems related to the structuring of various information. Neural networks (CNN, RNN, and LSTN) are effective methods of information recognition, affecting the ability to solve complex problems. The perception of information depends on the quality of structured information and the existing level of students' knowledge, [20]. E-learning promotes the development of educational environments using information technologies and digital resources. The process improves the learning experience, thereby improving students' performance. This may be related to the use of online platforms, software, video conferences, and mobile training programs. The process contributes to the improvement of educational content and enhances students' motivation. A high level of learning can be achieved by investing in technological infrastructure. Digital technologies enable online exams, remote control, interactive quizzes, and online discussions, [21].

The new educational needs can be met using digital technologies. Metaverse facilitates the creation of a realistic three-dimensional virtual space that allows students to interact with various digital objects. This contributes to the expansion of opportunities for the perception of educational material, conducting experiments at different educational levels, [22]. Digital technologies can provide an individual approach to learning, which facilitates adaptation to the learning of students with different educational levels, and development of abilities. Digital technologies provide an understanding of university design. The selection of the most favorable technologies can be implemented with the help of thematic analysis. This approach allows for a positive perception of the course of study, which affects the understanding of practical skills, [23]. Digital technologies contribute to the conduct of relevant research in the learning process. The use of digital technologies promotes the formation of computational thinking, which affects overall development. Computational thinking allows for a flexible approach to information perception, [24].

The results of the study showed that the articles considered the general possibilities of using digital technologies for education. Gaps in the research are related to the lack of data on the development of learning programs using digital technologies to enhance student motivation.

3 Methods

3.1 Research Design

The first level of research was to develop a structural model of learning for the study of Computer Technologies. During training, it was planned to ensure the use of digital technologies that promote motivation in the educational process. The choice of digital technologies provided for the possibility of their use for individual learning, and group online interaction. Ease of use was also considered. The choice of digital technologies for learning (Twiddla, Storyjumper, Emaze) involved the initial study of their functionality, and the study of advantages and disadvantages for the possibility of application in the educational process. Digital technologies for learning were selected because of observation, which allowed the use of the Twiddla application and a multimedia board to study the theoretical material. The Storyjumper application was used for the development of practical skills; digital applications Emaze and Storyjumper were used for the development of creative thinking. The training lasted 4 months from February to May 2023.

The second stage of the study involved the determination of how a separate stage of study

affected the level of students' motivation. The stages of training provided for orientation to the study of theoretical and practical material, the development of creative skills, as well as the general perception of the learning process. The results of students' interest in learning information were compared before the beginning of training and after 4 months of training. The results of students' interest in learning were obtained by using the sociological survey. Students had to decide which stage of study was the most motivating in the perception of educational information. The students considered the approach to the study of a separate stage, the applied digital technologies, and the extraordinary presentation of the material. The level of memorization of information at each stage of the research and the possibility of its practical use were also considered.

The third stage of the research involved an experimental verification of the knowledge that students acquired because of enhanced learning motivation. The knowledge test was provided for the presentation of the initial results and the results obtained after training. It was planned to determine the presence of comprehensive knowledge about methods and ways of applying theoretical material during the knowledge test. It was also planned to determine knowledge of laws and methods of practical application of theoretical information. The knowledge test involved determining students' overall performance during 4 months of study and because of the exam.

The third stage of training also provided for determining how students' motivation affected the educational process. The results were obtained by monitoring students' progress, as well as through conducting a sociological survey among students. A psychological social survey determined the level of students' motivation to ensure further education using digital technologies. The results were obtained using a sociological survey.

3.2 Sampling

The study involved a total of 193 students who were studying to become Computer Science teachers to achieve the aim of the research. The sample was represented by students from Ternopil Volodymyr Hnatiuk National Pedagogical University. The sample was limited to students in 2nd-3rd years of study, as first-year students did not have specialized knowledge of the subject. The lack of knowledge could affect the quality of the educational projects.

3.3 Methods

The structural model of learning was developed by using the general theoretical method of observation, which involved the study of existing methods, [5], [25], [26]. The observation method was used to study the advantages and disadvantages of possible approaches to training, which made it possible to develop the author's training model.

