Cypriot Journal of Educational Sciences

Volume 17, Issue 9, (2022) 3545-3555

www.cjes.eu

Methodology of application of case technology in the process of teaching mathematics

Rima Abdualiyeva [a*], Zhetysu University named after I. Zhansugurov, Higer School of Natural Sciences, 187a Zhansugurov Street, Taldykorgan 040009, Republic of Kazakhstan https://orcid.org/0000-0002-4161-9825

Sabyrkul Seitova [b], Zhetysu University named after I. Zhansugurov, Higer School of Natural Sciences, 187a Zhansugurov Street, Taldykorgan 040009, Republic of Kazakhstan https://orcid.org/0000-0001-8414-3508),

Ryskul Tasbolatova [c] Zhetysu University named after I. Zhansugurov, 187a Zhansugurov Street, Taldykorgan 040009, Republic of Kazakhstan https://orcid.org/0000-0001-6922-1651

Laura Smagulova [d] Zhetysu University named after I. Zhansugurov, 187a Zhansugurov Street, Taldykorgan 040009, Republic of Kazakhstan https://orcid.org/0000-0002-1359-2119

Suggested Citation:

Abdualiyeva, R., Seitova, S., Tasbolatova, R., & Smagulova, L. (2022). Methodology of application of case technology in the process of teaching mathematics. *Cypriot Journal of Educational Science*. *17*(9), 3545-3555. https://doi.org/10.18844/cjes.v17i9.8119

Received from May 15, 2022; revised from July 25, 2022; accepted from September 25, 2022.

Abstract

The application of the capabilities of information technology in the process of teaching mathematics by computer technology teachers has brought with it many advantages. The use of technology in schools is effective in terms of improving students' cognitive skills. When we look at the areas of use of new pedagogical technologies, they provide innovative learning with different educational materials in many teaching areas, especially mathematics education. Observations show that in most cases, the teacher works alone during the lesson, and the students remain observers. For teachers, it is desirable to improve the effectiveness of the use of technology in mathematics lessons, its structure and content and to determine the effectiveness of 'Information Technologies in Mathematics Education'. This case study aims to investigate the impact of the integration of information and communication technology applications on mathematics education. Within the scope of this general purpose, semi-structured interview questions prepared by the researchers were asked. A qualitative method was used in the research. The opinions of 32 mathematics teachers who use technology in their high school courses were consulted. As a result of the research, it was concluded that technology-supported training is very effective in mathematics. It has been concluded that the use of a numerical field of mathematics and technology-supported applications is effective in developing skills in students. In the same way, it has emerged that mathematics teachers need in-service training about technology-supported trainings.

Keywords: Mathematics, case study, technology, education, teaching, mathematics teaching, innovative;

* ADDRESS FOR CORRESPONDENCE: Rima Abdualiyeva, Higer School of Natural Sciences, Zhetysu University named after I. Zhansugurov, 187a Zhansugurov Street, Taldykorgan 040009, Republic of Kazakhstan.
E-mail address: r.abdualieva@zu.edu.kz

1. Introduction

In the last century, technological developments have also emerged in educational sciences and have enabled educators to conduct research and development studies in this field (Gipal et al., 2022; Şahin & Arslan Namlı, 2019). The 21st century is a century in which science and technology are developing very rapidly. Today, with increasing momentum, the development of science and technology has made it inevitable to change and develop the social structure of societies. The rapid development of science and knowledge requires that education systems keep pace with this change. The use of computers and technology in education has become mandatory as education affects technology, and technology affects education and a teaching approach that does not reflect the educational environment and is remote from technology negatively affects success (Akcil et al., 2021; Erdemir et al., 2009; Kaleli-Yilmaz, 2015). In line with the development of the education system, the study has started to develop a new curriculum aimed at ensuring the active participation of students in the teaching and learning process in primary and secondary education. With the development of the programme, the traditional teacher-centred approach to education in schools has been replaced by new theories and approaches based on the development of student-centred and scientific process skills such as constructivism, multiple intelligences, problem-solving, project-based and collaborative learning. Accordingly, the concept of the teacher is no longer a person who imparts knowledge, but a person who applies these contemporary teaching methods and techniques in their lessons, uses teaching technologies, guides students, researches, produces and is open to change (Dockendorff & Solar, 2018; Uzunboylu et al., 2021; Yildirim et al., 2009).

