Kastamonu Education Journal, 2021, Vol. 29, No:1, 63-83
doi: 10.24106/kefdergi.726886

| Research Article / Araştırma Makalesi |

Teacher Performance in Terms of Technopedagogical Content Knowledge Competencies[1]

Teknopedagojik Alan Bilgisi Yeterlikleri Açısından Öğretmen Performansı

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Keywords

1. Technopedagogical content knowledge,
2. TPACK
3. Teacher performance
4. Teacher competencies
5. Technology integration

Anahtar Kelimeler

1. Teknopedagojik alan bilgisi
2. TPAB
3. Öğretmen performansı
4. Öğretmen yeterlikleri
5. Teknoloji entegrasyonu

Received/Başvuru Tarihi
26.04.2020

Accepted/Kabul Tarihi
30.12.2020

Abstract

Purpose: Technology can be quickly and effectively integrated into education processes due to its rapidly developing and changing nature. Technopedagogical content knowledge (TPACK) emerges as one of the important types of knowledge that teachers should have in the process of technology integration. Teacher performance is naturally affected, as technology integration reshapes the education process. However, there are no studies on how teacher performance is related to the use of technology in Turkey, and teacher performance evaluation is not studied robustly. This study aims to determine the relationship between teachers' TPACK competencies and their performance.

Design/Methodology/Approach: This study was designed using a correlational model to determine the relationship between teachers' TPACK competencies and performance. The study group consists of 305 teachers working in primary, secondary and high schools in the Central Anatolia Region. Data in the study were collected through TPACK-Practical Scale and Teacher Performance Scale. The data were analyzed using descriptive statistics, t-test, ANOVA, correlation and regression techniques.

Findings: The findings of the study showed that TPACK and performance did not differ according to the gender of the teachers. TPACK competencies differ according to educational status and school type, and teacher performance differs according to school type. TPACK competencies and performances of teachers were negatively correlated with their ages and seniority. On the other hand, small positive relationships were determined between TPACK and performance.

Conclusions: As a result, thanks to technology integration, teacher performance can be improved, and student achievement, which is seen as the most concrete output of teacher performance, can be improved. In this respect, it can be suggested that TPACK is considered as a whole, and it can be developed theoretically and practically. This study suggests that technology, pedagogy, and content knowledge should not be included separately in teacher education, but presented in an integrated way.

Öz

Çalışmanın Amacı: Teknoloji hızla gelişen ve değişen doğası gereği eğitim – öğretim süreçlerine de hızla ve etkili şekilde entegre olmaktadır. Teknopedagojik alan bilgisi (TPAB) ise teknoloji entegrasyonu sürecinde öğretmenlerin sahip olması gereken önemli bilgi türlerinden biri olarak karşımıza çıkmaktadır. Teknoloji entegrasyonunun eğitim öğretim sürecini yeniden şekillendirmesi nedeniyle öğretmen performansı da doğal olarak etkilenmektedir. Ancak ülkemizde öğretmen performansının teknoloji kullanımıyla nasıl ilişkili olduğuna yönelik araştırmalar bulunmadığı gibi, öğretmen performans değerlendirmesi de üzerinde yeterince durulmayan alanlardan biridir. Bu araştırmanın amacı, öğretmenlerin TPAB yeterlikleri ile performansları arasındaki ilişkinin belirlenmesidir.

Materyal ve Yöntem: Bu amaçla araştırma, öğretmenlerin TPAB yeterlikleri ve performansları arasındaki ilişkilerin belirlenmesi adına ilişkisel model kullanılarak desenlenmiştir. Çalışma grubunu İç Anadolu Bölgesinde ilkokul, ortaokul ve liselerde görev yapan 305 öğretmen oluşturmaktadır. Araştırmanın verileri, TPAB- Uygulama Ölçeği ve Öğretmen Performansı Ölçeği aracılığıyla toplanmıştır. Veriler betimsel istatistikler, t testi, ANOVA, korelasyon ve regresyon teknikleri kullanılarak analiz edilmiştir.

Bulgular: Araştırmanın bulguları, TPAB yeterlikleri ve performansın öğretmenlerin cinsiyetine göre farklılaşmadığını göstermiştir. TPAB'i yeterlikleri eğitim durumu ve okul türüne göre farklılaşmaktadır ve öğretmen performansı ise okul türüne göre farklılaşmaktadır. Öğretmenlerin TPAB yeterlik ve performansları yaşları ve kıdemleri ile negatif yönde ilişkili bulunmuştur. TPAB ve performans arasında ise küçük düzeyde pozitif yönlü ilişkiler belirlenmiştir.

Sonuçlar: Teknoloji entegrasyonu sayesinde öğretme performansı ve öğretmen performansının en somut çıktısı olarak görülen öğrenci başarısı geliştirilebilir. Bu doğrultuda, TPAB'ın bir bütün olarak ele alınması ve teorik-pratik olarak geliştirilmesi önerilebilir. Bu çalışmada, öğretmen eğitiminde teknoloji, pedagoji ve içerik bilgisinin birbirinden ayrılmadan, bütüncül olarak sunulması önerilmektedir.

