TECHNOLOGICAL PEDAGOGICAL FIELD KNOWLEDGE IN EDUCATIONAL ENVIRONMENTS

Seher ŞEN

Ministry of Education, zeyben78@gmail.com, https://orcid.org/0009-0004-9359-7164

Hatice KOÇPINAR

Ministry of Education, gafahatice@gmail.com, https://orcid.org/0009-0008-2867-4089

Mesut ÇAĞLAR

Ministry of Education, mesutcaglar@msn.com, https://orcid.org/0009-0009-5306-890X

Miyase ÜNLÜ

Ministry of Education, idaida06@hotmail.com, https://orcid.org/0009-0003-2990-1881

Özlem YILDIZ

Ministry of Education, ozlemkesendere@gmail.com, https://orcid.org/0009-0008-7153-1673

Serap ÖZTÜRK

Ministry of Education, ozturkserap1982@gmail.com, https://orcid.org/0009-0008-4911-2499

ABSTRACT

Developments in technology are applied to many areas today. One of the most important areas where being applied is education. It is important to introduce technologies into the education and training process, use them effectively and increase the area of use. For this reason, it has become mandatory for teachers to acquire technological pedagogical field knowledge. How this obligation emerged in educational environments and how it was realized was the subject of the research. In this context, in the research designed as a literature review, technological pedagogical content knowledge was addressed in the first stage, technological knowledge in the second stage, pedagogical knowledge in the third stage, pedagogical knowledge in the fourth stage, field knowledge in the fifth stage, pedagogical content knowledge in the sixth stage, technological field knowledge in the seventh stage and technological knowledge in the eighth stage was taken. In the last stage, domestic and international studies on technological pedagogical content knowledge are included. In the literature review, it was determined that technological information should be used strategically to support and enrich teaching and learning processes. In addition, in the literature review, regarding teachers' pedagogical knowledge; it has been determined that it is necessary to plan the teaching process, develop student-specific methods and strategies by taking into account the individual differences of the students, the activities carried out should be remarkable and have the knowledge to evaluate student levels through measurement and evaluation. This situation has been evaluated as one of the main factors in the positive outcome of the process, with teachers' mastery of various information about the components of the teaching-learning process. In addition to these results, it has been determined that before teachers use technology in educational environments, they should make a detailed organization by determining how the technology they choose will contribute to the realization of teaching activities, as well as the necessary information about the technologies they will use and taking into account the pedagogical approach to be followed by taking into account the learning differences of the students.

Keywords: Technological knowledge, pedagogical knowledge, field knowledge, technological pedagogical field knowledge, educational environments

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1. INTRODUCTION

Technological Pedagogical Content Knowledge (TPACK), which was suggested by Mishra and Koehler (2006), stands out as an important teaching skill in preparing teachers for the needs of the current world. The most important factor in defining the 21st century as the information age can be called technology. Technology is the solutions put forward by scientific knowledge to make life easier or improve its conditions. These solutions appear in different forms in every period of our lives (Yeşilorman and Koç, 2014). In order to adapt to educational programs and to achieve the expected efficiency, technological tools must be used in a programmed manner and this used technology must coincide with the educational environment and program for technology to effectively. (MacArthur et al., 1995). Educational technology tools are the most effective tools used in education and training environments today, regardless of age group. Lifelong education can reach wider audiences with the use of technology. The use of technology in formal education is very important (Heinich et al., 2002).

Equipped teachers are more competent in integrating technology into educational processes (Kartal and Güven, 2006). By using educational materials and tools, they can enrich course content, provide interactive learning opportunities and provide students with more diverse experiences (Şendurur and Arslan, 2017).

In our age, it is very important for the teacher not only to know everything about his own field but also to be able to convey what he knows to his students. Technological tools are also used in learning environments and it is expected that teachers can use these tools at an adequate level. According to Pedagogical Content Knowledge (PCK), which Shulman (1986) introduced to the literature, teachers' in-depth understanding of the content of the subject they teach is called content knowledge and their understanding of concepts regarding student motivation, evaluation and child development is called pedagogical knowledge. When the teacher's experience and pedagogical knowledge come together, that is, pedagogical knowledge (PK) and content knowledge (CK) interact with each other, revealing the concept of Pedagogical Content Knowledge. The interaction of pedagogical and technological perspectives supports the connection between pedagogical principles and technological approaches appropriate to the content in the construction of educational environments.

