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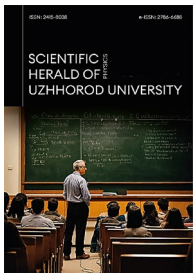

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Technology on increasing the preparedness of future teachers for integrated teaching in primary school

Botakoz Zhekibayeva
Karaganda Buketov University
100028, 28 Universitetskaya Str., Karaganda, Republic of Kazakhstan

Assemgul Kalimova
Karaganda Buketov University
100028, 28 Universitetskaya Str., Karaganda, Republic of Kazakhstan

Zhanar Sarsekeyeva
Karaganda Buketov University
100028, 28 Universitetskaya Str., Karaganda, Republic of Kazakhstan

Baglan Zhaparova
Pavlodar Pedagogical University
140000, 60 Mira Str., Pavlodar, Republic of Kazakhstan

Yerkin Ayagan*
Karaganda Buketov University
100028, 28 Universitetskaya Str., Karaganda, Republic of Kazakhstan

Abstract

Relevance. The study addresses the critical need for effective technology to prepare future primary school teachers for integrated teaching, highlighting the importance of the author's TPSIL technology in enhancing students' readiness for this approach.

Purpose. The purpose of this study is to determine the impact of TPSIL author's technology on the readiness for integrated learning in primary school of students which are future teachers.

Methodology. An experimental study was conducted to assess the initial level of preparedness of future teachers for integrated teaching in primary school. The researchers employed questionnaires and testing to determine the students' interest in the studied problem and assess their level of readiness for integrated teaching, aiming to provide insights into the effectiveness of the TPSIL technology in preparing future teachers for this approach.

Results. The authors found that the level of preparedness of future teachers for integrated teaching in primary school is low for most of the respondents. The need for the introduction of TPSIL technology (the technology of preparing students for integrated teaching) was substantiated according to the results of the experiment.

Conclusions. The study demonstrated the effectiveness of the authors' TPSIL technology in preparing future primary school teachers for integrated teaching by enhancing their knowledge and skills. However, the analysis revealed areas for

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*Corresponding author

improvement in the university educational process, which can be addressed through the implementation of the TPSIL technology and focused work by the university.

Keywords: training of future teachers; integrated teaching; students; experiment; technology; primary school; pedagogy.

Introduction

Today, an urgent problem worldwide is improving the quality of higher professional education. According to Z. Al-Zoubi et al. [1], a teacher is a dynamic axis in the educational process. An effective teacher is a source of inspiration, who has an effective, positive impact on teaching students. However, the social attractiveness and prestige of the academic profession has reached an extremely low level over the past twenty years, despite the fact that the profession of a teacher has been declared one of the honorary and responsible professions by R. Nagovitsyn et al. [2]. According to L.K.J. Baartman, N. Kilbrink and E. de Bruijn [3], vocational education and training is aimed at developing students' knowledge, their skills and competencies necessary to perform work in professional activities. A number of studies carried out worldwide cover some aspects of teacher training, including: methodical training of a physics teacher in the context of modernization of education in the works of A. Batyrbekova et al. [4]; teacher training for natural sciences E.A. Davis, F.J.J.M. Janssen and J.H. Van Driel [5]; a conceptual approach to the development of creative competencies of future teachers in the system of higher pedagogical education of Kazakhstan by A.Kh. Sarybayeva et al. [6]; conditions for school reform by K.Å. Parding, A. Berg-Jansson [7] and many others.

The introduction of integrated teaching in the primary school conditions requires careful preparation by teachers, allowing them to adapt to pedagogical innovations. S.M. Drake [8] believes that knowledge of the integration fundamentals will increase the training level of students, which in its turn will contribute to a deep understanding of upcoming professional activities by the last. The author's work presents approaches to the integration of curricula and their use in the school educational process. The issues of integrated multidisciplinary training programs that combine different subject areas are examined in detail.