The information from students was collected through a sociological survey. This made it possible to obtain results regarding the learning element that had the greatest impact on the development of students' motivation. A sociological survey conducted among students determined how motivation reflected on the student's involvement in the learning process. The method also contributed to determining the level of student's motivation to continue the learning process using digital technologies. The sociological survey was chosen for the study because it enables obtaining data among an unlimited number of people. The sociological survey was conducted using Google Forms, which contributed to the correctness of the results. The sociological survey was intended to provide data from respondents on three questionnaires (Appendix A). Questionnaires for a sociological survey involved answers to one question with a different number of answer options. The questions of the questionnaire were closed-ended, which did not involve specifying detailed answers and were developed directly by the authors of the article.

To test knowledge, it was planned to calculate the efficiency ratio, which involved comparing the results before and after the study. The performance during the study period and the performance obtained as a result of the exam were included in the calculation. The calculation formula was developed by the authors of the article, which excluded orientation to existing calculations.

$$r = \frac{\kappa_p - \kappa_c}{\sum \kappa_k} \quad (1)$$

κ_p – the obtained performance for a separate indicator of knowledge; κ_c – the level of complexity of information perception; $\sum \kappa_k$ – overall effectiveness of the knowledge test;

The calculated efficiency ratio will be reached at a high level if the value is equal to 0.9 - 1.0. The medium level ranges between 0.7 and 0.89; the low level is below 0.7.

Calculations of the comparison coefficient were used to study the areas of activity that were most

influenced by students' motivation. The comparison coefficient was also developed by the authors to provide correct numerical values as the basis for further analysis:

$$\rho = \frac{x_a}{x_b} - 1 \quad (2)$$

x_a – a conditional indicator that reflects the level of students' motivation in expanding the relevant activities after training; x_b – a conditional indicator that reflects the level of students' motivation in expanding the relevant activities before training.

3.4 Data Analysis

Comparison of the obtained calculations of the coefficient of standard deviation with statistics is important in the research. It allows for more accurate confirmation of the obtained data. Statistical calculations were performed to determine the comparison of the acquired knowledge before and after the study. They were also used to compare the areas of activity that were developed in students due to their learning motivation. The coefficient of standard deviation was also used to compare the results of a psychological social survey to determine the level of students' motivation. Statistical calculation made it possible to evaluate and confirm the validity of the obtained data, [27].

$$S = \frac{\sum_{i=1}^{n}(x_i - x_{mean})^2}{n-1} \quad (3)$$

n – the number of indicators that were used for comparison; x_i – an indicator of a separate value; x_{mean} – mean value of the indicators.

3.5 Ethical Criteria

Ethical norms were observed due to the use of the Guidelines for Research Ethics, [28]. This ensured the same conditions for all students who participated in the study. Following ethical norms, it was also planned to ensure the correctness of the presentation of the results, which excluded their falsification.

4 Results

Digital technologies can have a variety of uses in the learning process, which varies depending on the level of teachers' professional qualifications and the capabilities of educational institutions. A structural model of training was developed to ensure the training of future teachers (Figure 1).

The study of the theoretical material, and the principles of differentiation of the educational material involved the assimilation of the main concepts of the subject, and the possibility of using the subject of Computer Science to study other subjects. The study of the theoretical material was based on the use of an interactive multimedia board, which made it possible to provide a detailed visualization of the material. The online digital tool Twiddla was used to learn the theoretical material. Twiddla enables working in a team, which contributes to the discussion of the studied topic, and its deepening. The study of theoretical material also involved the creation of independent lessons by students to present a separate topic with the help of Twiddla. The use of the Twiddla digital application promoted the development of Digital Twin, which influenced the possibility of discussing theoretical material between students. The results were achieved through modeling a particular topic for presentation in class.

The practical skills based on in-depth study of the material were developed using interactive graphics, which included the display of educational animation elements. During the practical classes, it was planned to imprint the theoretical material by completing the tests. The development of electronic textbooks was also provided for the practical use of the acquired knowledge. The use of the Storyjumper digital application contributed to the creation of electronic textbooks, which could be used later to teach students. At this stage of education, the development of electronic textbooks involved the search for mechanisms to improve information presentation approaches.

The development of creative thinking based on the acquired skills involved in the creation of individual projects. During training, it was planned to create a curriculum, and create a fragment of an electronic textbook by the created program. The creation of educational programs involved the use of the Emaze digital application, which facilitated the visualization of information. At the same time, students had to ensure the use of creative approaches to presenting the material. Using Emaze facilitated content creation with existing prompt options. The digital application Storyjumper was used to create a fragment of electronic textbooks.

After training among students, it was determined how it affected the level of motivation. The initial level of students' motivation was compared with the motivation level after training (4 months) (Table 1).

