

**ПЕДАГОГИКА ҒЫЛЫМДАРЫ БАҒЫТЫ
НАПРАВЛЕНИЕ ПЕДАГОГИЧЕСКИХ НАУК
DIRECTION OF PEDAGOGICAL SCIENCES**

тақырыптық рубрикалар/тематические рубрики/ subject headings

**ПЕДАГОГИКА И МЕТОДИКА ПРЕПОДАВАНИЯ
ПЕДАГОГИКА И МЕТОДИКА ПРЕПОДАВАНИЯ
PSYCHOLOGY AND INCLUSIVE EDUCATION**

IRSTI: 14.35.09

<https://orcid.org/0000-0001-9722-9175>

Mamadaliyev S.T.*

master, teacher. O.Zhanibekov, SKPU. Shymkent, Kazakhstan

**THE USE OF PROBLEM-BASED LEARNING TECHNOLOGIES IN THE
PROFESSIONAL TRAINING OF SPECIAL EDUCATION TEACHERS**

***Corresponding-author:** Sanzhar_sherlock@mail.ru

Abstract: This research investigates the impact of problem-based learning technologies on the professional competencies of special education students. The study involved a four-week experiment with control and experimental groups. Results showed significant improvements in the experimental group's professional competencies, including corrective and developmental work for speech disabilities, collaboration with parents, and diagnostic work with children with speech disabilities. The study highlights the effectiveness of problem-based learning in enhancing student motivation, engagement, and positive attitudes towards their profession. The paper concludes that integrating problem-based learning technologies into special education curricula can significantly enhance students' professional preparedness and equip them with essential skills for addressing the challenges of the field.

Key words: problem-based learning, special education, technology integration, teacher training, student motivation, collaboration

FTAXP: 14.35.09

<https://orcid.org/0000-0001-9722-9175>

Мамадалиев С.Т.*

магистр, оқытушы. Ө.Жәнібеков атындағы ОҚПУ. Шымкент, Қазақстан

**АРНАЙЫ БІЛІМ БЕРУ СТУДЕНТТЕРІН КӘСІБИ ДАЯРЛАУДА ПРОБЛЕМАЛЫҚ
ОҚЫТУ ТЕХНОЛОГИЯЛАРЫН ҚОЛДАНУ**

***Автор-корреспондент:** Sanzhar_sherlock@mail.ru

Түйін: Бұл зерттеу жұмысы проблемалық оқыту технологиясын арнайы білім беру студенттерінің кәсіби құзыреттіліктеріне әсерін зерттейді. Зерттеу бақылау және эксперименттік топтармен төрт апталық экспериментті қамтыды. Нәтижелер эксперименттік топтың кәсіби құзыреттіліктерінің айтарлықтай жақсарғанын көрсетті, оның ішінде сөйлеу қабілеті бұзылысы бар балаларды түзету және дамыту жұмыстары, ата-аналармен ынтымақтастық орнату және сөйлеу қабілеті бұзылған балалармен диагностикалау жұмыстары. Зерттеу оқушылардың ынтымақтасу, белсенділігін және өз мамандығына деген оң көзқарасын арттырудағы проблемалық оқытудың тиімділігін көрсетеді. Мақалада проблемалық оқыту технологияларын арнайы білім беру бағдарламаларына біріктіру оқушылардың кәсіби дайындығын айтарлықтай арттырып, оларды осы

саладағы мәселелерді шешу үшін қажетті дағдылармен қамтамасыз ете алады деген қорытындыға келді.