Mishra and Koehler (2006) developed the TPACK model (Technological Pedagogical Content Knowledge Model) as a model that supports content knowledge by blending it with technology knowledge and pedagogy knowledge. What makes Mishra and Koehler's (2006) research different from other studies that involve associating technology with pedagogy and field knowledge is that they clearly express the relationships between these three fields. When examined from this aspect, field knowledge includes knowledge of the subject planned to be taught; Pedagogical knowledge is knowledge that covers student-related processes; Technology knowledge includes the knowledge of using technology and technological tools linked to curriculum. Pedagogical content knowledge is the pedagogical knowledge used to teach a content, as in Shulman's research. Technological pedagogy knowledge is the totality of information about the use of technology in education. It is a critical concept that enables teachers to understand how to effectively use technologies to improve course content and teaching methods. Technological domain knowledge refers to the knowledge and expertise in a specific technological subject or field. Having knowledge about a technological field requires a person to understand the basic concepts,

principles, operation, applications and current developments in that field. Technological domain knowledge covers a broad spectrum of a person's abilities to use and manage technology.

In the developing and changing world, the impact of technology on learning processes is rapidly increasing today (Abbitt, 2011). Teacher quality undoubtedly has the greatest impact on students' ability to achieve qualified learning outcomes. One of the most important characteristics of qualified teachers is that they have the ability to actively use information technologies in learning processes. For this reason, training teachers who are qualified to adapt to today's needs and conditions depends on reaching a certain standard in teacher competencies by taking into account the information technology technologies of the institutions and ensuring the effective integration of technologies (Seferoğlu, 2009).

The study titled "Examining the TPACK self-confidence perceptions of pre-school teacher candidates studying at Mersin University" by Tokmak, Konokman and Yelken (2013) was conducted with the participation of 154 pre-school teacher candidates and they studied whether TPACK self-confidence perceptions changed according to grade levels and gender variables. The results of the study showed that candidate teachers' TPACK self-confidence perceptions were high, but no difference was observed according to gender and grade levels.

In İlkay's (2017) study titled "Self-efficacy of Pre-School Teacher Candidates towards TPACK", in which 326 students studying at the Sakarya University preschool teaching department participated, the participants' self-efficacy perceptions towards TPACK were found to be at a higher level than the average and the IK factor had a higher score than the TB factor had. When the self-efficacy perception levels of the strategies were used, student participation and classroom management were evaluated, it was concluded that they were at an adequate level. In his research, Aksan (2020) examined teachers' purposes of using technology in education in terms of their technology self-efficacy levels. According to the results of the research, it was concluded that teachers' technology self-efficacy did not show a significant change according to their age, professional seniority and education level.

Technological Pedagogical Content Knowledge

The most important function of education is to raise people who are useful to society. The rapid advancement of technology also accelerates integration into educational environments. While the integration of technology with education as an important support in educational institutions is one of the most important expectations, it has become one of the most important needs of education in today's conjuncture. Effectively using of technology in education can be achieved if teachers use teaching tools in a healthy way and have sufficient knowledge of technology. While technology forms the basis of a model consisting of the interaction of pedagogical and content concepts, teaching based solely on technology is not sufficient. For this reason, it is necessary to create a more dynamic structure by using it together with pedagogical knowledge and field knowledge (Koehler and Mishra, 2009). For this purpose, a model has been developed to improve course content knowledge and related teaching methods with technology support (Mishra and Koehler 2006). While there are three main elements of the Technological Pedagogical Content Knowledge model and three sub-elements consisting of the intersection of these three main elements, these components constitute the Technological Pedagogical Content Knowledge (TPACK).

Technological Knowledge

Technology means using the results of scientific research for practical purposes. This use is made in order to make people's lives easier and solve their problems (Yeşiltaş and Sönmez, 2009). It is a whole that includes information on the use of traditional tools such as chalk, blackboard, paper, pencil and eraser, as well as software and hardware that come with advanced technologies such as smart boards, smart phones and tablets (Kaya and Dağ, 2013).