Literature Review

The existing system of training future teachers is aimed only at the functional development of the profession; therefore, the level of potential and improving the quality of education depends on the quality with wich integrated teaching was built up. Analysis of such foreign sources as I.A. Sáez and N.B. Sancho [9] demonstrates the successful experience of introducing an integrated curriculum into the professional activities and culture of teachers.

At the same time, the essence of integration is irreducible only to its consideration as integrity. Such authors as Y. Beaumont-Walters and K. Soyibo [10] dedicated their study of student performance to the five skills of an integrated scientific process. The study determined the performance of Jamaican students in five skills of an integrated scientific process according to statistical differences in their performance. They were related to their gender, level of education, place of study, type of school, and socio-economic background. According to J. Kneen et al. [11], integration is a feature of many new curricula. The author noted that the integration of academic disciplines is the most necessary condition for revealing the essence of synthesis, and the integrity of knowledge. G. Zhou and J. Kim [12] implemented a study in which a methodological course was introduced to prepare primary school teachers; the course included the integration of several disciplines. During the experiment, teachers' knowledge in the field of integration of disciplines was improved. The authors note the professional growth of faculty teachers in the process of planning and teaching this course, as well as the high enthusiasm for the integration of the curriculum during their teaching practice.

Scientists such as C.C. Lam, T. Alviar-Martin, S.A. Adler and J.B.-Y. Sim [13] examined in their study eleven teaching and learning concepts intended for Singaporean teachers and related to their experience in implementing an integrated curriculum. Integration concepts of teachers reflected a variety of interdisciplinary models. The authors identified the advantages, disadvantages, and features of integration in training. In 2014, interdisciplinary education in Finland in basic education became compulsory. A study by N. Mård [14] focuses on the teaching of history as part of an interdisciplinary teaching module in a Finnish primary school. The author believes that the content of the subject of history can serve as the basis for the development of common competencies and skills associated with other subjects.

Such authors as K.A. Holley [15] examined the experience of 40 students enrolled in the integrated programme Phd. The data obtained in the process of the study indicate the importance of understanding the integration process, recognition of interdisciplinary results, and the ability to participate in joint research of teachers and postdoctoral students. In their work, R. Gresnigt et al. [16] provide an overview of integrated primary school curricula. The authors believe that integrated curricula are promising for increasing attention to science and technology in the primary education system. In the paper by J. Chauvot and M.M. Lee [17], a model of an online science and mathematics integration program for Texas middle school teachers was introduced. The authors conducted a detailed analysis of this program over four years of its implementation to eliminate problems in the development of sustainable online programs with the participation of natural science and maths teachers.

E. De Freitas and S.J. Bentley [18] presented the results of relations between universities and museums in their study. These relations are oriented to study the methods of integration between mathematics and physics. The authors examined the problematic, museum-based, and practical approaches to the study of integration between maths and physics. The authors also highlighted the benefits of a museum-integrated curriculum which creates the conditions for teaching maths and physics. In the empirical study by B. Kleve and S. Penne [19] it was found that intersubject perspectives are important steps towards improving the effectiveness of schooling for all students.

Exploring the similarities and differences between the two school subjects which are the Norwegian language and maths, the authors introduced a three-level integration of them: the level of discourse, the level of genre, and the way of thinking.

Such authors as A. Asrizal et al. [20] believe that educators need to use integrated teaching materials to improve students' knowledge and digital literacy. Researchers came to the conclusion that the use of integrated scientific and educational material has a significant impact on the knowledge and experience of students. The study of such authors as M. Kans and A. Gustafsson [21] identified four characteristics of interdisciplinary (integrated) training: people integration, knowledge integration, deepening of integrated knowledge as a result and problem solving and as a means of integration itself.

According to R.M. Harden et al. [22], integrated teaching is a powerful educational strategy. Based on the study of the authors, we believe that integrated teaching forms a system of knowledge about the interaction and interdependence of man, nature and society. A distinctive feature of integrated teaching is the focus on the formation of not only inter subject communications, as well as wide range of skills: functional and creative application of knowledge, the development of critical thinking; formation of a productive training system; the development of cognitive activity of students; formation of a holistic picture of the world, as well as the comprehensive development of the student's personality [23; 24].