Кілт сөздер: проблемалық оқыту, арнайы білім беру, технологиялық интеграция, мұғалімдерді даярлау, студенттерді ынталандыру, ынтымақтастық

МРНТИ: 14.35.09

<https://orcid.org/0000-0001-9722-9175>

Мамадалиев С.Т.*

магистр, преподаватель, ЮКПУ им.Ө.Жәнібеков. Шымкент, Казахстан

ИСПОЛЬЗОВАНИЕ ТЕХНОЛОГИЙ ПРОБЛЕМНОГО ОБУЧЕНИЯ В ПРОФЕССИОНАЛЬНОЙ ПОДГОТОВКЕ ПЕДАГОГОВ СПЕЦИАЛЬНОГО ОБРАЗОВАНИЯ

*Автор-корреспондент: Sanzhar_sherlock@mail.ru

Аннотация: В данном исследовании изучается влияние технологий проблемного обучения на профессиональные компетенции учащихся специальных учебных заведений. Исследование включало четырехнедельный эксперимент с контрольной и экспериментальной группами. Результаты показали значительное улучшение профессиональных компетенций экспериментальной группы, включая коррекционную и развивающую работу с детьми с нарушениями речи, сотрудничество с родителями и диагностическую работу с детьми с нарушениями речи. В исследовании подчеркивается эффективность проблемного обучения в повышении мотивации, вовлеченности и позитивного отношения учащихся к своей профессии. В документе делается вывод о том, что интеграция технологий проблемного обучения в программы специального образования может значительно повысить профессиональную подготовленность учащихся и дать им необходимые навыки для решения задач в данной области.

Ключевые слова: проблемное обучение, специальное образование, интеграция технологий, подготовка преподавателей, мотивация студентов, сотрудничество.

Introduction

The integration of technology into the educational process has become a critical aspect of modern teaching practices. However, the implementation of these technologies in the classroom, particularly in the training of special education teachers, has presented a unique set of challenges [1]. This research paper aims to examine the issues surrounding the use of problematic teaching technologies in the professional training of special education teachers.

Numerous studies have highlighted the various challenges faced by teachers when attempting to integrate technology into their instructional practices. One of the primary barriers is the lack of adequate training and support for teachers, which can lead to a reluctance to embrace new technologies [2]. Additionally, teachers' core beliefs about teaching and learning can also serve as significant obstacles to successful technology integration.

In the context of special education, the integration of technology can be even more complex, as teachers must navigate the unique needs and learning styles of their students. This paper will explore the specific challenges faced by special education teachers in this regard, and provide insights into strategies for addressing these issues.

Recent research has highlighted the connection between teachers' human capital, as measured by both direct and indirect indicators, and their impact on student achievement, a phenomenon often referred to as "teacher value-added." These studies suggest a link between teacher training and quality, and their influence on the broader student population. However, quantitative investigations focusing specifically on special education teachers remain limited. Similarly, only a small number of studies have explored the overall effects of special education programs on the academic performance of students with disabilities. Nevertheless, prior research

has examined the training of special education teachers and its influence on their classroom practices.

Several studies have examined the relationship between the training of special education teachers and their classroom practices, including works by Algozzine, Morsink, and Algozzine in 1988; Sindelar, Daunic, and Rennells in 2004; and Nougaret, Scruggs, and Mastropieri in 2005. These studies have consistently found that the quality of teacher training is a significant predictor of the effectiveness of special education instruction, underscoring the importance of addressing the challenges associated with integrating technology into the professional development of these educators [3; 4]

Another key issue is the accessibility and availability of appropriate technologies for special education classrooms. Many of the existing technologies may not be tailored to the specific needs of students with disabilities, making it difficult for teachers to effectively utilize these tools in their instruction.

Challenges in Integrating Technology in Special Education Teacher Training:

The integration of technology in the professional training of special education teachers is a complex and multifaceted challenge. One of the primary obstacles is the lack of adequate training and support for teachers, as they often lack the necessary skills and confidence to effectively utilize technology in their instruction. Many teachers, including those in special education, may have preconceived beliefs about the role of technology in teaching, which can hinder their willingness to embrace new technologies.

Moreover, teachers' attitudes and beliefs about the role of technology in the classroom can also serve as significant barriers to successful integration. Teachers who are resistant to change or perceive technology as a threat to their traditional teaching methods may be less likely to embrace new technologies, ultimately hindering the progress of their students.

Additionally, the culture and norms within the special education field can also play a role in the adoption of new technologies. If the subject culture does not value or support the use of technology, teachers may be less inclined to invest time and resources into integrating it into their teaching practices.