[1] This study is a part of the corresponding author's phd thesis named "Factors That Affect the Interactive Whiteboard Usage of Teachers and Its Effect on Teacher Performance". This study was supported by The Scientific and Technical Research Council of Turkey, International Research Fellowship Programme (2214/A) and Eskisehir Osmangazi University Scientific Research Projects Commission (Project number: 201621A209).

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INTRODUCTION

Technology can be quickly and effectively integrated into education processes due to its rapidly developing and changing nature. Many countries have made high-budget investments to ensure technology integration. Technology integration can be defined as a sustainable and ongoing change in the social system of schools resulting from the adoption of technology to help students construct knowledge (Belland, 2009). Many studies which examine effective technology integration focus on factors and barriers that affect technology integration. Such barriers, which were first conceptualized by Ertmer (1999) in the literature, were defined as internal and external. Internal barriers are relatively more abstract and difficult to overcome. They express the beliefs, attitudes, knowledge, and skills of the individual, and are mostly seen in relation to teachers (Ertmer, 1999; Hew & Brush, 2007). External barriers, on the other hand, are explained as the absence or insufficiency of external resources, such as access to technology, time, support, education, and are solved more easily than internal barriers (Ertmer, 1999). As external barriers to technology integration in the world are gradually overcome, the focus of researchers has shifted towards the nature of integration and internal barriers. This is necessary as overcoming external obstacles such as the provision of hardware infrastructure are not sufficient on their own for successful technology integration unless the beliefs and attitudes of teachers are changed as well.

There are a growing number of studies examining technology integration in schools, focusing on many different technologies in teaching. These studies conclude that when technology is used together with appropriate pedagogy, it affects learning and achievement positively (Albaaly & Higgins, 2012; Almekhlafi, 2006; Erbas, Ince & Kaya, 2015; Lei & Zhao, 2007; Malik & Shanwal, 2015; Mouza, 2008). However, research results are considered limited in terms of making an inference that technology use increases the quality of teaching (Inan & Lowther, 2010). In addition, despite the positive research results and the overcoming of external obstacles, technology is still not used as often and in the desired quality in teaching to provide the development of teaching practices in classrooms (Lim & Chai, 2008; Lowther, Inan, Strahl, & Ross, 2008). Technopedagogical content knowledge (TPACK) emerges as one of the important types of knowledge that teachers should have in the process of technology integration.

Technopedagogical Content Knowledge (TPACK)

Technological Pedagogical Content Knowledge [TPACK] (Mishra & Koehler, 2006) was formed by adding the technology dimension to the Pedagogical Content Knowledge model proposed by Shulman (1986). In the TPACK model Mishra and Koehler (2006) created seven fields of knowledge, namely *Content Knowledge, Pedagogical Knowledge, Technology Knowledge, Pedagogical Content Knowledge, Technological Content Knowledge, Technological Pedagogical Knowledge,* and *Technological Pedagogical Content Knowledge*. Pedagogical content knowledge refers to understanding the teachability of a subject and what makes things easy or hard to learn in that subject (Shulman, 1986). TPACK is the combination of content knowledge, pedagogical knowledge and technological knowledge (Pierson, 1999). It is defined as the effective combination by teachers of their understanding of technology, pedagogy and content to produce effective teaching in their discipline (Harris, Mishra, & Koehler, 2009). The TPACK model hence serves as a framework that creates the necessary understanding for teachers to ensure effective technology integration in their teaching. Different variant TPACK models have emerged as a result of studies and many different perspectives on TPACK. The TPACK - Practical Model considered within the scope of this research is the product of a different perspective brought to TPACK model.

TPACK - Practical Model

TPACK-Practical model was developed to reflect the importance of teachers' experiences and teaching practices to build on the TPACK model. It consists of eight knowledge dimensions belonging to five pedagogical fields, including learners, subject content, curriculum design, practical teaching and assessment (Yeh, Hsu, Wu, Hwang, & Lin, 2014). Explanations regarding the five pedagogical fields in the TPACK-Practical Model are given below.

(*i*) Learners: This refers to the prior knowledge that teachers should have in order to understand the subject that students will learn, and the knowledge about the difficulties they will experience in learning the relevant subject (Ay, 2015). This pedagogical area regarding learners also has an important place in terms of teacher competencies (MEB, 2008). It was emphasized that qualified teachers should know which subjects students will learn easily or difficulty and the reasons for these difficulties.

(*ii*) Subject Content: This highlights the knowledge of teachers of technologies appropriate to the subject area and how to use them, and points out that technologies suitable for each subject area should be determined (Ay, 2015). Similarly, in order to achieve maximum efficiency in the subject area and technology interaction, the contribution of technological tools to the teaching of the subject should be determined in subjects that students cannot grasp easily or teachers have difficulty in teaching effectively (Angeli & Valanides, 2009).