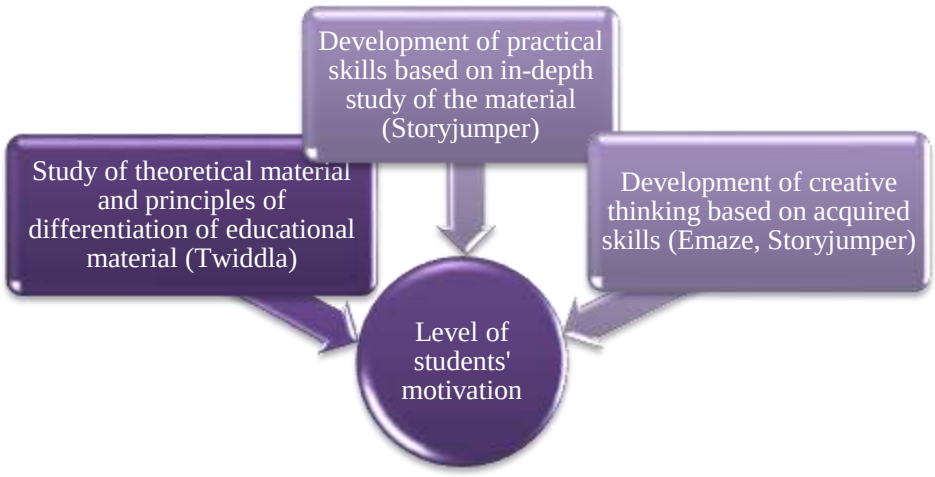

Fig. 1: Structural model of learning using digital technologies

Table 1. Determining the stage of the study that had the greatest impact on the motivation level

Learning stage	Percentage value before training	Percentage value after training
Study of theoretical material	-	22%
Study of practical material	16%	24%
Development of creative skills	30%	25%
General perception of the learning process	13%	29%
It didn't affect	41%	-

It was established that the students achieved a higher motivation level after training. This was reflected in the study of theoretical and practical material, the level of development of creative skills, and the general perception of the learning process. The results are related to the fact that training was delivered in a non-standard format, which involved the use of digital technologies. This made it possible to ensure a creative process of assimilation of information. A high level of motivation was reflected in the expansion of cognitive abilities, and the development of self-improvement. A high level of motivation contributed to the achievement of high educational goals, and the use of non-standard methods for completing educational assignments. The use of digital technologies ensured the completion of assignments in a non-standard form, and the use of a diagnostic format for displaying information. A higher motivation level is also associated with increased student success. A lower motivation level was observed among students before the training, which was reflected in the lack of awareness of the need to acquire new knowledge. It also affected the student's responsibility to study information. This was reflected in the lack of motivation in the performance of educational assignments, and assimilation of information.

It was planned to conduct an experimental test of knowledge during training, which was reflected in the consideration of the motivational criterion (Table 2).

Table 2. Experimental testing of students' knowledge

The parameter for which the performance was determined	Before training	After training	S
Availability of complex knowledge about methods and techniques of learning theoretical material	0.73	0.94	0.051
Knowledge of laws and methods of practical application of theoretical information	0.71	0.96	0.067

Experimental testing of knowledge showed that students achieved a high level of theoretical and practical knowledge after training. Learning with the help of digital technologies provided the possibility of using the learned information to create a programme of classes, and e-books. The process influenced the application of creative skills to use various forms and methods in education. This approach to education contributed to students' understanding of educational processes, which influenced the search for the most favorable approaches to completing the assignments. Students acquired the ability to use basic computer technologies, which was reflected in the completion of practical assignments. High results are also associated with the development of analysis skills, which made it possible to arrange information. This

affects development prospects, and skills in using digital technologies to complete certain assignments.