Pedagogical Knowledge

Pedagogical knowledge (PK); It is a body of information about methods for teaching processes and practices (Mishra and Koehler, 2008). PB stands for knowledge and understanding. PK is used to understand learning and teaching processes, meet students' learning needs, develop effective teaching strategies and increase students' success. PK is a type of knowledge that must be possessed by those working in the field of education. This information helps teachers understand how to teach effectively in the classroom, how to identify student needs, how to provide appropriate support to students and how to evaluate their learning processes.

Pedagogical Knowledge helps teachers effectively manage educational processes and improve student learning. At the same time, PC is used by education administrators and policy makers to improve education systems. PK involves understanding how to transfer knowledge to students in educational environments (Mishra & Koehler, 2008). In addition to general program information, PK includes information about the difficulties students experience in learning, independent of any field (Grossman, 1990).

Content Knowledge

For teachers, content knowledge (CK) is the in-depth knowledge that teachers have about the subject or field in which they teach or have expertise. AB is the body of knowledge that teachers have acquired through various learning styles related to their fields (Mishra and Koehler, 2009). Each teacher's AB may differ depending on their field of expertise. For example, a history teacher is expected to have in-depth knowledge in the field of history.

Teachers' EU is a fundamental element in effectively managing educational processes and contributing to students' learning. AB enables teachers to convey accurate and reliable information to students and increase student interest and participation. Teachers with high subject knowledge teach with self-confidence and provide immediate feedback to students' questions about the subject, making students' learning enjoyable (Küçükahmet, 2008; Davis, 2003).

Pedagogical Content Knowledge

PCK, which was first introduced to the literature by Shulman (1986); It is a blended form of pedagogical knowledge and field knowledge and is defined as the type of knowledge that prepares the course materials selected for teaching the concepts for the learning situations of the students in order to ensure the learning of a subject and ensures the use of education and training methods in accordance with the content (Shulman, 1986, 1987).

PCK helps teachers manage their educational processes well and improve student learning. At the same time, PCK enables teachers to adapt educational materials and methods to suit student needs. Content and method, which are the basis of teaching programs, should always be considered together. (Ozcan, 2011).

Technological Content Knowledge

It refers to teachers' ability to use technology effectively in educational processes and their in-depth knowledge of technology, which is formed by the interaction of technological knowledge and field knowledge. Today, technology is intertwined with education and is used to enrich course content, students' interaction and learning experiences. TAB is to investigate the most efficient way to use technology to overcome the limitations of learning (Niess, 2005). Teachers with TAB can effectively integrate technology into classroom teaching processes, increase student interaction and make students' learning experiences richer. Therefore, teachers' MAP is considered an important competency in today's educational environment (Mishra and Koehler, 2009).

Technological Knowledge

Technological knowledge is also an important component in educational institutions and teaching programs and is included in education and training processes to improve individuals' skills in using technology effectively. In summary, it can be called the knowledge required to use technology effectively and efficiently in daily life. TB is the type of information obtained about all advanced technologies such as the internet, education and software programs, smart boards and tablets, as well as technologies used from past to present such as pencil, paper, eraser and board. TB is the ability to know and use digital technologies, computer hardware, software, operating systems and basic computer terminologies (Mishra and Koehler, 2006). Nowadays, it is seen that transferring knowledge through traditional methods is not efficient enough, it is emphasized that educators should review and renew their technological knowledge over time (Yavuz and Coşkun, 2008).

Examples from Various Studies in Türkiye Related to Technological Pedagogical Content Knowledge

Karakaya and Cirit (2019) aimed to examine the relevance of peer coaching to the development of newly appointed Science Teachers' TPACK and competencies. Under the title of "Teaching Practice" course, a one-hour blackboard lesson was held and feedback on teaching practices and peer coaching forms was provided to newly appointed teachers. Progress by week and positive changes in future teachers' knowledge management and transfer were reported. It has been suggested that peer coaching practice be disseminated in teacher training institutions.

Emre (2020) aimed to examine the TPACK levels of newly appointed biology teachers with a lesson plan. This study, carried out with the document analysis method, determined that numerous and long studies would contribute to the improvement of the TPACK levels of 20 Biology teacher candidates and that the use of different measurement tools in studies related to TPACK would yield more accurate results. It has been suggested that EBA should be associated with undergraduate

internships for those who are new to teaching, so that they can use technology better.