Effective special education teaching practices often involve a dynamic process of trial and error in selecting appropriate instructional strategies. Key elements of this adaptive approach include:

- Designing lesson plans that incorporate multiple scenarios, perspectives, and learning modalities to cater to diverse student needs.
- Closely monitoring student responses and progress to gauge the effectiveness of lessons and identify areas for improvement.
- Regularly evaluating and adapting lessons based on ongoing assessment of student performance, with a focus on continuous refinement.
- Collaborating with peers, both within the special education field and in general education, to review lesson plans, share best practices, and generate new ideas.
- Developing and maintaining a network of experienced mentors and colleagues who can provide guidance, support, and valuable insights.
- Compiling a comprehensive list of teaching resources, lesson plans, and professional development opportunities to continuously expand one's knowledge and skills.
- Establishing a structured professional development plan with measurable goals, ensuring ongoing growth and staying up-to-date with the latest educational research and strategies.
- Implementing data collection systems to facilitate the monitoring and refinement of lessons, enabling evidence-based decision-making and targeted interventions.

- Seeking advice, techniques, and perspectives from both special education and general education teachers to gain a well-rounded understanding of effective instructional practices.

Integrating technology into this adaptive process can present significant challenges, as teachers must not only navigate the technical aspects of using new tools but also thoughtfully integrate them into their existing teaching practices. [5]

Main provisions

The use of modern pedagogical technologies can enhance students' learning motivation and the quality of their knowledge acquisition. A significant number of skilled researchers and educators have been and continue to be engaged in exploring innovative educational technologies. The primary goal of educational endeavors is to create conditions that foster each student's personal fulfillment, the disclosure of their abilities and inclinations, and the opportunity to experience success and believe in their own capabilities. In contrast to traditional learning, where competencies are formed through the assimilation of pre-existing scientific knowledge, the main objective of problem-based learning is the mastery of competencies through the activation of students' independent research and creative activities. Problem-based learning is designed to cultivate a unique style of mental activity, research engagement, and intellectual independence in students. The theoretical foundation of problem-based learning is the conceptualization of thinking as a productive process.

Problem-based learning involves the independent, complete or partial, resolution of feasible problems by students. To establish a problem situation, students should be given a practical or theoretical task, the completion of which requires the discovery of new knowledge and the acquisition of new skills.

The use of problem-based learning technologies has gained significant attention in the professional training of special education teachers due to its potential to enhance learners' problem-solving skills, critical thinking, and overall preparedness for the profession

Literature Review

Recent research has highlighted the potential of problem-based learning methods as promising approaches in education. In contrast to the algorithmic thinking underlying programmed learning, problem-based learning encourages creative and innovative thought processes, which may be particularly valuable in addressing the challenges of non-standard classroom settings. The theoretical foundations of problem-based learning have been extensively explored by many educators, with a focus on the key concepts of "problem" and "problem situation." These problem situations are designed to stimulate students' thinking, prompting them to acquire new knowledge, overcome emerging contradictions, and actively engage in the search for solutions.

During the implementation stage, the classroom serves as the primary setting for instruction. Building upon their initial preparation, teachers should present pre-designed problem scenarios and introduce new problems in real-time. Students are then expected to either solve the provided problems or formulate their own based on the problem situations they envision. To support the problem-posing process, teachers may offer appropriate prompts or exemplar problems to help students effectively and constructively generate and articulate their own problems.

The benefits of problem-based learning have been well-documented in the literature, particularly in its ability to foster problem-solving skills, critical thinking, and self-directed learning. For example, one study found that problem-based learning was more effective than traditional instruction in promoting long-term information retention, conceptual understanding, and self-directed learning.

Building upon the extensive research conducted by scholars such as L.A. Volovich, G.I. Ibragimov, and G.V. Mukhametzyanova, the concept of developing qualified specialists has been a subject of intensive study. Proponents of Problem-Based Learning argue that the function of

thinking in education transcends the mere acquisition of new knowledge; it also involves the development of innovative approaches to achieve desired objectives. According to A.M. Matyushkin, the primary role of thinking in teaching is to not only enable the acquisition of new knowledge, but also to foster the ability to act in novel and creative ways. An individual's entire system of knowledge and actions is a reflection of their cognitive capacities, which serve as the foundational tools for their intellectual development and growth [6].