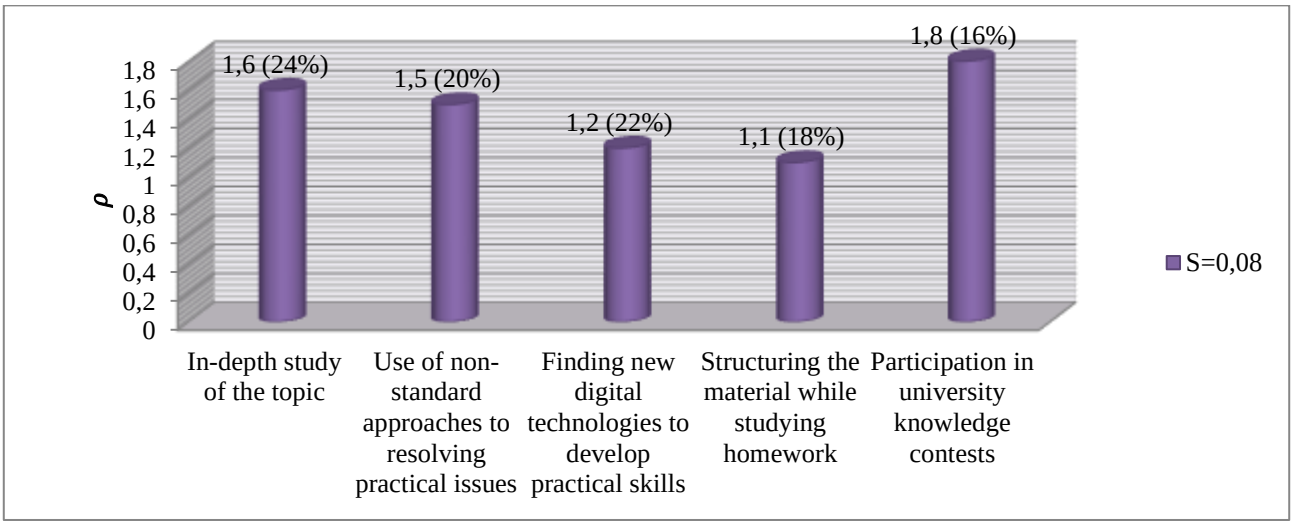

Fig. 2: Areas of student activity that were developed under the influence of motivational approaches

The results showed that after training, knowledge of laws and methods of practical application of theoretical information was achieved at a higher level than having theoretical knowledge. This is due to the use of digital technologies, which ensured the development of practical skills. The level of theoretical knowledge was higher than the level of practical knowledge before the training, which indicates poor organization of the educational process.

The last stage of the research provided for determining the directions of students' activities during their studies, which were affected by the development of motivational approaches. The results were obtained by calculating the comparison coefficient (Figure 2).

It was established that the use of digital technologies during education contributed to a more in-depth study of the topic by students. This ensured the search for new lessons with the help of digital technologies, which resulted in a more detailed study of a particular topic. The students also began to take the initiative in finding new digital technologies for the development of practical skills, which made it possible to improve existing knowledge. The search for digital technologies made it possible to expand the idea of further pedagogical activity and develop new approaches to the presentation of material. The use of non-standard approaches to completing practical assignments was based on the development of creative skills, which enhanced students' interest. This helped to complete assignments of various complexity, which was reflected in the deepening of professional knowledge. Some students also found an approach to creative homework preparation, as digital technologies expand educational opportunities. This had a positive effect on lectures and practical classes. The use of digital technologies was reflected in students' participation in university knowledge contests. The acquired knowledge made it possible to achieve high performance and participation in regional knowledge contests. The knowledge contests are based on the use of students' creative skills, as they require not only software knowledge but also creativity in solving problems.

A psychological social survey was also conducted to check the level of students' motivation to continue their studies using digital technologies (Figure 3).

A psychological and social survey of students established that most of them are interested in continuing their studies using digital technologies. This is due to a new approach to studying subjects, which motivates them to search for new information, which affects professional development. It also allows them to persevere in learning and influences the development of a creative approach, which is manifested in a non-standard approach to solving problems, and the continuation of research activity. Students develop independence in studying the subject, which affects their participation in extracurricular activities (participation in professional competitions, and knowledge contests). A medium level of satisfaction in education is related to the need to use a greater variety of technologies in education. A neutral level of motivation was found among a small number of students, which is explained by the lack of

attendance in all classes. The results of the comparison of the coefficient of standard deviation showed a difference in values, which does not confirm the correlation of the results. This is due to the advantages of a high level of student motivation and insignificant values of the medium and neutral levels.