Thus, the real practical tasks of integrating knowledge in teaching should be reflected in the content of university training of students. There is a problem of the need to formulate a research hypothesis. For the formation of professional and pedagogical competence of students which are future teachers, the development of technology is required, including: target module, theoretical module, process module, information and multimedia module, and a result. If the technology developed by us would be introduced into the pedagogical process of a university, this will increase the quality of training for future teachers, as students will be involved in activities aimed at mastering the totality of knowledge, competencies and skills of integrated teaching in primary school.

Materials and Methods

To identify the initial state of the preparedness level of future teachers for integrated teaching in primary school, an experiment was conducted, the basis of which was diagnostics. Graduating students studying in the specialty "Pedagogy and Methods of Primary Learning" took part in the ascertaining experiment at E.A. Buketov Karaganda State University in the amount of 120 people.

The purpose of this study is to determine the impact of TPSIL author's technology on the readiness of students, which are future teachers, for integrated teaching in primary school. The experiment was carried out in the 2019-2020 academic year, during which the following tasks were set and solved: to identify whether future teachers have an interest in the problem being studied; to determine the level of preparedness of future teachers for integrated teaching in primary school; to identify the level of preparedness of future teachers for integrated teaching in primary school, the following methods were used: questionnaire, testing.

According to such authors as P. Broberg, T. Umans and C. Gerlofstig [25], questionnaires are an effective method of collecting information. We have compiled an author's questionnaire, which was sent to students, to the electronic mail addresses mail.ru. The period of questioning students lasted from October 7 to October 11, 2019. This questionnaire included seven questions. Within the framework of our study, we examined the following indicators of readiness of future teachers: knowledge of the content, features of integrated teaching in primary school; the desire to improve readiness for integrated teaching in primary school. In identifying the maturity degree concerning readiness indicators for future teachers on integrated teaching in primary school, we identified the following levels: high, medium, low.

Future teachers with a high level of readiness are characterized by a stable positive orientation towards professional and pedagogical activity, and awareness of the importance of the profession. These students have a need to acquire and improve knowledge in the field of integrated teaching. Future high-level teachers creatively use the knowledge of the essence and content of the integrated teaching of primary school students. They can determine the appropriateness of this training and adequately evaluate the results of their activities. The activities of future teachers having a high level of readiness are distinguished by the ability to rationally use the possibilities of integrated teaching, and also have a productive nature, which manifests itself in the ability to consciously plan and analyse their pedagogical activity [26].

The average level of readiness of future teachers for integrated teaching in primary school is characterized by: assimilation of theoretical knowledge; insufficient formation of skills to apply the acquired knowledge in practical activities; awareness of the importance of the primary school teacher profession as a necessity; not clearly expressed need to improve knowledge in the field of integrated teaching. Such students do not use theoretical knowledge appropriately. The low level is characterized by incomplete readiness of future teachers for integrated teaching in primary school. Future teachers with a low level of readiness do not realize the importance of their profession; they are characterized by a lack of interest not only in integrated teaching and the features of its use, but also in future professional and pedagogical activities. These students are distinguished by the use of common techniques and methods of organizing their activities, lack of skills to plan independently, define goals and objectives. The activities of future teachers with a low level of readiness for integrated teaching in primary school are reproductive.

In our study, we found out a key component of the phenomenon being studied, namely the essence of the training of future teachers, which was carried out in integrated teaching. We identified this category's essence on the basis of the analysis of scientific literature, which led to the conclusion that the phenomenon under study is considered as a set of integrative professionally significant personal qualities that contribute to the implementation of relevant knowledge, skills and experience of professional activity.

Results and Discussion

At the ascertaining stage of the experiment, we conducted a survey of students. An analysis of the results showed that the majority of respondents showed interest in the problem under study and took an active part in the survey. The first question was, "Are there differences between the activities of primary school teachers and teachers of the same subject?" 14.1% of the students surveyed said that there were no differences; 78.2% found it difficult to answer the first question, and they could not give a thorough answer; 7.7% believe that there is a significant difference between the activities of primary school teachers and subject teachers.