(*iii*) Curriculum Design: This area consists of 3 sub-pedagogical areas: planning, representations and teaching strategies. The planning area explains the information about the integration of TPACK into curriculum at macro, medium and micro level within the scope of technology integration. Within the scope of technology integration, teachers are expected to design learning opportunities in accordance with the development of the students, to determine the appropriate technology resources for

learning activities, and to determine strategies for their effective use (Ay, 2015; Yeh et al., 2014). During the curriculum design process, the teacher is expected to prepare learning environments and activities related to real life (Becit İşçitürk, 2013). In the field of teaching strategies, it is emphasized that technology should be used in shaping the teaching process, as a more general concept that includes teaching methods and techniques in achieving the goals of the course

(*iv*) Practical Teaching: This pedagogical field consists of 2 sub-pedagogical fields: Instructional management and teaching practices. The preparation of activities and materials in the teaching process of instructional management can be explained as using technology in classroom management. Teaching practices are defined as the process in which the teaching-learning process is centered and the student, teacher and context interact (Ay, 2015). As the step where the effect of technology is felt at the highest level, how technology will be used in the learning-teaching process needs to be planned in detail (Akay, 2013).

(*v*) Assessment: Assessment in TPACK-centered teaching. This includes the evaluation of student performances in the activities performed with the help of a series of performance criteria and requires the use of both process and result-oriented alternative assessment approaches (Ay, 2015). Information in this area reveals that it is necessary not only for teachers to evaluate students' learning processes, but also to evaluate the effectiveness of teaching (Yeh et al., 2014).

In the literature, it is suggested that pre-service teachers' views on technology use and technology integration in education were positive (Choy, Wong, & Gao, 2009; Gülbahar, 2008, Kabakçı Yurdakul, 2011; Yılmaz, 2021). It is seen that more positive outcomes are achieved in the lessons where teachers provide ICT integration (Angeli & Valanides, 2005, 2009; Chai, Koh, & Tsai, 2010; Jimoyiannis, 2010; Koehler & Mishra, 2005; Niess, 2005). In literature review studies, it is emphasized that most of the theoretical studies conducted with TPACK were conducted in the United States (Chai, Koh, & Tsai, 2013; Voogt, Fisser, Pareja Roblin, Tondeur, & Braak, 2011). In this respect, it is contended that the theoretical and conceptual frameworks related to technology integration are still insufficient, despite many studies being undertaken (Angeli & Valanides, 2009).

Teacher Performance

Teacher performance has been defined in different ways as: a concept that determines quantitatively or qualitatively what is obtained as a result of a purposeful and planned activity (Şimşek & Nursoy, 2002); the evaluation of all efforts made to achieve organizational goals (Palmer & Winters, 1993); and the output of the organization at a certain time (Akal, 1992). Although it is frequently used in the field of human resources management, it is a concept whose boundaries and content are not sufficiently explained (Açıkalın, 1999). Barutçugil (2002) defines the elements that makeup performance as focus, competence, and dedication. Other factors affecting performance consist of personal factors, leadership, team, system, and environmental factors (Öztürk, 2006).

Performance evaluation is evaluating the performance of employees against predetermined standards (Palmer & Winters, 1993). It is also defined as the interpretation of concrete performance measures in terms of performance standards or effectiveness levels (Aydın, 2012). Such performance evaluations of the individuals are important in achieving organizational goals. At the same time, it is used for purposes such as promotion, determination of training needs, remuneration, rewarding, rotation, career management, job development, job enrichment, or dismissal (Alpaslan, 2015; Çelik Uyanıktürk, 2009). To date, mistakes made in the performance evaluation process have been emphasized as personal bias, one-way measurement, central tendency, measurement tool error, halo effect, and recent time effect (Alpaslan, 2015).

One aspect of evaluation is the use of competences, which are defined as the characteristics that must be possessed in order to fulfill the requirements of a profession successfully (Şişman, 2002). They should be regarded as part of professional performance and considered as minimum standards for a job (Şahin, 2004). In the Ministry of National Education (MoNE) Performance Management Model, the concept of competence is considered as the characteristic features that inform the desired high performance. The competency areas that should be found in teachers generally consist of sub-competencies required by each field and performance indicators that these competencies will be observed (EARGED, 2006). MoNE determined the General and Domain-Specific Competencies for the Teaching Profession in 2008 and made it more comprehensive than the School Performance Management Model (MEB, 2008). It has been envisaged that the teacher competencies prepared by the MoNE (2008) will be used in determining teacher training policies, in pre-service teacher training institutions of higher education institutions that train teachers, in in-service training of teachers, in the selection of teachers, in evaluating teachers 'job performance and performance, and in teachers' self-knowledge and career development.

However, there are no studies examining the use of the competencies for these purposes (Atik Kara, 2012) and it remains uncertain how the competencies will be put into practice (Özoğlu, 2010). Nevertheless, Teacher Training and Education Science General Field Competencies are specified, consisting of knowledge, skills and competencies (HEC, 2011). The most striking situation is that the competences determined by HEC are not associated with the competencies determined by the MoNE. It is striking that the institutions that train teachers in Turkey have not made any attempt to meet the competencies of the institution that will employ teachers as one of the most important points in improving the quality of education is the cooperation of MoNE and HEC. The development of training programs to gain competencies in pre-service teacher education necessitates this

cooperation (TED, 2009). Furthermore, it is known that institutions that train teachers abroad have to meet the required standards. In addition, there is concern that the centrally prepared teacher competencies will not provide the expected change at the local level (Şişman, 2009).