Education is an important tool for cognitive development and increasing efficiency. At the same time, in modern pedagogical research, there is a full-fledged realisation of the capabilities of IT tools. The process of developing cognitive interest is not well understood. There are many studies of interest in the application of IT. To improve the educational process abilities, to increase motivation and to reach the level of independence ‘discovery’ of the studied phenomena patterns, many modern researchers emphasise the need to use information and communication technology (ICT) in studying mathematics (Hastedt et al., 2021; Taşdan & Kabar, 2022; Thompson, 2008). In addition to domestic and foreign studies, teachers' experience with IT tools, the process of reading mathematics in secondary schools, the opportunity to conduct educational activities in this field and special packages that provide computer programmes for teaching mathematics (Mathcad, Matlab, Mapl, Matematica, Derive and Excel vb) developed with substantial copyright (Melievna, 2020; Turskienė, 2002).

Many teacher training programmes challenge the skills and knowledge prospective teachers need to integrate technology into math teaching. Shulman (1986) claimed technological pedagogical content knowledge, technological knowledge, content knowledge and the interconnection and intersection of pedagogical knowledge were developed based on the concept of pedagogical content knowledge (Dockendorff & Solar, 2018). Technologies used in mathematics education suggest new ways to go beyond traditional applied content (Turhan Türkkan & Arslan Namlı, 2018). The application of technology reinforces concrete and experiential approaches to mathematics and provides students in later periods with achievements that involve a more abstract and symbolic

approach. Thus, it offers the possibility of representing dynamic changes in mathematical relationships when defining problems (Şahin & Başgül, 2019; Santos-Trigo & Espinosa-Perez, 2002).

Instructional technology is defined as a set of academic systems that can effectively design learning and teaching environments, solve problems in learning and teaching, and increase the quality and permanence of the learning product (Gökdere et al., 2004; Uzunboylu et al., 2022). It can be said that educational technology is effective in any field. Apart from the general need for the use of technology in teaching, teaching mathematics in particular is a suitable field for the use of technical resources (Öksüz & Karakoc, 2010). Karadag and McDougall (2009) explained that the dynamic and visual learning environment created by technology will positively influence our perspective on mathematics education not only in terms of teaching and learning strategies but also in terms of mathematics classroom content. The use of technology while creating conceptual and procedural knowledge in the minds of students in mathematics classes will make teachers' jobs easier. In this sense, it is possible for teachers to convey mathematical concepts and for students to embody those concepts with pre-planned technology-enhanced lessons. The 21st century is a century in which science and technology are developing very rapidly. Today, with increasing dynamics, the development of science and technology makes changes and developments in the social structure of society inevitable. The rapid development of science and knowledge requires that the education system keep up with these changes. Urh et al. (2022) investigated the effectiveness of gamification, which is technology-supported education in colleges. It was concluded that pre-service teachers expressed positive opinions about technology-supported education.

In recent years, the place and importance of mathematical modelling in mathematics education have been emphasised by many mathematics education researchers (Gravemeijer & Doorman, 1999; Lesh & Doerr, 2003; Lesh & Lehrer, 2003). Today, there is an increasing need for individuals with advanced mathematical problem-solving and modelling skills who are at ease with technology in technology, engineering, architecture, economics and many other fields (Lingefjard, 2006). Technologies used in mathematics education suggest new ways of dealing with traditionally applied content (Hohenwarter et al., 2009). The application of technology enhances the concrete and experiential approach to mathematics and enables students to succeed in later periods that involve a more abstract and symbolic approach. As such, it provides a way to show dynamic changes in mathematical relationships as problems are defined (Santos-Trigo & Espinosa-Perez, 2002).