The integration of technology can play a crucial role in enhancing problem-based learning. Technology-based tools and processes can facilitate the design, delivery, and participation in problem-based learning units, allowing teachers to create more immersive and engaging learning experiences for their students.

For example, digital tools can be leveraged to support the presentation of problem scenarios, the facilitation of collaborative problem-solving, and the ongoing assessment and feedback mechanisms that are essential to the problem-based learning approach. Technology can enable the creation of more interactive and engaging learning environments, allowing teachers to guide students through complex problem-solving processes and provide timely feedback and support. By integrating technology, the problem-based learning methodology can be further enhanced to better meet the diverse needs of special education students [7;8]. Moreover, digital tools can be leveraged to support the presentation of problem scenarios, the facilitation of collaborative problem-solving, and the ongoing assessment and feedback mechanisms that are essential to the problem-based learning approach [9].

However, the successful implementation of problem-based learning in special education teacher training presents unique challenges. Educators must carefully consider the diverse needs and learning styles of special education students, and adapt the problem-based approach accordingly. Integrating technology can be particularly complex, as teachers must ensure that digital tools and resources are accessible and supportive of the unique needs of their students. Additionally, problem-based learning may require additional scaffolding and support to help special education students navigate the problem-solving process effectively. Despite these challenges, the benefits of problem-based learning, such as fostering critical thinking and problem-solving skills, make it a valuable approach worth exploring in special education teacher training.

Theoretical analysis

Materials and methods. This study employed a qualitative research design to explore the use of technology in the problem-based learning approach within the context of special education teacher training. The data collection process involved a comprehensive review of relevant literature, including scholarly articles, book chapters, and industry reports.

The literature review focused on understanding the key principles and practices of problem-based learning, as well as the potential role of technology in enhancing this pedagogical approach. The review also examined the unique challenges and considerations associated with implementing problem-based learning in special education teacher training programs.

The findings from the literature review were synthesized to develop a deeper understanding of the current state of research and practice in this field.

The aim of this study is to examine the use of problematic teaching technologies in the professional training of special teachers, with a focus on how technology can be integrated to support the problem-based learning approach in this context.

The task of this study:

1. Understand the key principles and practices of problem-based learning, and how it can be applied in the context of special education teacher training.
2. Examine the potential role of technology in enhancing problem-based learning, particularly in the context of special education teacher training.

3. Identify the unique challenges and considerations associated with implementing problem-based learning in special education teacher training programs, and how technology can be leveraged to address these challenges.

The outcomes of this study will provide insights and recommendations for effectively integrating technology-enhanced problem-based learning in the professional training of special education teachers.

Subject of this research is the use of problematic teaching technologies in the professional training of special teachers.

This study anticipates that the integration of technology-enhanced problem-based learning can provide significant benefits in the professional training of special education teachers.

This study employed an experimental approach to investigate the use of problem-based learning technologies in the professional training of special education students. The key stages of the research involved:

1. Developing a methodology for integrating Problem-Based Learning Technologies into the professional training curriculum for special education students.
2. Conducting a detection experiment to assess the current use of problem-based learning technologies in the professional training of special education students.
3. Implementing a formation experiment to evaluate the effectiveness of the developed problem-based learning methodology in the professional training of special education students.
4. Analyzing the results to determine the efficacy of the problem-based learning technologies employed in the professional training of special education students.

An experiment aimed at the use of problem-based teaching technologies in the professional training of special education students was conducted at the South Kazakhstan Pedagogical University, Department of Preschool Education and Teaching Pedagogy, with 4th-year students studying in "Training Specialists in Special Pedagogy" (6B01901). The university's suitability was determined, experimental materials were prepared, and 60 students were selected from 4th -year students for the experimental and the control group.

Mastering the curriculum can serve as a foundation for shaping the professional training of special education students.