When the teacher competencies and performance evaluation studies carried out around the world are examined, differences in terminology emerge (Şişman, 2009). The USA, UK, Australia and European Union use the concept of meeting standards as part of teacher qualifications. In the USA, teaching standards are prepared by professional organizations, and states use the standards prepared by these organizations when developing their own standards. These standards are taken into account by teacher training institutions and teachers are expected to meet these standards (Goodwin, 2020). At the same time, the standards shape the performance evaluation systems and include performance indicators and evaluation forms that schools will use in this process. For example, in the state of California, "Performance Assessment for California Teachers-PACT" has been developed to evaluate teacher performance (Pecheone & Chung, 2006). Similarly, performance standards and performance indicators have been set in many states and regions. Opinions are collected from stakeholders including administrators, teachers, students and parents. Teachers may face various sanctions at the end of the performance evaluation process. In the USA, the Interstate New Teacher Assessment and Support Commission (InTASC) has determined teaching standards and competencies and these have been implemented in many states (Yıldırım, 2013). These standards, which were first determined in 1992, have been updated over the years. Similarly, the Core Teaching Standards prepared by InTASC are the most accepted according to regional and school-based standards. Finally, the Core Teaching Standards prepared in 2013 aim to explain the new vision needed for today's learners and the teaching practices compatible with this vision and what strategies teachers can use for development (InTASC, 2013). In the literature, various measurement tools used for the development and self-assessment of pre-service teachers based on these standards are also included (Bradley, Isaac, & King, 2020; Nweke, Perkins, & Afolabi, 2019). The main reason for using the standards developed by InTASC within the scope of this research is that performance indicators reveal what a teacher should be able to do in a more concrete, measurable and observable manner compared to those in Turkey.

The InTASC Core Teaching Standards have ten performance standards as follows: (*i*) learner development, (*ii*) learning differences, (*iii*) learning environments, (*iv*) content knowledge, (*v*) application of content, (*vi*) assessment, (*vii*) planning for instruction, (*viii*) instructional strategies (*ix*) professional learning and ethical practice, (*x*) leadership and collaboration (InTASC, 2013). Performance standards are gathered under four main areas for the convenience of teachers and practitioners. Each standard is detailed under three separate headings as performance indicators, essential knowledge, and critical dispositions. The reason why standards are gathered under these headings is that teachers' practices, which are complex, can be examined in depth. Essential knowledge explains the necessary information for effective teaching, important points highlight professional behavior and ethical codes, and performance indicators explain how all of these can be put into practice (InTASC, 2013). The concept of *learner* is used because the concept of student indicates a more passive meaning. Similarly, the term *learning environment* is used instead of classroom in terms of representing every environment in which learning can take place.

The Learner and Learning

Teachers must know the development and learning patterns of learners so that each learner gains new knowledge and skills. Effective teachers should have high expectations to suit each learner's level of development. It is predicted that high expectations will enable learners to use their full potential and reach high standards. Teachers cooperate with learners, colleagues, school administrators, families, stakeholders and the community to achieve these standards and maximize learning. At the same time, individual and collaborative learning should be encouraged by ensuring that the learner takes responsibility for their own learning. The standards under this category are as follows (InTASC, 2013):

(i) *Learner development:* According to this standard, teachers should understand how learners grow and develop, as well as know how each individual's learning and development can be diversified in cognitive, linguistic, emotional and physical areas. According to these differences, the learners are expected to design and implement learning experiences that are motivating and require them to struggle.

(ii) *Learning differences:* Teachers are expected to provide learning environments that encompass individual differences, diverse cultures and communities in order to ensure that each learner reaches high standards.

(iii) *Learning environments:* According to this standard, teachers should work with their colleagues to create individual and collaborative learning environments. At the same time, it is expected that learning environments will be arranged in accordance with positive social interaction, active participation in learning and self-regulation.

Content Knowledge

This category envisages that teachers have deep and flexible content knowledge and they are expected to transfer this knowledge to learners through meaningful learning from real life. They should make information accessible in a variety of ways, including digital media and information technologies. Learning should take place with the help of interdisciplinary skills and the content should be linked to local, national, and global contexts. The standards under this category are as follows (InTASC, 2013):

(iv) *Content knowledge:* Teachers are expected to know the basic concepts, tools of inquiry, and the structures of their disciplines. It should make the content meaningful and accessible and create learning experiences in order to ensure the expertise of the learners in the content.

(v) *Application of the content:* Teachers engage learners in critical thinking, creativity, and collaborative problem solving on authentic local and global issues using differing perspectives.

Instructional Practice

Effective teaching depends on teachers' coordinated integration of assessment, planning, and teaching methods. First of all, teachers are expected to determine the outcomes and make an evaluation in line with these gains. Teachers, who are expected to be experts in the design, implementation, and reporting of total and formative assessments, should provide immediate feedback and reinforcement to learners during teaching and change teaching when necessary. It should take advantage of the effect of technology to enhance individual learning in planning and teaching and, at the same time, make sure that learners take responsibility for their own learning. The standards under this category are as follows (InTASC, 2013):

(vi) Assessment: This standard defines assessment as a resource for monitoring development processes with learners' participation and for decisions to be made at later stages. In this respect, teachers are expected to know and use alternative assessment methods.