The unpreparedness of the mathematics teacher, in addition to the systematic use of ICT tools in the teaching process, aids in the low quality of electronic teaching and the lack of preparation of the teacher in the field of correct selection Some of these tools make it difficult to use them to achieve the specific methodological objectives of the course. But the most important thing is that in modern pedagogy, at the moment, there are no generalised approaches to the application of IT abilities focused on the study of the laws of the subject students on the development of cognitive interest. In this context, teaching mathematics is important.

1.1. Purpose of the research

It is aimed to determine the views of mathematics teachers working in high school on technology-supported education. Within the scope of this general objective, answers to the following sub-objectives have been sought:

1. What materials do you use in math class? Do you do sorting?

2. What do you pay attention when choosing the assistive technologies that you use in class?

3. What is the contribution of technology-supported education to mathematics teaching?

4. What are your suggestions for designing technology-supported education?

2. Method and materials

2.1. Research method

This research is qualitative, phenomenological research. Phenomenology is one of the perspectives that forms the basis of qualitative research and focuses on facts and events that people are aware of in their daily lives but do not have detailed information about. It aims to reveal people's experiences and the similarities or differences in these experiences (Wojnar & Swanson, 2007). It is desired for teachers to develop the effectiveness, structure and content of using a technology in a mathematics lesson and to determine the effectiveness of 'Information Technologies in Mathematics Education'. This case study is to investigate the effect of the integration of ICT applications on mathematics education. Within the scope of this general purpose, semi-structured interview questions prepared by the researchers were asked. The phenomenology method was preferred because it was thought that the views of mathematics teachers who used technology in their classes in high school would be investigated with the best phenomenological method.

2.2. Participants

The participants of this study were consulted for the opinions of 32 mathematics teachers who used technology in their lessons in the high school in the spring term of 2021–2022. Participants were selected by a simple random sampling method. They must be giving technology-supported education in prerequisite courses. Simple random sampling is the simplest and most common method of selecting a sample where the sample is chosen with equal probability of selection for each unit in each draw (Singh, 2003). Participants participated in the research voluntarily.

Personal information of the participants participating in the research is given in Table 1.

Table 1. Demographic information

Variable	Group	*F*
Gender		
	Female	18
	Male	14

2.3. Data collection tools

The data of the research were collected with the 'Semi-Structured Interview Form' in order to determine the opinions of high school mathematics teachers about technology-assisted education

in mathematics teaching. While preparing the interview questions, they were evaluated by three teachers who are experts in their fields, and a pilot study was conducted by interviewing three teachers other than those who participated in the research to ensure the validity and reliability of the form. The semi-structured interview form took its final form after necessary arrangements.

2.4. Data collection process

Participants were asked to answer semi-structured interview forms created as a measurement tool. The purpose and content of the study were explained to each participant. The forms were distributed to the participants by face-to-face interviews outside of the classroom hours, and they were asked to answer them. Interviews with students were recorded. Filling the forms took an average of 25 minutes for each teacher.

2.5. Data collection analysis

Content analysis method, which is one of the qualitative data analysis techniques, was used in the analysis of the data obtained from the research. Content analysis is a method for analysing the content of various data such as visual and verbal data. Events are divided into defined categories for analysis and interpretation. The opinions of the teachers participating in the research were coded as T1, T2, T3…. Themes were formed by examining the answers given to the questions in the semi-structured interview forms. The data were evaluated by three independent expert teachers. After the codes were created, thematic coding was started and the codes were divided into groups by the researcher and appropriate themes were extracted. Then, all the interview data were coded and interpreted and turned into a report. The themes created were submitted to the approval of the teachers participating in the research. In terms of the reliability of the research, sub-themes and common themes were determined and given in tables. In addition, the opinions of the participants who supported the themes are given under each table by quoting directly with their codes.