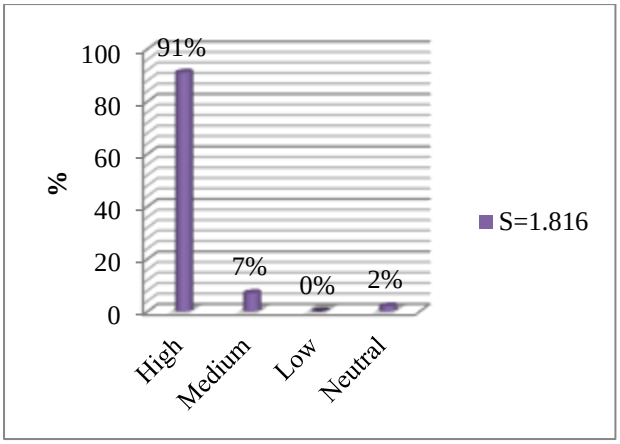

Fig. 3: The level of students' motivation in continuing their studies using digital technologies

5 Discussion

The obtained results showed that digital technologies contribute to greater effectiveness in learning, which correlates with research, [29], where the positive role of interactive technologies is also identified. Digital technologies contribute to providing more personalized and adapted learning, which affects greater efficiency and interest of students in learning. This is because they allow for the creation of educational materials, online courses, and training manuals. Digital technologies facilitate a flexible and modular approach to learning, allowing adaptation of the materials to students' needs, [29]. However, the aspects of the personalized influence of digital technologies in education were not established in the conducted research. Emphasis is placed on the possibility of in-depth development of students' professional skills.

The virtual classroom platform has the effect of increasing the level of students' interest in learning, as the process is related to the possibility of ensuring the use of new methods and technologies of education. This contributes to students' self-efficacy, development of their abilities, and communication skills. The results are related to the structuring of modules, and the use of specialized software, [30]. Digital platforms are one of the common elements of education in vocational colleges. Also, such an approach to education allows one to achieve high academic results and affects the possibility of ensuring self-regulated learning. Digital technologies contribute to faster assimilation of information, which provides the possibility of developing various skills, [31]. Digital technologies contribute to the creation of new opportunities for the transformation of learning, which improves professional skills. Digital technologies help to ensure the development of critical thinking, creative skills, interdisciplinary communications, flexibility, and initiative. These technologies allow for in-depth study of educational material by students, which affects the growth of professional competence, [32]. Virtual distance learning processes are not identified in our research. However, this study established those digital technologies contributed to the enhancement of students' motivation. This was manifested in the in-depth study of the topic, and the use of non-standard approaches to completing practical assignments. It also helped in the search for new digital technologies for the development of practical skills, structuring material when doing homework, and participation in university knowledge contests. The learning process provided for the study of theoretical material, the expansion of practical skills, as well as the development of creative skills.

The success of learning with the help of digital technologies is achieved due to several factors. Teachers should show interest in finding non-standard approaches to presenting information, and promote the search for new information for display. The introduction of such an approach in education has a positive effect on student motivation, which affects the search for approaches for professional development, [33]. Digital technologies contribute to the development of communication among students with the help of video services, which improves information perception. The existing education system is aimed at expanding basic knowledge, which contributes to its adaptation during the creation of educational projects. This approach affects the implementation of tools for the productive transfer of knowledge and skills. Involvement of the game principle of learning, visualization of information improves the perception of materials, [34], [35]. The combination of pedagogical knowledge and information technologies has a positive meaning for the motivation of students and their active participation in education. Students mastered pedagogical and technological thinking, which influenced increasing overall efficiency, [36]. The development of students' motivation based on interactive tools occurs because of information visualization and the possibility of immersion in the subject. The

ARCloud application has advantages in education, as it involves preliminary analysis, design, development, and implementation of training programs. The application also provides for the assessment of students' knowledge using multimodal tools, [37], [38]. In contrast to the presented works, which indicate the general importance of digital technologies, our article used specialized online tools that contributed to the acquisition of professional knowledge and the formation of students' motivation (Twiddla, Storyjumper, Emaze).

Digital technologies provide online classes, which facilitate the interaction of students and teachers. It also has an impact on the development of students' independence, which allows the development of students' personal capabilities, and interactive motivation. This makes it possible to provide more opportunities for the development of digital education and is also reflected in the increase in the level of knowledge of students, [39], [40]. The analysis of studies established that the research is aimed at determining the positive and negative aspects of the introduction of digital technologies in the educational process. In the presented study, the results are related to the development of a learning model, in which the emphasis is placed on the training of future teachers, which shapes the strengths of our research. The model developed by the authors provided for the use of digital technologies aimed at studying theoretical material, developing practical skills, and creative thinking. The advantage of our study is also the use of applications Twiddla, Storyjumper, and Emaze, which contributed to effective training. In addition to the determined students' effectiveness during training, it was also determined how digital technologies affected the activity of students in training.