(vii) Planning for instruction: Teachers should plan to teach so that each learner can achieve learning goals through subject area, curriculum, social context, and interdisciplinary skills.

(viii) Instructional strategies: In this standard, teachers are expected to know and use various teaching strategies to encourage learners, develop deep knowledge in the subject area and its connections, and build skills for the application of knowledge in meaningful ways.

Professional Responsibility

Since it is predicted that creating and supporting safe and efficient learning environments will maximize learners' success, providing these environments is considered the first responsibility of the teacher. This situation requires continuous development and renewal of teachers. Teachers can enter the professional development cycle with management and institutional support and contribute to schools' missions. The standards under this category are as follows (InTASC, 2013):

(ix) Professional learning and ethical practice: Although teachers' participation in professional learning is important, they are constantly responsible for evaluating their own practices, especially the impact of their choices and practices on stakeholders. When necessary, it should be able to organize its applications to meet each learner's needs.

(x) Leaderhip and collaboration: Teachers collaborate with learners, families, colleagues, other school professionals, and community members; they should be open to leadership roles. These are what must be done to secure the progress of learners and to progress in the profession.

The prerequisite for a beneficial evaluation of performance depends on clear job descriptions (Koçak, 2006). In this respect, teaching is a multi-dimensional profession, making it difficult to make job definitions. The adaptation of Taylor's (1997) scientific management principles to performance evaluation in education caused teachers to be evaluated with the results of standard exams taken by students. Classical performance evaluation approaches are used to make decisions such as salary and promotion based on performance. This result-oriented evaluation system increases the destructive competition culture and thus causes negativity in the educational environment. In this respect, it is not considered correct to evaluate teachers by measuring the results in a process where different interactions are experienced, and students develop in different ways (Buyruk, 2014; Yıldırım, 2013). Peterson (2000) states that typical teacher evaluations do not improve teacher behavior and do not represent what is happening in the classroom. Hisotrically, teacher evaluation methods have low validity and reliability (Darling-Hammond, Wise, & Pease, 1983), minimal measurement of what teachers have to do, and the superficiality of teacher evaluation (Stiggens & Duke, 1988) are among the criticism (Danielson & McGreal, 2000). On the other hand, contemporary performance evaluation approaches aim to ensure the personal development of the individual and increase the organization's efficiency. Although the necessity of contemporary performance evaluation is accepted (Koçak, 2006), performance evaluation continues to remain a problematic area due to evaluation errors and unfair judgments (Kozlowski, Chao, & Morrison, 1998), the confusion of political and personal thoughts (Cooper, Ehrensal, & Bromme, 2005), and difficulties in questioning employees' bad behavior (Remington, 2002). Seeing student achievement as the most important output of teacher performance receives robust support. The quality of schools and teachers depends on how successful students are in exams, and as a result, schools and teachers are under great pressure to make students successful (Archer, 2000; Popham, 2000). However, many experts agree that the scores students get from standard tests are affected by many variables that teachers cannot control and do not reflect teachers' performance (Kohn, 2000; Neill, 1999; Tell, 2001). Nevertheless, in studies examining the relationship between teacher performance and student achievement in the literature, it is found that there is a lower level of relationship between the classical performance evaluation

performed only by the principal and student achievement (Medley & Cooker, 1987), while a higher level of relationship between teacher performance and student achievement in standards-based assessments (Bommer, Johnson, Rich, Podsakoff, & MacKenzie, 1995; Heneman, 1986; Milanovsk, 2004).

When the literature is reviewed, performance and performance evaluation are handled with many concepts such as: organizational commitment (Swailes, 2002); organizational citizenship (Podsakoff, MacKenzie, Paine & Bachrach, 2000); organizational culture (Biswas, 2009; Harwiki, 2013; Jung & Takeuchi, 2010; Ogbonna & Harris, 2000); organizational climate (Litwin and Stringer, 1968); stress (Kakkos & Trivellas, 2011; Kazmi, Amjad, & Khan, 2008; Khalid, Murtaza, Zafar, Zafar, Saqib, & Mushtaq, 2012); burnout (Garden, 1991; Taris, 2006); motivation (Kunz & Pfaff, 2002); organizational learning (Garcia-Morales, Jimenez-Barrionuevo and Gutierrez-Gutierrez, 2012, Montes, Moreno, & Garcia-Morales, 2005); conflict management (Kotlyar, 2001; Wakefield, Leidner, & Garrison, 2008); organizational justice (Williams, 1999; Zehir, Akyüz, Eren, & Turhan, 2013); school culture (Heck & Marcoulides, 1996; Maslowski, 2001), organizational trust (İşleyen, 2011), teacher education (Ferguson & Womack, 1993; Pecheone & Chung, 2006), leadership style (Danişman, Tosuntaş & Karadağ, 2015); quality of life (Bektaş, 2013). At the same time, there are studies on performance evaluation such as teachers and administrators' opinions (Altun & Memişoğlu, 2008; Alpaslan, 2015; Soydan, 2012; Süzen, 2007; Tamam, 2005; Yariv, 2009); performance evaluation tools (Flowers & Hancock, 2003; Gün, 2012; Koçak, 2006); and performance evaluation methods (Anagün, 2002; Kantos, 2013). Although the necessity of contemporary performance evaluation is accepted in many studies in which opinions about teacher performance evaluation were taken, various positive or negative opinions were reached, and there was no clarity on this issue. Studies show that teachers' knowledge and understanding of performance evaluation standards and processes enable them to approach performance evaluation positively. It is important to create objective standards and indicators and ensure the transparency of the evaluation process to reduce the negative opinions of teachers and the healthy functioning of the performance evaluation system (Buyruk, 2014; Koçak, 2006). Teacher performance is naturally affected as technology integration reshapes the education and teaching process. However, there are no studies on how teacher performance is related to the use of technology in Turkey, and teacher performance evaluation is not studied robustly. This study aims to determine the relationship between teachers' TPACK competencies and their performance. In this context, the hypotheses to be tested are as follows:

H_{1a}	*Teachers' TPACK-Practical scores differ according to gender.*
H_{1b}	*Teachers' TPACK-Practical scores differ according to educational level.*
H_{1c}	*Teachers' TPACK-Practical scores differ according to the school type.*
H_{1d}	*There is a relationship between teachers' TPACK-Practical scores and age.*
H_{1e}	*There is a relationship between teachers' TPACK-Practical scores and years of seniority.*
H_{2a}	*Teachers' performance scores differ according to gender.*
H_{2b}	*Teachers' performance scores differ according to educational level.*
H_{2c}	*Teachers' performance scores differ according to the school type.*
H_{2d}	*There is a relationship between teachers' performance scores and age.*
H_{2e}	*There is a relationship between teachers' performance scores and years of seniority.*
H_3	*There is a positive relationship between teachers' TPACK-Practical scores and performance scores.*

METHOD

Research Design

This study was designed using a correlational model to determine the relationship between teachers' TPACK competencies and performance. Correlational research design is used to determine the relationships between two or more variables (Fraenkel & Wallen, 2011).

Participants

The study group consists of 305 teachers working in primary, secondary, and high schools in the Central Anatolia Region. An appropriate sampling technique was used to reach the study group. Simultaneously, in terms of sample size, it was considered that it must be large enough for a scale development study. In this context, a sample of 300 people is considered sufficient (Tabachnick & Fidell, 1996) and good (Comrey & Lee, 1992) in terms of scale development studies. Details on the characteristics of participants are presented in Table 1.

Table 1. Demographic information of the participants

Variables		1	2	3	4	Total
Gender		Female	Male			-
	n	171	134			305
	%	56.1	43.9			100
Educational level		Bachelor	Postgraduate			-
	n	262	43			305

	%	85.9	14.1			100
		Primary	Secondary	High school		-
School type	*n*	4	154	147		305
	%	1.3	50.5	48.2		100
		20-30	31-40	41-50	51+	-
Age	*n*	51	140	81	33	305
	%	16.7	45.9	26.6	10.8	100
		0-10	11-20	21-30	30+	-
Years of seniority	*n*	116	116	57	16	305
	%	38.0	38.0	18.7	5.2	100

Data Collection Tools

Data in the study were collected through two scales, one of which is the TPACK- Practical Scale. Since there is no scale with the features determined for measuring teacher performance in the literature, the Teacher Performance Scale developed within the study's scope was used.

TPACK – Practical Scale

The TPACK- Practical Scale was developed by Yeh et al. (2013) in order to determine teachers' TPACK in terms of their competence in teaching and adapted to Turkish by Ay (2015). It consists of 22 items in a 5-point Likert-type graded between "I am completely sufficient" and "I am completely inadequate" regarding TPACK competencies. The scale consists of 5 pedagogical areas: (i) learners, (ii) subject area, (iii) curriculum design, (iv) practical teaching, and (v) assessment. It also has 8 dimensions of knowledge: (i) Using ICT to understand students, (ii) using ICT to understand subject content, (iii) planning ICT-infused curriculum, (iv) using ICT representations to present instructional representations, (v) employing ICT-integrated teaching strategies (vi) applying ICT to instructional management, (vii) infusing ICT into teaching contexts (viii) using ICT to assess students. While the goodness of fit indices [RMSEA = 0.06, AGFI = 0.86, GFI = 0.89, CFI = 0.92, NFI = 0.87] regarding the construct validity of the scale show that the modeled factor structure of the scale is appropriate; the Cronbach Alpha reliability coefficient of .89 reveals that the scale is reliable.

Teacher Performance Scale

It was determined that the scales available in the literature do not cover all sub-dimensions of teacher performance and it was concluded that there was no teacher performance scale that would serve the purposes of the study. In this context, was necessary to develop a comprehensive measurement tool for measuring teacher performance. The steps followed in the development of the measurement tool are explained in detail.