3. Findigs

3.1. Findings on the preference ranking of the materials used by mathematics teachers in their lessons

Table 2. The order of preference of the materials used in the course

Theme	*f*
Textbook and lecture notes	21
Math test books	20
Projection	11
Smart board	10
Websites	7

Mathematics teachers were asked about the materials they used in the lesson. When the answers to this finding were examined, it was found that textbooks and lecture notes were the most

used material. Likewise, the majority of the teachers gave the answer as test books. Projectors, smart boards and websites are among the materials used in mathematics.

Some of the opinions of the math teachers are as follows:

T1: 'The compulsory course book is among the materials I use the most. In addition to the textbooks, I often use the lecture notes that I have prepared myself. When my lecture is completed with a comprehensive unit, I benefit from the questions in the math test books published by other publishing houses. During my lecture, I used the projector frequently'.

T2: 'Although mathematics is a numerical course, it is a course that includes theoretical subjects. Theoretical topics are explained in detail in the textbooks. The materials I use the most are textbooks, test books and smart boards'.

3.2. Findings on the issues considered in the selection of assistive technologies

Table 3. Considerations in the selection of assistive technologies

Theme	*f*
Relevance to the subject	25
Suitability for the individual	21
State of the school and classroom	12

In mathematics education, what should be considered for the assistive technologies to be selected in education and these designs is expressed as the models developed in accordance with the individual purchasing 21 teachers' findings.

Some of the opinions of the math teachers are as follows:

T1: 'When choosing the materials that I will use in the lesson, he decides whether I will find suitable materials with the topics that I will explain in the lesson. I have a hard time finding material on some subjects'.

T2: 'When choosing the auxiliary materials that I will use in the course, I prepare the materials according to the characteristics of my students according to their level of readiness'.

3.3. Findings on the contribution of technology-supported education to mathematics teaching

Table 4. The contribution of technology-supported education to mathematics teaching

Theme	*f*
Skill development	21
Effective learning	20
Interaction (teacher–student and student–student)	10
Calculation fluency	8
Problem-solving	7

Considering the opinions of mathematics teachers on the use of technology in mathematics lessons, most of the teachers stated that they improved the skills of the students (21) and provided an effective teaching environment (20). Subsequently, there are 10 teachers who state that technology-supported educational environments provide interaction among students; 8 who state that they provide computational fluency; and 7 who state that they provide problem-solving abilities.

Some of the opinions of the math teachers are as follows:

T1: 'Technology is one of the most effective methods in mathematics, as it is in every field of education. I can say that the skills of the students develop faster in the activities we have done thanks to the technological tools'.

T2: 'Learning with technology provides effective learning because it includes different techniques. It enables students to learn both individually and in groups'.

T3: 'Developing high-level skills is very important. The development of these skills of a high school student becomes easier with technology'.

3.4. Findings on the recommendations for the design of technology-supported education

Table 5. Recommendations for the design of technology-supported education

Theme	*f*
In-service training	25
Sufficient tools and equipment	24
Suitable classroom environments	18

In Table 5, the suggestions of mathematics teachers in the creation of technology-supported learning environments are rated. The opinions of majority of the mathematics teachers on this question stated that they need in-service training. Most teachers gave the same answers to this finding. They stated that sufficient tools and equipment should be provided by the school and that appropriate classroom environments should be created.

Some of the opinions of the math teachers are as follows:

T1: 'I consider the educational content we have received at the university to be insufficient in terms of technology-supported trainings. Technology is developing very quickly. In order to keep up with this situation, we need to constantly renew ourselves. In-service trainings about technology-supported trainings can be given every year. I think we need these trainings. In the same way, I believe that it should be done at the end of the year in their discussions about whether we use the trainings we have received in the lessons'.

T2: 'No matter how much sufficient knowledge we have in the field of technology, we need tools to use technology. The school method needs to provide these tools'.