5.1 Research Limitations

The study provided for the development of a training model for future teachers studying in the 2nd and 3rd years. However, the results show a limited value of indicators, which excludes the possibility of involving schoolchildren in the educational process and conducting additional research. However, it is practically impossible to do this within the scope of this research, which requires the search for additional mechanisms for the implementation of training and comparison of different efficiency approaches. This may affect the overall correctness of the results and indirect analysis of the obtained results.

5.2 Recommendations

This study is aimed at identifying the positive role of digital technologies in education, but they are more focused on the general analysis of digital technologies, excluding their diversity. Therefore, we believe that it is necessary to elaborate learning models that will contribute to the development of individual professional skills, which will later allow their use during their lessons. The training options provide for interactivity, which enables obtaining a high level of knowledge both during offline classes and online. This will ensure the training of teachers who have not only in-depth knowledge of computer technologies but also can use a creative approach to teaching. The use of digital technologies also involves the preliminary development of the lesson with the filling of appropriate educational materials. The teacher needs to decide how the training will take place, and what approach to choose for presenting the material. Also, from the proposed options of tasks, choose the most appropriate ones for the studied material using a digital application, which will ensure the correct verification of students' knowledge.

6 Conclusions

The authors achieved the aim of the article, as the positive role of digital technologies in increasing student involvement in the educational process was established. The primary development of the structural model of education ensured the use of digital technologies, which were aimed at developing the professional qualifications of future Computer Science teachers. The study of the theoretical material and the principles of differentiation of the educational material involved the use of a multimedia board and the online tool Twiddla. The process was aimed at the perception of educational information with the help of graphic material. The development of practical skills was based on an in-depth study of the material as a result of using the Storyjumper application. The Emaze and Storyjumper applications were used for the development of creative thinking. This ensured the creation of separate projects based on the acquired knowledge.

After 4 months of training, it was established that the general perception of the learning process (29%) had the greatest impact on the development of students' motivation. The training was aimed at the use of various digital technologies to learn different approaches to the perception of information. The development of creative skills also

contributed to the students' satisfaction, which is related to the variety of assignments to be completed, and the lack of patterns. The study of practical material also enhanced students' interest in learning and raised the level of completed assignments compared to the results before the study.

It was established after the training that the knowledge of laws and methods of practical application of theoretical information was achieved at a higher level. Students were able to achieve a high level of developed practical skills, as digital technologies allowed for the development of various directions. This contributed to the improved knowledge of theoretical material, the creation of training programs, fragments of e-books. The majority of students (91%) became motivated to continue their studies using digital technologies.

The results showed that students, with the help of developed motivation for learning, were able to achieve in-depth study of the topic. It also influenced the search for new digital technologies for the development of practical skills, which forms the academic novelty of the work. This contributed to a detailed study of a separate topic, and an understanding of the principles of using theoretical information in practice. The greatest effectiveness was achieved as a result of participation in university knowledge contests but among a smaller number of students.

The practical significance of the work is in the possibility of using new digital technologies for the training of future Computer Science teachers. The prospects for further research may be related to the comparison of various mechanisms of enhancing students' motivation and its influence on the positive development of professional skills.

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APPENDIX

Appendix A
Questionnaire No. 1 for a Sociological Survey
Respondents should give preference to one of the stages of education that contributed to the development of the highest level of student motivation. Pre- and post-training data collection was planned. Answer options include:
- study of theoretical material;
- study of practical material;
- development of creative skills;
- general perception of the learning process;
- did not affect.

Questionnaire No. 2 for a Sociological Survey
Respondents need to determine the areas of activity in education that were formed under the influence of the development of motivational approaches. Respondents should indicate the presence or absence of the level of motivation to expand the areas of professional activity before and after training. Answer options include:
- in-depth study of the topic;
- use of non-standard approaches to completing practical assignments;
- Search for new digital technologies for the development of practical skills;
- structuring the material when doing homework;
- participation in university knowledge contests.

Questionnaire No. 1 for a Sociological Survey
Respondents need to determine their level of motivation to continue their studies using digital technologies:
- high level of motivation;
- medium level of motivation;
- low level of motivation;
- neutral level of motivation.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)
The authors equally contributed to the present research, at all stages from the formulation of the problem to the final findings and solution.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself
No funding was received for conducting this study.

Conflict of Interest
The authors have no conflicts of interest to declare

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