Emre et al. (2020) aimed to determine the TPACK levels of newly appointed classroom teachers with a lesson plan. It was conducted using the document analysis method, one of the qualitative research methods. It has been observed that the transfer of technology apart from teaching, especially the lack of a connection with the special teaching method and the lack of adequate practices cause candidate teachers to be at a low level in terms of technology integration. It has been suggested that more emphasis should be given to studies related to TPACK in the courses included in classroom teaching.

Ardıç (2023) aimed to determine the relevance of online teaching of mathematics teachers in Covid-19 to TPACK self-confidence. With cohort screening, findings from studies before and during the pandemic were evaluated. It has been determined that the online training provided by teachers during the pandemic had a positive effect on their TPACK self-confidence. It was determined that the low self-confidence before the pandemic was significant for female teachers, older teachers and teachers who had a negative view on students' use of technology during the lesson. Since online education, which is common with Covid-19, is a much newer formation for mathematics teachers, it has been recommended to provide significant in-service training.

Ekici and Çoruk (2019) aimed to examine the relationship between classroom management mastery and TPACK of teachers working in Çanakkale according to different variables. The "TPACK Scale" and the "Classroom Management Skills Scale (SYBS)", whose validity and reliability studies were conducted, were applied. Parametric tests were used. A correlation analysis was applied to establish the relationship between teachers' TPACK levels and classroom management mastery. When we look at the total TPACK scale of the teachers when evaluated in terms of gender, age and marital status, no significant difference was found. If we look at the type of school, it was revealed that the opinions of the employees differ significantly in the total score of the TPACK scale. A positive relationship was determined between the concepts of TPACK and classroom management mastery. It has been suggested that TPACK and classroom management courses should be included in teachers' undergraduate programs.

Demir et al. (2018) aimed to examine the knowledge levels of candidate teachers registered for formation certificate training in terms of TPACK with different outputs. A screening model from descriptive studies was applied. It was observed that the TPACK levels of the participants were low and while there was no significant difference in TPACK levels according to gender and departments, there was a significant difference in terms of owning a personal computer, internet access levels and the high school graduated. It is recommended that teachers participate in in-service training activities to increase their knowledge levels on TPACK, MAP, TP and AB.

Doğan and Doğan (2022) aimed to describe the (TPACK) levels of management staff in primary schools, in their opinion, in terms of male and female, rank and education levels. TPACK levels of school administrators working in primary schools are high. TPACK levels of male and female employees are the same. It has been observed that people who have worked for more than 16 years are lower than those who have worked for 6-10 and 11-15 years. Technological formation regarding TPACK is significantly high. The rapid change in technology in 20 years may cause school administrators who have worked for less than 16 years to have difficulty adapting to this change. It is recommended that employees who have been teaching for a long time should be

assisted in their personal development with PC-assisted teaching technologies. It is recommended that TPACK courses should be integrated into teacher training programs and their number should be increased.

Organ Ulus and Aşiroğlu (2022) aimed to examine the relationship between TPACK and UEYT of secondary school mathematics teachers during the pandemic period. It has been reported that the TPACK of participants who taught online during the pandemic was positively affected. TPACK and UEYT levels do not differ in terms of gender. It is recommended that mathematics teachers are given in-service training on how to more effectively transfer their TPACK knowledge into practice in online education.

Filiz et al. (2022) aimed to determine the TPACK levels of pre-school teacher candidates and their thoughts on the words "technology" and "use of technology" using metaphors. Candidate teachers' TPACK levels were found to be high. The TPACK level increased in direct proportion as the grade level increased and at the same time, it was reported that there was a significant difference in the TPACK level in favor of the senior grades compared to other grades. It was determined that participants who had positive thoughts about the word technology also had high TPACK levels. It has been suggested that pre-school teacher candidates gain awareness about technology education throughout their education in order to increase the time spent with technology during their education and to integrate technology more into courses throughout university.