4. Conclusion, discussion and suggestions

The general purpose of this research is to determine the opinions of mathematics teachers working in high schools about technology-assisted education. When looking at the results obtained from the sub-objectives in general, it was concluded that mathematics teachers found technology-assisted education effective, but there were areas they needed to provide technology-assisted education. Amador (2018) mentioned that pre-service mathematics teachers could not use teacher actions effectively in video simulation tasks. In this case, it is evident that the number of technology-supported trainings given at the university should be increased. Murzatayeva et al. (2022) examined teachers' use of technology in their study. Similar results were obtained with this study.

When the results regarding the materials used by the mathematics teachers in the mathematics lesson were examined, it was concluded that the textbooks and lecture notes were the most preferred materials. It has been concluded that lecture notes, projectors, smart boards and websites are among the materials used in mathematics.

In mathematics education, teachers were asked whether they pay attention to choosing assistive technologies in education. When the results of this finding were examined, it was concluded that they chose the material according to whether it was suitable for the subject; they chose the students according to the level of suitability; and paid attention to the physical condition of the school and the classroom. The result obtained from this finding is supported by other studies. Amador (2018), in his study on the use of technology in mathematics teaching, argued that it is essential for pre-service teachers to know how to organise productive mathematical discussions. In another study, he argued that while the use of technology in mathematics and even in teaching geometry was provided, mathematical processes and technological actions emerged. Drijvers et al. (2013) stated that a teacher who participated in his study used the revoicing technique in the classroom.

Considering the opinions of mathematics teachers who use technology in mathematics on the contribution of technology use to students in mathematics lessons, it was concluded that most of the teachers improved the skills of the students and provided an effective teaching environment. Again, it has been concluded that technology-supported educational environments provide interaction between students, provide numerical fluency and help students gain problem-solving skills. The importance of mathematics teaching in which ICT is integrated and its success with students has been proven (Bülbül, 2010). Computer-assisted technology-assisted education also improves teaching, attention, discovery and problem-solving skills (Bybee et al., 2006). Bello et al. (2020) defended the effectiveness of the media as educational technologies in their study. They argued that technological tools are effective in every step of teaching.

Mathematics teachers' suggestions were asked for the creation of technology-supported learning environments. The opinions of the mathematics teachers on this question indicated that they needed in-service training. Most teachers gave the same answer to this finding. They stated that sufficient tools and equipment should be provided by the school and that appropriate classroom environments should be created. With the advancement in technology, it is reasonable to

conclude that the frequency of in-service training should be increased for teachers to learn new generation teaching methods.

There is a lot of research and application that can be done in the field of mathematics. Like every science, tools and materials are required to do mathematics and to learn/teach it effectively. Therefore, the tools available in homes and schools need to be evaluated effectively. University students should be assigned special projects that they will carry out and develop in the field of effective use of cognitive tools in school mathematics in education faculties. In order for teachers to gain new competencies in their profession and to realise specialist modern education, the number of in-service trainings must be increased. In general, teachers should be informed about advanced educational technologies. It should be ensured that primary school and mathematics teachers gain skills and competencies.

References

Akcil, U., Uzunboylu, H., & Kinik, E. (2021). Integration of technology to learning-teaching processes and Google workspace tools: A literature review. *Sustainability, 13*(9), 5018. https://www.mdpi.com/2071-1050/13/9/5018#

Amador, J. M. (2018). Video simulations to develop preservice mathematics teachers' discourse practices. Technology, *Pedagogy and Education, 27*(1), 1–14.

Bello, H. S., Idris, S. U., & Bappayo, A. (2020). Media and educational technology in Nigeria: Managing the broadcast programmes of Radio Nigeria Globe FM towards girl child education. *International Journal of Innovative Research in Education, 7*(1), 16–25. https://doi.org/10.18844/ijire.v7i1.4715

Bülbül, Y. (2010). *Effects of 7e learning cycle model accompanied with computer animations on understanding of diffusion and osmosis concepts* [Ph.D. Doctoral Program]. Middle East Technical University. http://etd.lib.metu.edu.tr/upload/12612299/index.pdf

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins, effectiveness and applications.* Office of Science Education National Institutes of Health.