Answering the second question of the questionnaire, the majority of students (83%) could not give a definition of the concept "integrated teaching in primary school"; the rest (15.6%) found it difficult to formulate a definition, and only 1.4% indicated that integrated teaching is based on the integration of knowledge in primary school. When students answered the third question "Is it important to know the substantive differences of the updated curricula for primary school?", the following was observed: 54.9% of university graduates believed that it is not necessary to know the differences between updated curricula; 28.7% did not think about this, and only a small part, 16.4%, noted the importance of the helicity principle knowledge in the designing of the content of educational subjects. "Can you identify the role of cross-cutting themes in integrated teaching?" This question was answered by 3.4% of graduate students who believed that "cross-cutting themes" carry out interdisciplinary communication, with the help of which students repeat educational material throughout their schooling; 18.7% found it difficult to answer this question; 77.9% of the students surveyed said they could not determine the role of "cross-cutting themes" in integrated teaching.

When answering to the fifth question, "Do you think that the updated primary school programs are aimed at integrating the knowledge of students?" 79.6% of them believed that the updated programs are not aimed at integrating knowledge in training; 10.3% of respondents found it difficult to answer this question and only 10.1% of students gave a detailed answer.

When answering to the question "Is the principle of helicity important for integrated teaching?", students argued their answers as follows: 54.4% answered that this principle does not play a role for integrated teaching; 40.1% indicated that the principle of helicity is key when designing a lesson, and 5.5% of students answered that the principle of helicity is important for integrated teaching. The question of the questionnaire "How do you assess your level of readiness for integrated teaching in primary school?" gave us the following answers. The overwhelming majority of graduate students (67.3%) noted that the current training contributes little to professional training; innovations are needed. 20.2% of 4th year students are satisfied with their professional training and believe that the current training is quite conducive. And only 12.5% of this group of respondents found it difficult to answer.

To achieve the greatest objectivity and reliability of the information, we invited students to undergo testing. Test items consisted of ten questions and five answer options. The analysis of answers showed that 38.6% of students are fluent in pedagogical terminology, correctly answer questions related to the main categories, principles, laws, methods and means of integrated teaching. The results of the successfully passed test tasks on the organization of integrated teaching in the lessons in primary school amounted to 7.7% of the students surveyed. With a sufficiently high level of interest in integrated teaching, 53.7% of students lack practical knowledge in the field of putting theoretical knowledge into practice.

These diagnostic facts are manifested in the matters that when the initial knowledge and skills are formed, the students which are future teachers do not have a complete understanding of how to use knowledge in the upcoming pedagogical activity, since they do not know how to organize integrated training in the educational process. We were able to identify the level of knowledge formation of integrated teaching in primary school using questions related to the presence of concepts and ideas in this area. The questionnaire and testing were used to assess crucial indicators of students' preparedness for integrated teaching in primary school. These indicators included their understanding of future professional duties related to integrated teaching, knowledge of the updated primary education curriculum in the Republic of Kazakhstan, and proficiency in the skills required to apply integrated teaching within the primary school educational setting.

A combined analysis of student diagnostic results related to knowledge in the field of integrated teaching in primary school shows that a significant share of the students' surveyed show their low level of knowledge. The results are presented in Table 1.