Hanbay et al. (2022) aimed to determine whether teachers' TPACK self-efficacy perception levels are a predictor of their EBA self-efficacy perception levels. It has been reported that teachers' TPACK self-efficacy perceptions differ at a statistically significant level when we look at age, professional experience and degree of computer use and their self-efficacy perceptions of using EBA do not differ statistically significantly according to these variables. It has been suggested that in-service training should be provided so that teachers with different characteristics can adapt to technological innovations and actively use these innovations in the educational process, in accordance with the content and pedagogical principles.

Yusufoğlu and Gençtürk (2021) aimed to examine the TPACK levels of social studies teacher candidates in terms of different variables. Data was collected using the “TPACK Competencies Scale”. Analysis was done with the help of SPSS. It was observed that 4th grade students had higher TB levels than 1st grade students. Pre-service teachers' taking courses with technological content was examined in terms of TPACK level and it was reported that attending technology-related courses did not have a significant effect on TPACK and sub-competencies. For the combination of technology with pedagogy and content knowledge, TPACK or models that provide technology integration have been suggested to be integrated into institutions that train social studies teachers.

Bıçak and Şeker (2021) aimed to examine whether Social Studies teachers have computers and their level of computer use has an effect on their TPACK perceptions. Social Studies teachers who have personal computers feel better about TPK, TB and TAB than participants who do not have personal computers; It has been observed that teachers who have personal PCs and are up-to-date on technology are at a good level in integrating technology into their lessons and it has been determined that social studies teachers' proficiency in using computers has a positive effect on their TPACK self-efficacy perceptions. It has been suggested that prospective teachers should be given quality technology-related lessons and working teachers should be given in-service training on

computer use so that they can integrate technology into their lessons more easily.

Koçoğlu (2009) evaluated his findings in his study titled "The impact of candidate teachers' TPACK development in computer-assisted language learning course" in line with the TPACK of candidate teachers. As a result of the study, it was concluded that technology-supported language learning can support the development of PIK, TİK and TPK.

Burmabiyik (2014) conducted a study on examining teachers' self-efficacy perceptions towards TPACK in terms of different variables. This was done to determine whether there were any differences. According to the results of the study, no significant relationship was found between the teachers' Technological Pedagogical Content Knowledge and the specified independent variables. It has been determined that there is no significant difference in IK, PK, PIK and TPK scores according to teachers' ability to access the technology they need in the schools where they work. There was a positive and weak correlation between technology usage levels and TPB, TPB and TPACK, a positive and moderate correlation was found between TPB and no correlation was found between TPB, PK and PIK.

Erdoğan and Akbaba (2021) aimed to investigate the correlation between social studies teachers' technostress levels and gender, TPACK, school aid and job satisfaction variables. It was designed with the relational screening model from quantitative research. It was determined that gender, TPACK, school aid and job satisfaction significantly differentiate the technostress levels of teachers and the increase in TPACK competencies caused the technostress levels to decrease. It has been reported that high TPACK proficiency of social studies teachers reduces technostress and help in the school environment. It has been suggested that teachers' technostress levels can be reduced by providing assistance programs for technological culture and technology integration in schools.

Kadıoğlu et al. (2023) aim to investigate to what extent ICT usage categories predict the TPACK of science teacher candidates. The ICT-TPACK-Science framework concluded that ICTs and their pedagogical opportunities should be transformed according to student characteristics, duration, content and course objectives in the enriched science teaching process. Approximately one-third of the variability in total TPACK scores can be explained by three ICT measures. The relative importance of individual predictors is arranged in the following order: desktop software, emerging ICTs and hardware. As for the dimensions of the ICT-TPACK-Science Scale, the overall impact of the ICT predictors decreased in the following order: Design, implementation, planning, competence and ethics. While developing ICTs make the highest contribution to the design and competence dimensions; it has been determined that desktop software makes the highest contribution to the application, planning and ethical dimensions.

Examples from Various Studies from Abroad on Technological Pedagogical Content Knowledge

Hsu et al. (2023) English teachers' TPACK. The contextual effects of the spread of technology in every school on teachers' TPACK have not been determined yet. This study aimed to fill this gap. It was determined that English teachers were positive about integrating technology into their teaching, they did not experience difficulties, limited accessibility to technology infrastructure, lack of administrative support on technology, lack of knowledge and lack of time to integrate technology into pedagogy were identified as problems. Therefore, it is important to provide specific support to teachers and meet their individual needs and expectations, it is suggested that these

requests come from the teachers.