This study, aimed at increasing the professional readiness of special education students through the use of problem-based teaching technologies, consisted of 3 stages:

1. Diagnostic: Diagnostic testing was conducted to determine the professional competencies of special education students.
2. Formative: Based on the identification of the professional competencies of special education students, a program was developed to enhance their professional training.
3. Monitoring: At this stage, the implementation and effectiveness of the developed methodology were checked through a practical experiment, and the levels of development after the experimental work were determined, and the conclusions were analyzed.

In the first stage of the practical study, the professional training of special education students was assessed through a 40-point test. The initial 15 questions, worth 15 points, evaluated the students' knowledge of their chosen profession.

Additionally, the assessment included three situational questions, each worth 5 points, which evaluated the students' abilities in three key areas: performing corrective and developmental work for dyslalia or other speech disabilities, collaborating with parents, and conducting diagnostic work with a child with dyslalia or other speech disabilities.

Finally, the last two questions, worth 5 points, gauged the students' interest in the profession and their future prospects.

Based on the results of the diagnostic testing, a program was developed to enhance the professional training of special education students.

The formative stage of the study involved the implementation of the developed program, which included:

1. Familiarizing students with the theoretical foundations of problem-based learning and its application in the context of special education.
2. Providing opportunities for students to engage in problem-solving exercises and case studies related to special education teaching.
3. Integrating technology-enhanced learning activities, such as online simulations, virtual classrooms, and collaborative problem-solving platforms, to support the problem-based learning approach.
4. Encouraging students to reflect on their learning experiences and apply their knowledge to real-world situations in special education settings.

In the second stage of our practical experiment, we implemented problem-based learning technologies to enhance the professional training of special education students.

The problem-based learning technology integrated into the professional training of special education students involved the following stages:

1. Creating a problematic scenario to engage students and introduce a challenge.
2. Fostering students' awareness of the core issue and formulating a specific problem or question to guide the learning process.
3. Facilitating the problem-solving process, which included dialogue-based exploration and the generation of hypotheses.
4. Formulating a rule, method, or approach, and comparing it to relevant scholarly sources.
5. Providing opportunities for students to independently apply the proposed solution or approach in practical contexts.

We designed a problematic scenario to engage students and introduce a challenging situation. A problematic situation refers to a state of cognitive challenge stemming from the learner's insufficient prior knowledge and inadequate mental or practical strategies to address an emerging cognitive issue.

Problematic situations can be categorized into two types:

1. Situations with an element of surprise, where students exhibit divergent perspectives on the performance of a shared task.
2. Situations with inherent difficulty, where students are unable to competently manage a practical assignment involving unfamiliar subject matter [10].

The experiment was conducted over a period of four weeks. The results of the experiment indicate that the implementation of problem-based learning technologies in the professional training of special education students led to significant improvements in their professional competencies [11].

Results and discussion

The results from the control and experimental groups of the study examining the implementation of problem-based learning technologies in the professional training of special education students are presented below (Figure 1; 2).

The average score for the experimental group increased from 25.3 to 33.7 points, whereas the control group remained relatively unchanged, going from 25.9 to 28.9 points.

Notably, the students in the experimental group demonstrated significant improvements in their ability to perform corrective and developmental work for speech disabilities, collaborate with parents, and conduct diagnostic work with children with speech disabilities.