Table 1. The level of readiness of future teachers for integrated teaching in primary school (n=120)

Level	Indicators of readiness for future teachers					
	Knowledge of the content of integrated teaching in primary school		Knowledge of the features of integrated teaching in primary school		Desire to improve readiness for integrated teaching in primary school	
	n	%	n	%	n	%
High	23	19.17	27	22.50	25	20.83
Middle	44	36.66	42	35.00	41	34.17
Low	53	44.17	51	42.50	54	45.00

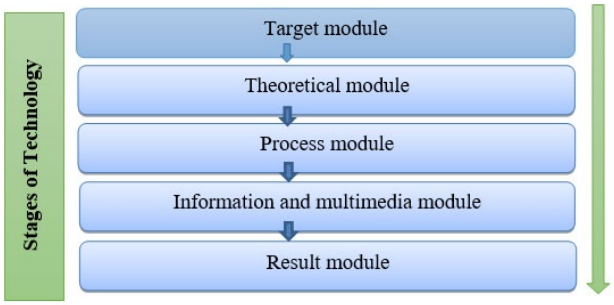
An assessment of the readiness level of future teachers for integrated teaching in primary school showed that for the majority of the respondents studied, the level of readiness is low, and it does not correspond to the completeness, consistency and awareness of the totality of knowledge about integrated teaching. This means that students do not have sufficient theoretical knowledge which would allow them to be used optimally in practical activities and would correspond to the high level of readiness of future teachers for the type of activity being studied. Particularly noteworthy is the fact that most students have a pronounced negative attitude towards improving the preparedness of the future profession of primary school teachers.

The content and quality of teaching disciplines is of a separate nature and does not fully contribute to the creation

and establishment of theoretical knowledge; this fact is the reason for the poor learning outcomes of the students passed the study. The elimination of identified shortcomings is possible only in the process of the university's focused work in this direction. This problem can be solved by introducing TPSIL's proprietary technology in the pedagogical process of the university to increase the level of readiness of students – future teachers for integrated teaching in primary school [27; 28].

We have developed TPSIL technology, which consisted of the following stages: target module, theoretical module, process module, information and multimedia module, result module.

The basis for the introduction of TPSIL technology was the analysis of the initial state of readiness for integrated teaching in primary school. The main objective of the next stage of the experiment was the introduction and testing of technology, as well as verification of its effectiveness. A schematic representation of this technology is presented in the Figure. 1.



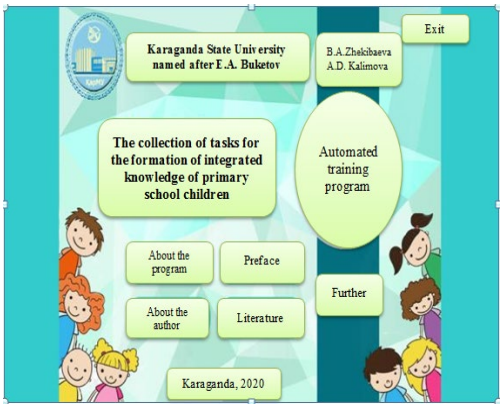
Target module of the TPSIL technology. In accordance with the requirements of modern society, it is essential to prepare competitive and competent teaching staff who will contribute to the global educational space, which is a social order in the field of education. The target module of the technology provides for a detailed study of regulatory documents in the field of education in the Republic of Kazakhstan: the Law on Education, the State Program for the Development of Education for 2020-2025, the State Compulsory Standard for Higher and Primary Education.

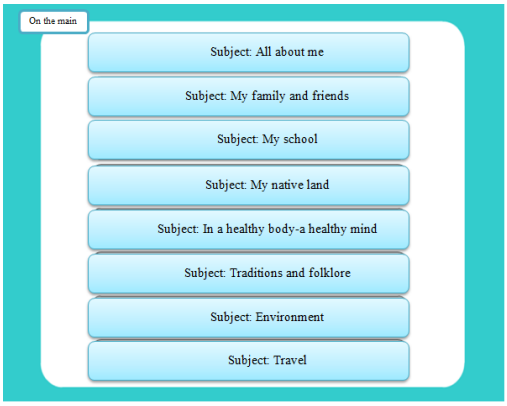
Theoretical module of the TPSIL technology. At this stage, we have implemented and tested a seminar for students named as "Fundamentals of Integrated teaching in Primary school". The purpose of this seminar is the formation, generalization and systematization of theoretical knowledge, the development of practical skills for future teachers in the implementation of integrated primary school education. The content of the seminar included questions revealing Scientific and theoretical foundations of integrated teaching in primary school, Socio-pedagogical prerequisites for integrated teaching in primary school, Features of integrated teaching for younger students, Levels of integration, Types and forms of integration, Forms, methods, means of forming the preparedness of future teachers for the integrated teaching of primary school students, Criteria and indicators of future teachers' readiness for the integrated teaching of primary school students.