Dockendorff, M., & Solar, H. (2018). ICT integration in mathematics initial teacher training and its impact on visualization: The case of GeoGebra. *International Journal of Mathematical Education in Science and Technology, 49*(1), 66–84. https://doi.org/10.1080/0020739X.2017.1341060

Drijvers, P., Tacoma, S., & Besamusca, A. (2013). Digital resources inviting changes in mid-adopting teachers' practices and orchestrations. *ZDM Mathematics Education, 45*, 987–1001. https://doi.org/10.1007/s11858-013-0535-1

Erdemir, N., Bakirci, H., & Eyduran, E. (2009). Öğretmen adaylarının eğitimde teknolojiyi kullanabilme özgüvenlerinin tespiti. *Journal of Turkish Science Education, 6*(3), 99–108. https://dergipark.org.tr/tr/pub/yyuefd/issue/25853/272549

Gipal, R. J. D., Carrillo, L. J., & Mallonga, J. C. (2022). Teachers' experiences of online teaching in English as a second language classes during the COVID-19 pandemic. *International Journal of Learning and Teaching, 14*(4), 97–111. https://doi.org/10.18844/ijlt.v14i4.6758

Gökdere, M., Küçük, M., & Cepni, S. (2004). Egitim Teknolojilerinin Üstün Yetenekli Ögrencilerin Fen Egitiminde Kullanimi üzerine bir Çalisma: Bilim Sanat Merkezleri Örneklemi. *TOJET: The Turkish Online Journal of Educational Technology, 3*(2), 149–157.

Gravemeijer, K., & Doorman, M. (1999). Context problems in realistic mathematics education: A calculus course as an example. *Educational Studies in Mathematics, 39*(1), 111–129. doi:10.1023/A:1003749919816.

Hastedt, D., Eck, M., Kim, E., & Sass, J. (2021). *Female science and mathematics teachers: 'Better than they think?' IEA compass: Briefs in education* (Number 13, Special Issue). International Association for the Evaluation of Educational Achievement.

Hohenwarter, J., Hohenwarter, M., & Lavicza, Z. (2009). Introducing dynamic mathematics software to secondary school teachers: The case of GeoGebra. *Journal of Computers in Mathematics and Science Teaching, 28*(2), 135–146. https://www.researchgate.net/publication/234730242_Introducing_Dynamic_Mathematics_Software_to_Secondary_School_Teachers_The_Case_of_GeoGebra

Kaleli-Yilmaz, G. (2015). The views of mathematics teachers on the factors affecting the integration of technology in mathematics courses [Online]. *Australian Journal of Teacher Education, 40*(8), 132–148. https://search.informit.org/doi/10.3316/informit.441717347062620

Karadag, Z., & McDougall, D. (2009). *Visual explorative approaches to learning mathematics.* PME-NA.

Lesh, R. A., & Doerr, H. M. (2003). *Beyond constructivism: Models and modeling perspectives on mathematics problem solving, learning, and teaching*. Routledge.

Lesh, R., & Lehrer, R. (2003). Models and modeling perspectives on the development of students and teachers. *Mathematical Thinking and Learning, 5*(2–3), 109–129. doi:10.1080/10986065.2003.9679996.

Lingefjard, T. (2006). Faces of mathematical modeling. *ZDM, 38*(2), 96–112.

Melievna, M. D. (2020). Using information technology tools in mathematics lessons for teaching future teachers. *International Journal of Scientific & Technology Research (IJSTR) IJSTR, 9*(3), 4168–4171.