Wu et al. (2022) aimed to evaluate the adequacy of Technological Pedagogical Content Knowledge in Video-Based Distance Education (VTUE). It has been observed that teachers who support student- and teacher-centered education are more self-confident in applying VTUE and the proficiency of TPACK has a positive effect on VTUE. Moreover, compared to high school teachers, secondary school teachers in this study are more self-confident in TPACK for VTUE. For VTUE, it has been suggested that TPACK should include more technology-related professional development activities and implement more professional development programs in teacher education and training.

Li et al. (2022) It was aimed to examine the level of teachers' TPACK skills and whether there are any differences in these skills according to different teaching stages and teachers' education levels. It has been observed that teachers' TPACK skills are at a high level and as the education level increases, teachers' TPACK skills also increase. Therefore, teachers should effectively integrate technology into lessons and it is suggested to apply appropriate teaching methods according to the teaching content at different teaching stages.

Koh (2019) aimed to see how teachers' concepts of pedagogical change can be supported by using different TPACK design tools such as meaningful learning rubrics, course design heuristics and TPACK Activity Types. These design scaffolds have been found to have positive effects on teachers' TPACK confidence and are useful for helping teachers express pedagogical development in their lesson designs. Feedback to develop TPACK design scaffolds, as well as guidelines for using them, have been suggested to provide pedagogical development through TPACK professional development programs.

Bedin et al. (2023) How chemistry teachers see the relationship between TPACK and content integration. It is aimed to provide a general framework for the integration of digital technologies into chemistry education and to integrate empirical research on teachers' relationships with distance education during the pandemic. It has been determined that it is necessary for chemistry teachers to carry out training courses to improve their ICT-related skills and, as a result, to use the knowledge that forms the TPACK structure in interrelated ways, so that chemical instructions can be used in a pedagogically appropriate way and effectively to improve students' chemistry learning experience. TPACK and Johnstone's Triangle can be reapplied and developed and new theoretical and knowledge contributions can be added, it is recommended to support framework technologies to improve the teaching and learning process of chemistry.

Kim et al.'s (2021) TPACK framework aims to determine which teacher competencies are needed to improve artificial intelligence teaching and learning for K-12. A mass case study research approach was adopted to gain insight into teacher competency for K-12 AI education. To gain a broader understanding of teachers' core competencies for AI education, the world's existing AI education resources were simultaneously examined. It has been determined that teachers teaching AI to K-12 students need TPACK to create, prepare and facilitate project-based classes that solve problems using AI technologies.

It was aimed to examine the effect of teaching experience and Self-Regulated Learning (SRL) on teachers' emotions in the context of TPACK development in Huang 2022. More than one-third of teachers reported experiencing extreme negative emotions during the lesson planning task

in the computer-based learning environment. It has been determined that teachers have difficulty designing lessons with technology integration. Significant differences in emotional experience have been identified among teachers. It has been suggested that ministries include SRL strategy development content in both pre-service and in-service course design for teachers and that guidance services in institutions should be directed to a teacher community where teachers are encouraged to share the challenges they face in planning and implementing technology-related instruction and to support their peers.

Kumala et al. (2022) aimed to analyze primary school teachers' TPACK value in science teaching based on teacher demographic factors (gender, age, working status and teaching experience) and to investigate the relationship between teacher demographic factor and teachers' TPACK value. It was determined that the TPACK value for male teachers received higher scores than female teachers and for the age category, teachers between the ages of 30-40 and under the age of 30 had better technological skills and performed better than older teachers. In terms of employment status, civil servant teachers showed slightly higher scores than non-civil servant teachers. Regarding teaching experience, the teacher's TPACK level is proportional to the duration of teaching experience. In general, it has been shown that there is a relationship between teacher demographics factor and TPACK. It is suggested that the school should create a policy such as developing TPACK training based on teacher characteristics, which can improve the TPACK profile of teachers.