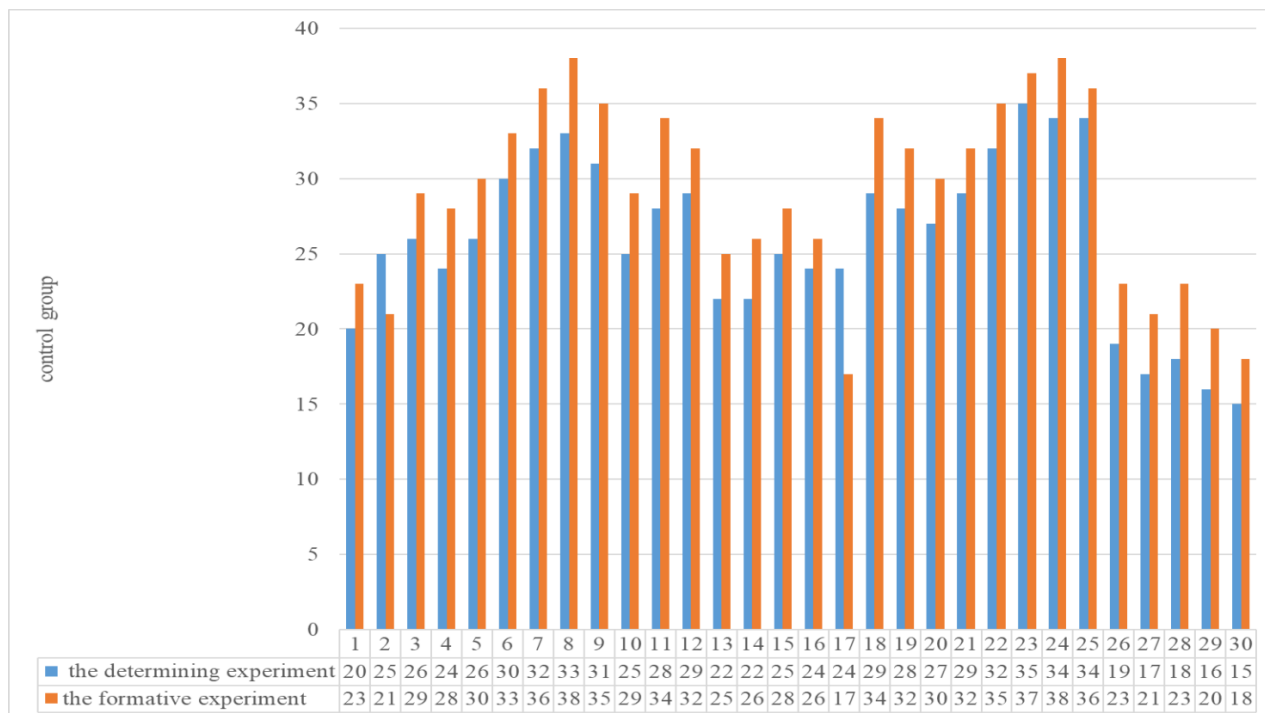


Figure - 1. Control group

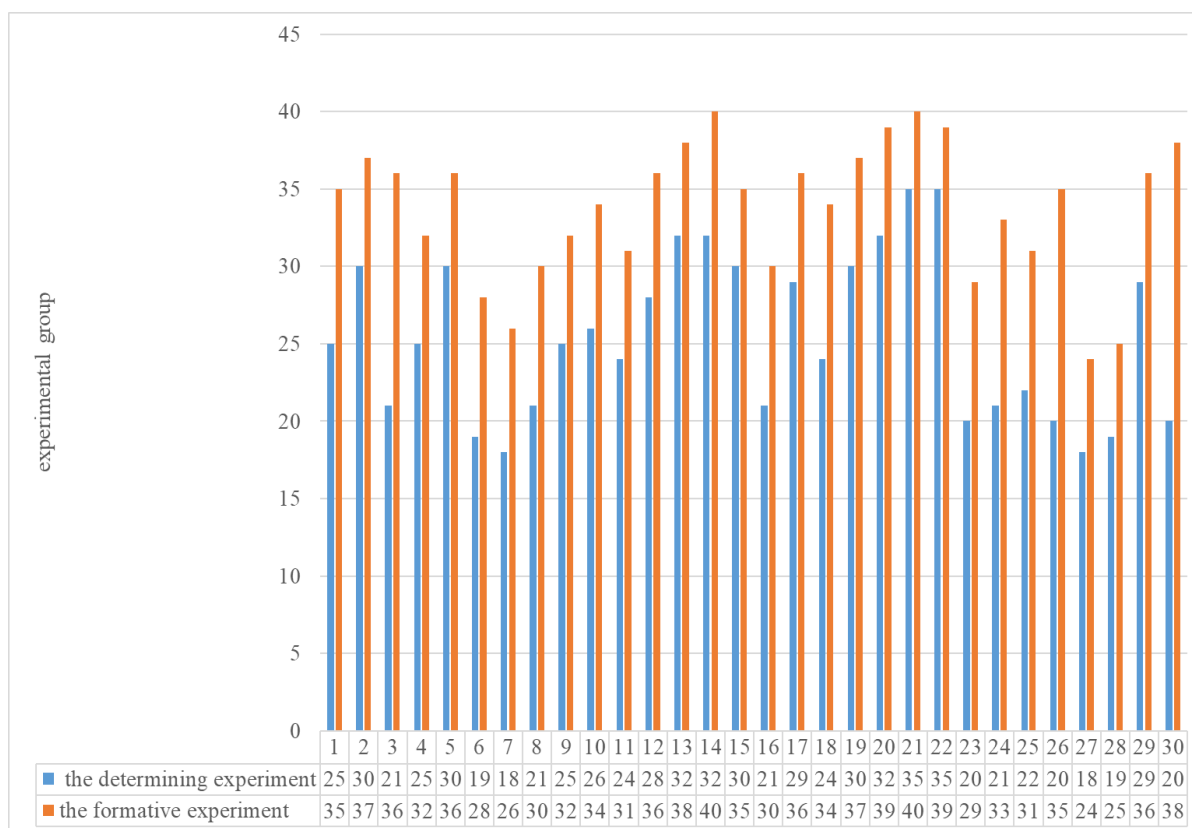


Figure - 2. Experimental group

Additionally, the students in the experimental group exhibited a higher level of interest and

positive attitudes toward their chosen profession, which is crucial for their future success as special education teachers [12].

The results of the study indicate that the application of problem-based learning technologies in the professional training of special education students can effectively enhance their professional competencies.

Conclusion

The findings of this study suggest that the implementation of problem-based learning technologies can have a positive impact on the professional training of special education students.

By incorporating problem-based learning into the curriculum, students were able to develop essential skills, such as critical thinking, problem-solving, and collaboration, which are crucial for their success as special education teachers [13]

Key conditions for effective implementation of problem-based learning include ensuring student motivation and engagement, designing realistic and balanced problem scenarios, emphasizing the value of knowledge gained, and fostering a supportive environment where all student ideas are acknowledged and encouraged.

The three main forms of problem-based learning we provided are as follows: 1) problem-solving exercises and case studies related to special education teaching, 2) technology-enhanced learning activities like online simulations and virtual classrooms, and 3) opportunities for students to reflect on their learning and apply knowledge to real-world situations.

Also, we keep main forms of problem-based learning: a) The teacher presents the material through lectures or seminars. In lectures, the teacher asks challenging questions, outlines the tasks, and provides solutions. The students are actively engaged in finding solutions and may offer their own ideas when prompted; b) Partially-guided activities during problem-solving