In order to measure teacher performance, teacher performance standards and competencies in the literature were examined. General Competencies for the Teaching Profession developed by the MoNE in Turkey; Core Teaching Standards developed by the InTASC in the USA have been evaluated in terms of model, scope and indicators. The General Competencies for the Teaching Profession consist of 6 competence areas, 31 sub-competencies related to these and 233 performance indicators (MEB, 2008); Core Teaching Standards consist of 4 general categories, 10 standards and 74 performance indicators (InTASC, 2013). Among the models that were evaluated, it was deemed appropriate to use the Core Teaching Standards as a theoretical framework during the scale development phase, since it deals with the performance of teachers in a more comprehensive and updated manner. According to this framework, the scale is planned to be composed of 4 subscales: (*i*) learner and learning; (*ii*) content knowledge; (*iii*) instructional practices; and (*iv*) professional responsibility. Also, (*i*) learner development, (*ii*) learning differences, (*iii*) learning environments, (*iv*) content knowledge, (*v*) application of the content, (*vi*) assessment, (*vii*) planning for instruction, (*viii*) instructional strategies, (*ix*) professional learning and ethical practice, (*x*) leadership and collaboration 10 performance standards are included. An item pool was created by preparing 74 performance indicators under Core Teaching Standards as scale items. The item pool covering all indicators in each dimension was reviewed together with a Turkish language expert. As a result, items that were not understood and thought to represent more than one performance indicator were corrected and a draft scale form was created.

The draft scale form was grouped according to the subscales and the items it contains. After making explanations about the subscales, an expert opinion form for content validity was created and it was presented to 3 experts working in this field. Experts were asked to evaluate the extent to which each draft item was able to measure the subscale to which it belongs, and to state their suggestions, if any. According to expert opinions, while no items were removed from the draft scale form, some items were corrected. Ultimately, a 71-item scale form in 5-point Likert-type graded as "always", "often", "occasionally", "very sparse" and "never" was created. Within the scope of the research, teacher performance was measured through classroom observations and 867 forms were obtained. It was checked whether the scales were filled in a sincere manner. Data with extreme values (n = 52) were excluded from the dataset by examining the z scores of each item. Series means were assigned to the missing data. The

normality of the data was checked according to the kurtosis and skewness values, and it was concluded that the data were normally distributed. The psychometric properties of the scale were examined using complete data consisting of 815 forms.

Item discrimination, construct validity and reliability analyzes of the scale items were performed. A Pearson product-moments correlation analysis was used in item-total and item-remainder analyzes performed to determine item discrimination, and independent group t-test was used for 27% lower-upper group comparison. The construct validity of the scale was determined using confirmatory factor analysis, and its reliability was determined using the Cronbach's Alpha coefficient using the internal consistency method. In order to determine item discrimination, item-total, item-remainder, 27% lower-upper group comparison analyzes were made. Item-total and item-remainder correlation values ranged from .49 to .75 and were found to be statistically significant. It was also observed that the lower and upper groups differed significantly in the lower upper group comparison analysis of 27% of each item ($p < .01$). As a result of the analysis, it was concluded that the discrimination values of each item were statistically significant.

Confirmatory factor analysis was performed using the LISREL 8.51 program, and the maximum likelihood method to determine the construct validity of the scale and fit indices were examined. Values not exceeding theoretical limits were determined according to the results obtained. Chi-square ($\chi 2$) value and statistical significance levels for confirmatory factor analysis were determined [$\chi 2 = 10632.62$, sd = 2369, $p < .01$]. The ratio of Chi-square to degrees of freedom shows that the proposed model is suitable for the collected data. Other goodness of fit indexes of the model [RMSEA = 0.06, GFI = 0.71, AGFI = 0.70, CFI = 0.85, NFI = 0.80] show that the proposed model for the scale is appropriate. According to these results, it is seen that the factor structure modeled within the scope of standard fit values is confirmed. The reliability of the scale was examined using the internal consistency method. It was concluded that the Cronbach Alpha internal consistency coefficient of the whole scale was 0.98; meanwhile, the subscales' internal consistency coefficient ranged between 0.93 and 0.96.

As a result of the validity and reliability analysis, it was concluded that the Teacher Performance Scale had a total of 71 items in 5-point Likert type graded as 'always', 'most of the time', 'occasionally', 'very sparse' and 'never'. Teacher Performance Scale had 4 subscales as follows: (i) learner and learning, (ii) content knowledge, (iii) instructional practices, and (iv) professional responsibility.

(i) Learner and Learning: The high score obtained from this subscale shows that teachers can follow the development of learners, know the individual differences of learners and offer appropriate teaching opportunities and environments. Sample items for this subscale are as follows:
  (1) Teaching appropriate for learners' development levels
  (2) Providing learning opportunities appropriate to learners' strengths and needs

(ii) Content Knowledge: High scores from this subscale show that teachers can teach various domain-based perspectives through higher-order thinking skills. Sample items for this subscale are as follows:
  (1) Enabling learners to find creative solutions to problems
  (2) Supporting learners to improve their subject area literacy (mathematics literacy, science literacy, etc.)