Ariyani et al (2022) aims to explore the TPACK skills of Lampung language teachers and the advantages and problems of online Lampung language classes. Lampung language teachers have been found to specialize in TPACK, such as the use of various learning media and educational platforms in their online classes. It has been suggested that giving homework in creative ways, such as making videos of folk songs, can be used by Lampung language teachers to create enjoyable learning during the pandemic process by using local languages. It provides an overview of the TPACK skills of Lampung language teachers and information on the problems and advantages of online Lampung language learning during the pandemic. This information has been suggested by politicians as a resource to create the best Lampung language learning system.

Hayak and Avidov-Ungar (2023) aimed to examine the perceptions of teachers who use Digital game-based learning (DBL) in primary education classes regarding the types of information and the planning processes they use. Teachers use four types of information; game knowledge, game technological knowledge, game pedagogical knowledge and game technological pedagogical content knowledge. Five integration planning stages have been identified; Stages A-C are about the game selection process and stages D-E are about the integration of games into the classroom. While most teachers plan the integration of DOBÖ into their classrooms using a structured approach that follows each stage sequentially, some teachers adopt a flexible planning model that skips or reorders some stages. It has been found to be important for teachers who want to better integrate into their practices.

Zeng, Wang and Li (2022) What is the relationship between teachers' information technology integration self-efficacy and TPACK? Do gender, measurement tools, career stages, disciplines and educational levels have a moderating effect on the relationship between information technology integration self-efficacy and TPACK? It is aimed to answer the questions. It was concluded that teachers' information technology integration self-efficacy was significantly

positively related to TPACK and teachers' TPACK levels were improved by improving teachers' information technology integration self-efficacy. It is suggested that teachers should strengthen their own self-efficacy regarding information technology integration and improve their own TPACK literacy level based on their own actual professional development.

Wang (2022) TPACK assessments are aimed to evaluate teachers' technology integration levels in teaching English as a foreign language (EFL). It has been determined that English teachers have less confidence in their TPACK in teaching higher order thinking skills and English teachers in different cultures have different levels of confidence in TPACK and thinking skills. Highly successful English teachers achieved high TPACK self-efficacy results.

2. RESULTS

It refers to the ability to manage instructional processes and improve student learning by effectively using technology in education. This concept enables teachers to integrate educational technologies in accordance with educational goals and in a pedagogically effective manner (Akkaya, 2009). It is formed by the interaction of technology, pedagogy and content knowledge (Mishra and Koehler 2006).

It refers to the ability to use educational technologies effectively and efficiently. This concept includes topics such as how educational technologies will be used in educational processes, how they will be integrated to increase student learning and participation and how they will support educational goals. TPACK guides the teacher on how to plan, implement, evaluate and transfer technology to students in line with pedagogical purposes. In this context, technology should be used strategically to support and enrich teaching and learning processes (Kaya and Yılayaz, 2013).

PCK, whose theoretical foundation was laid by Shulman (1986), shed light on the research of Mishra and Koehler (2006) and created this model by adding technological knowledge to pedagogical knowledge and content knowledge. In this model, the concepts of PCK were formed with the interaction of pedagogy and field knowledge, TCK with the interaction of technology and field knowledge and technological pedagogical knowledge TPACK with the interaction of technology and pedagogy knowledge (Mishra and Koehler, 2006).

Within the framework of TPACK, in order to increase the effectiveness of the teaching process, it is important that all stages of teaching planning, execution and evaluation are carried out; based on technological pedagogical content knowledge (Kabakçı Yurdakul, 2011). In this way, the teaching process becomes meaningful for students and the desired learning outcomes can be achieved.

About pedagogical knowledge, which is a component of TPACK, Yurdakul and Odabaşı (2013) stated that teachers' knowledge of pedagogy: He stated that it is necessary to plan the teaching process, develop student-specific methods and strategies by taking into account the individual differences of the students, the activities being carried out, should be remarkable and have the knowledge to evaluate student levels through measurement and evaluation. This situation can be considered as one of the main factors in the positive outcome of the process by teachers' mastery of various information regarding the components of the teaching-learning process.

It can be said that the unplanned use of technologies in education and training environments causes different problems. Therefore, teachers need to make a detailed organization before using technology in educational environments by determining how the technology they choose will contribute to the realization of teaching activities, as well as the necessary information about the technologies they will use and taking into account the pedagogical approach to be followed by taking into account the learning differences of the students.

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