sessions, practical classes, and discussions, where students solve problems with the teacher's guidance. The teacher develops a system of challenging questions that build on students' existing knowledge and stimulate their thinking. The teacher provides indirect hints and leading questions, then summarizes the key points based on students' responses. This partially-guided approach ensures productive student engagement; c) Independent research activities, where students independently identify a problem and solve it through coursework, thesis, or research projects, with the teacher's subsequent review of the results. This ensures the creative nature of students' activities [14].

Careful consideration of these factors can enable the successful integration of problem-based learning technologies into the professional training of special education teachers, ultimately leading to enhanced competencies and better preparedness for the challenges of the field.

The use of problem-based learning technology helps students develop critical thinking, creativity, independence, and responsibility. It also strengthens their knowledge, as it is acquired through independent learning. The constant exposure to problematic tasks and situations encourages students to persist and find solutions, rather than giving up. Overcoming obstacles is a key part of the learning and development process.

The study highlights the importance of incorporating innovative teaching methodologies, like problem-based learning, to better prepare future special education professionals and address the unique challenges they will face in their careers.

Our theoretical analysis and experimental findings on the use of problem-based learning technology in the professional training of special education students led us to the following conclusions:

1) Problem-based learning can significantly improve the professional competencies of special education students, including their ability to conduct corrective and developmental work, collaborate with parents, and perform diagnostic assessments.