Process module of the TPSIL technology. This stage included the elective course "Integrated teaching for Primary Schoolchildren as part of the updated content of primary education" for students of the specialty 5B010200 "Pedagogy and Primary education methodology". The purpose of the elective course is the formation of knowledge and skills of integrated teaching for future primary school teachers. The total workload of the course is 30 hours, which corresponds to two credits. The content of the educational material of the elective course is reflected in three modules; an intermediate control is provided at the end of each of them. The elective course is designed to ensure continuity in the logic of training future teachers and give it completeness, consistency and completeness. Therefore, the developed elective course can be introduced as an optional component in the curriculum of the specialty "Pedagogy and primary education methodology" [29; 30].

Information and multimedia module of TPSIL technology. The next stage of the technology included information and multimedia support for preparing students for integrated teaching in primary school. According to the developed technology, future teachers had the opportunity to use the acquired knowledge and skills in the course of teaching practice, where they could test integrated fragments of lessons and other didactic material developed in the process of studying technology [31; 32].

We have developed an automated training program "Collection of tasks for the formation of integrated knowledge of younger students" for information and multimedia support of the technology intended for preparing future teachers to integrated teaching in primary school. The purpose of the automated training program is the formation of students' integrated knowledge of the socio-cultural and natural environment of man, understanding of national and social values and experience, as well as the skills of applying the rules of interaction in all spheres of human life. A screenshot of the automated training program is shown in the Figure 2.





The tasks in the automated training program are aimed at developing of thinking skills of students, and also contribute to the formation of the basics of knowledge in history, mathematics, geography, Kazakh, English, Russian languages, and social science. The practical tasks of the program are developed on the basis of intrasubject integration, which contribute to the formation of students' perception and thinking. An automated training program was introduced to consolidate, generalize the knowledge and skills of integrated teaching in primary school among students which are future teachers [33; 34].

Result module of the TPSIL technology. At the final stage, a re-survey of students was organized, in the teaching of which a technology to prepare students for integrated teaching in primary school was introduced. The results of the control experiment are presented in Table 2.

Table 2. The level of readiness of future teachers for integrated teaching in primary school after the introduction of the TPSIL technology (n=120)

Level	Indicators of readiness for future teachers					
	Knowledge of the content of integrated teaching in primary school		Knowledge of the features of integrated teaching in primary school		Desire to improve readiness for integrated teaching in primary school	
	n	%	n	%	n	%
High	58	48.34	61	50.83	64	53.34
Medium	44	36.66	46	38.34	48	40.00
Low	18	15.00	13	10.83	8	6.66

The questionnaire and testing were used to evaluate crucial indicators of students' readiness for integrated teaching in primary school. The assessed indicators encompassed their understanding of future professional responsibilities involving integrated teaching, their familiarity with the updated primary education curriculum in the Republic of Kazakhstan, and their mastery of the necessary skills to implement integrated teaching in the primary school classroom. The results of the correlation analysis are presented in Table 3.

Table 3. The results of the correlation analysis between the levels of readiness of future teachers for integrated learning in primary school according to Spearman (n=120)

Level	Student performance		
	A	B	C
High	0.79	0.67	0.01
Medium	0.46	0.74	0.21
Low	0.001	0.001	0.83

Correlation analysis of the research results showed reliable relationships between the training levels of future teachers. The data presented indicate that the results of preparing future teachers for integrated teaching in primary school became higher after the implementation of the developed author's technology.