Murzatayeva, A., Sarsembayeva, E., Makhadiyeva, A., Aspanova, I., & Dmitriy, M. (2022). The use of dual training technology in the formation of professional competencies of teachers. *World Journal on Educational Technology: Current Issues, 14*(4), 1120–1132. https://doi.org/10.18844/wjet.v14i4.7673

Öksüz, C., & Karakoç, Ş. A. (2010). İlköğretim Okullarında Matematik Derslerinde Teknoloji Kullanım Düzeyini Belirleme Ölçeği Geçerlik ve Güvenirlik Çalışması. *Elektronik Sosyal Bilimler Dergisi, 9*(32), 372–383.

Şahin, M. C., & Arslan Namlı, N. (2019). Öğretmen adaylarinin eğitimde teknoloji kullanma tutumlarinin incelenmesi. *Türkiye Sosyal Araştırmalar Dergisi, 23*(1), 95–112. https://dergipark.org.tr/tr/pub/tsadergisi/issue/44605/432280

Şahin, Ö., & Başgül, M. (2019). Türkiye'de Matematik Ders Kitaplarına Yönelik Yapılan Araştırmalardaki Eğilimler. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 13*(1), 328–358. doi:10.17522/balikesirnef.508802.

Santos-Trigo, M., & Espinosa-Perez, H. (2002). Searching and exploring properties of geometric configurations using dynamic software. *International Journal of Mathematical Education in Science and Technology, 33*(1), 37–50. https://www.researchgate.net/publication/233344593_Searching_and_exploring_properties_of_geometric_configurations_using_dynamic_software

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Singh, S. (2003). Simple random sampling. In *Advanced sampling theory with applications* (pp. 71–136). Springer. https://link.springer.com/chapter/10.1007/978-94-007-0789-4_2

Taşdan, B. T., & Kabar, M. G. D. (2022). Pre-service mathematics teachers' responding to student thinking in their teaching experiences. *Journal of Pedagogical Research, 6*(1), 87–109. https://doi.org/10.33902/JPR.2022175553

Thompson, T. (2008). Mathematics teachers' interpretation of higher-order thinking in Bloom's taxonomy. *International Electronic Journal of Mathematics Education, 3*(2), 96–109. https://doi.org/10.29333/iejme/221

Turhan Türkkan, B., & Arslan Namlı, N. (2018). Matematik Öğretiminde Bilgisayar Yazılımı Kullanmaya Yönelik Lisansüstü Tezlerin İncelenmesi. *International Online Journal of Educational Sciences, 10*(4), 38–62.

Turskienė, S. (2002). Computer technology and teaching mathematics in secondary schools. *Informatics in Education, 1*, 149–156. doi:10.15388/INFEDU.2002.12.

Urh, M., Jereb, E., Šprajc, P., Jerebic, J., & Rakovec, P. (2022). The impact of higher education students' personality traits on susceptibility to specific gamification elements. *New Trends and Issues Proceedings on Humanities and Social Sciences, 9*(1), 19–30. https://doi.org/10.18844/prosoc.v9i1.7092

Uzunboylu, H., Ethemi, B. P., & Hamidi, M. (2021). Content analysis of research papers on flipped learning. *Revista de Educación a Distancia (RED), 21*(66). https://doi.org/10.6018/red.451551

Uzunboylu, H., Prokopyev, A. I., Kashina, S. G., Makarova, E. V., Chizh, N. V., & Sakhieva, R. G. (2022). Determining the opinions of university students on the education they receive with technology during the pandemic process. *International Journal of Engineering Pedagogy, 12*(2). https://doi.org/10.3991/ijep.v12i2.29329

Wojnar, D. M., & Swanson, K. M. (2007). Phenomenology: An exploration. *Journal of Holistic Nursing, 25*(3), 172–180. https://doi.org/10.1177%2F0898010106295172

Yildirim, N., Nas, S. E., & Alipaşa, A. Y. A. S. (2009). Kimya öğretmen adaylarının öğretim teknolojilerini kullanabilme durumlarına işbirlikçi öğrenmenin etkisi. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 3*(1), 99–116. https://dergipark.org.tr/tr/pub/balikesirnef/issue/3368/46496