2) The implementation of problem-based learning enhances students' interest, motivation, and positive attitudes towards their chosen profession.

3) Careful design and facilitation of problem-based learning activities, including creating realistic problem scenarios, promoting student engagement, and providing appropriate guidance, are key to ensuring its effectiveness.

Given the complexity of the research topic, it was not feasible to thoroughly examine all its aspects. Consequently, we have presented a single solution for enhancing the professional preparedness of special education students. We anticipate that further exploration of issues related to the professional development of these students will provide a foundation for our future research endeavors.

References liste:

1D. Silva, S. Prates, S. Ribeiro As Novas Tecnologias e aprendizagem: desafios enfrentados pelo professor na sala de aula - Universidade Federal de Santa Maria, 2017. p.107-107 <https://doi.org/10.5007/1980-3532.2016n15p107>

2A.P. Ertmer Teacher pedagogical beliefs: The final frontier in our quest for technology integration?//Springer Science+Business Media. 2005. №53(4) p. 25-39 <https://doi.org/10.1007/bf02504683>

3J.N. Ellsworth, N.C. Hedley What's new in technology? Integrating technology: current directions//Taylor & Francis. 1993. №9(4). p. 377-380 <https://doi.org/10.1080/1057356930090409>

4A. Ottenbreit-Leftwich "Evolution of Teachers' Technology Integration Knowledge, Beliefs, and Practices: How Can We Support Beginning Teachers Use of Technology?//Taylor & Francis. 2018. №50(4) p. 282-304. <https://doi.org/10.1080/15391523.2018.1487350>

5Learning Technology Effectiveness (no date). Available at: <https://tech.ed.gov/wp-content/uploads/2014/11/Learning-Technology-Effectiveness-Brief.pdf>.

6O. Semper, K. Akriou, G. Scalzo Educational Implications That Arise From Differing Models of Human Development and Their Repercussions on Social Innovation - Frontiers Media, 2019 - №4. <https://doi.org/10.3389/feduc.2019.00139>

7B. Koichu Problem posing in the context of teaching for advanced problem solving //Elsevier BV. 2019. №102. p. 101428-101428. <https://doi.org/10.1016/j.ijer.2019.05.001>

8G. Dang Problem-Driven Teaching: Estimating the Population from a Sample. 2023 <https://doi.org/10.3390/iocma2023-14431>

9R.B. Belland Technology Applications to Support Teachers' Design and Facilitation and Students' Participation in PBL. 2019. p. 411-431. <https://doi.org/10.1002/9781119173243.ch18>

10 D. Z. Johnson College student misbehaviors: an exploration of instructor perceptions//Taylor & Francis. 2016. №66(1). p. 54-69 <https://doi.org/10.1080/03634523.2016.1202995>

11 P.K. Masuku, A. Mupawose Students' experiences of using a writing-intense programme to facilitate critical thinking skills on an online clinical training platform: A pilot study//AOSIS. 2022. №69(2) <https://doi.org/10.4102/sajcd.v69i2.919>

12 S. Bahri, M. Meisuri Enhancing Students' Drama Performance: A Process Approach. 2020. №3(1). p. 454-460 <https://doi.org/10.33258/birle.v3i1.840>

13 B. Sugeng, W.A. Suryani Enhancing the learning performance of passive learners in a Financial Management class using Problem-Based Learning //University of Wollongong. 2020. №17(1).p. 60-79 <https://doi.org/10.53761/1.17.1.5>

14 H. Suwono, K. E. Dewi Problem-based learning blended with online interaction to improve motivation, scientific communication and higher order thinking skills of high school students - American Institute of Physics, 2019 – p. 85 <https://doi.org/10.1063/1.5094001>

(Information about the author responsible for the correspondence (place of work, phone number, e-mail) Mamadaliyev Sanzhar Talibzhanovich - master's teacher of the Department of «special pedagogy», SKPU named after U. Zhanibekov. Shymkent, Kazakhstan. 87016334827; Sanzhar_sherlock@mail.ru