Conclusions

The study showed that the level of completeness and systematic assimilation of theoretical knowledge by future teachers and the development of their pedagogical skills depend on the TPSIL technology application developed by us. Therefore, the results obtained allow us to consider that the developed author's technology provides effective preparation of future teachers for integrated teaching in primary school and can be implemented in training practice. The success of achieving the teaching goal depends on the correct definition of the training content and on the level of training of future teachers, as well as whether they have an interest in organizing integrated teaching in their primary school.

Analysing the initial state of the preparedness level of future teachers for integrated teaching in primary school, we were able to identify a number of reasons that influenced the learning outcomes of the students surveyed: the content and quality of the taught basic cycle disciplines do not fully contribute to the formation of the needs of pedagogical activity, which negatively reflect on the importance of the future profession of primary school teachers; the educational process in the university has not created sufficient conditions for the formation of the necessary theoretical and practical knowledge of integrated teaching in primary school. The elimination of the identified causes is possible in the process of the university's focused work in this direction, which, in our opinion, should provide theoretical and practical training for future primary school teachers. The developed TPSIL technology, as well as other scientific results obtained during the study, can be used in the work of universities in order to improve the professional training of primary

school teachers, as well as in the continuing education system for teachers.

This study does not claim to be an exhaustive solution to all aspects of the problem under consideration. Its further practical development can be continued in the implementation of issues of training future teachers in the conditions of distance learning, as well as advanced training of teachers in the education system; it should also be related to information exchange issues. We see the prospects of this study as a multidimensional phenomenon in the further development of sites and programs for the exchange of information on the preparation of future teachers for integrated teaching in primary school.

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Conflict of Interest
None.

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Технологія підвищення готовності майбутніх учителів до інтегрованого навчання в початковій школі

Ботакоз Жекібаєва
Карагандинський університет імені Є. А. Букетова
100028, вулиця Університетська, 28, м. Караганда, Республіка Казахстан

Асемгуль Калімова
Карагандинський університет імені Є. А. Букетова
100028, вулиця Університетська, 28, м. Караганда, Республіка Казахстан

Жанар Сарсекеєва
Карагандинський університет імені Є. А. Букетова
100028, вулиця Університетська, 28, м. Караганда, Республіка Казахстан

Баглан Жапарова
Павлодарський педагогічний університет
140000, вулиця Миру, 60, м. Павлодар, Республіка Казахстан

Єркін С. Аяган
Карагандинський університет імені Є. А. Букетова
100028, вулиця Університетська, 28, м. Караганда, Республіка Казахстан

Анотація

Актуальність. У дослідженні розглядається гостра потреба в ефективній технології підготовки майбутніх учителів початкових класів до інтегрованого навчання, підкреслюється важливість авторської технології TPSIL у підвищенні готовності студентів до такого підходу.

Мета. Метою дослідження є визначення впливу авторської технології TPSIL на готовність до інтегрованого навчання в початковій школі студентів – майбутніх учителів.

Методологія. Було проведено експериментальне дослідження з метою оцінки вихідного рівня готовності майбутніх учителів до інтегрованого навчання в початковій школі. За допомогою анкетування та тестування було визначено зацікавленість студентів у досліджуваній проблемі та оцінено рівень їхньої готовності до інтегрованого навчання, що дало змогу з'ясувати ефективність технології TPSIL у підготовці майбутніх учителів до такого підходу.

Результати. Виявлено, що рівень готовності майбутніх учителів до інтегрованого навчання в початковій школі у більшості респондентів є низьким. За результатами експерименту обґрунтовано необхідність впровадження технології TPSIL (технологія підготовки студентів до інтегрованого навчання).

Висновки. Дослідження продемонструвало ефективність авторської технології TPSIL у підготовці майбутніх учителів початкових класів до інтегрованого навчання шляхом поглиблення їхніх знань і вмінь. Однак аналіз виявив напрями вдосконалення освітнього процесу в університеті, які можуть бути вирішені шляхом впровадження технології TPSIL та цілеспрямованої роботи університету.

Ключові слова: підготовка майбутніх учителів; інтегроване навчання; учні; експеримент; технологія; початкова школа; педагогіка.