(iii) Instructional Practices: The high score obtained from this subscale shows that teachers are able to plan for their learning needs and goals, they use various methods in the assessment process to ensure learners' participation in the process, and that they use a wide variety of appropriate teaching strategies to achieve learning goals. Sample items for this subscale are as follows:
  (1) Using a variety of strategies, resources, and materials to differentiate teaching
  (2) Using various assessment methods, taking into account the differences of learners

(iv) Professional Responsibility: High scores obtained from this subscale indicate that teachers are conscious of professional standards, ethical rules, and laws and maintain professional development. Sample items for this subscale are as follows:
  (1) Researching professional and technological resources to improve teaching
  (2) To have knowledge about the ethical rules, laws and policies, professional standards required by the profession

Data Collection and Analysis

The data collection process of the research was initiated after the Ethical Board Approval obtained at the institution where the researchers were affiliated and the permission obtained from the relevant Provincial Directorate of National Education. Not being limited to this permission, participants were informed that participation in the study is optional and that they can leave the study at any time. After this information, permissions were obtained from the participants and the school administrators. Data from participants who agreed to participate in the study were collected in two stages:

(i) Classroom observations were made to determine the teachers' performances. Some of these observations were made by the researcher and some of them were made by the pre-service teachers who observed for 14 weeks as part of the *Teaching Practice* course. The prospective teachers were informed by the researchers about how to make the observation before the data collection process. In order to prevent a possible bias, the fact that each participant was observed by at least 3 pre-service teachers was considered as a criterion. At the same time, teacher performance scores were calculated by taking the average of each scale.

(ii) All participants whose performance data was collected were reached by the researchers. A *TPACK- Practical Scale* was filled by the participants. Teacher Performance and this other scale were matched with the codes given to each participant.

In the analysis of the data, descriptive analyzes were made for all scales and subscales. Before the difference tests of the subscale scores, the normality of the data was checked according to the kurtosis and skewness values and it was decided that it was appropriate to use parametric analysis techniques. Difference tests were performed using t-test, one way ANOVA, and post hoc tests. In determining the relationships, Pearson product-moment correlation and multiple regression analysis were used to determine the predictive level of TPACK on teacher performance.

RESULTS

TPACK

Means and standard deviation values of the teachers' scores from TPACK- Practical dimensions are presented in Table 2. It can be seen that the averages of the scores obtained from the dimensions vary between 3.46 and 3.80. While planning ICT-infused curriculum has the lowest average (x = 3.46, sd = .87), the dimension of using ICT to understand subject content (x = 3.80, sd = .86) has the highest average. Looking at all the averages, it is seen that the averages are close to each other.

Table 2. Descriptive statistics of TPACK-Practical

Dimensions	Indicators	*n*	*X*	*SS*
1- Learners	Using ICT to understand students	305	3.61	.81
2- Subject Content	Using ICT to understand subject content	305	3.80	.86
3-Curriculum Design	Planning ICT-infused curriculum	305	3.46	.87
	Using ICT representations to present instructional representations	305	3.57	.86
4-Practical Teaching	Employing ICT-integrated teaching strategies	305	3.70	.87
	Applying ICT to instructional management	305	3.61	.84
	Infusing ICT into teaching contexts	305	3.52	.84
5- Assessment	Using ICT to assess students	305	3.55	.83

Independent groups t-test results regarding whether the teachers' scores TPACK- Practical differ significantly according to gender variable are presented in Table 3. According to the results obtained, it can be seen that the scores obtained from the learner, subject content, curriculum design, practical teaching, and assessment dimensions do not differ significantly according to gender [p> .05]. This situation shows that the views of male and female teachers towards applying TPACK are similar.

Table 3. T-test results of TPACK-Practical scores according to gender

Dimensions	Gender	n	X	*ss*	t	p
1- Learners	Male	134	3.67	.84	1.15	.25
	Female	171	3.56	.79		
2- Subject Content	Male	134	3.87	.88	1.33	.18
	Female	171	3.74	.85		
3- Curriculum Design	Male	134	3.68	.83	1.90	.06
	Female	171	3.50	.79		
4- Practical Teaching	Male	134	3.66	.84	1.87	.06
	Female	171	3.49	.79		
5- Assessment	Male	134	3.65	.83	1.83	.07
	Female	171	3.47	.83		

df=303

Independent groups t-test results regarding whether teachers' scores TPACK- Practical differ significantly according to the educational status variable are presented in Table 4. According to the results, while subject content scores did not differ significantly according to the education level [p>.05], the scores obtained from the learner, curriculum design, practical teaching, and assessment subscales differ significantly in favor of the teachers who have graduate education [p<.05]. For this reason, it can be said that postgraduate education contributes to teachers in terms of using ICT in understanding learners, curriculum design, teaching, and assessment. However, in terms of using ICT in understanding the subject area, teachers who have graduate education and those who have undergraduate education have similar views.

Table 4. T-test results of TPACK-Practical scores according to education level

Dimensions	Educational level	*n*	*X*	*ss*	*t*	*p*

1- Learners	Bachelor	262	3.57	.80	-2.40	.02
	Postgraduate	43	3.88	.83		
2- Subject Content	Bachelor	262	3.77	.87	-1.49	.14
	Postgraduate	43	3.98	.77		
3- Curriculum Design	Bachelor	262	3.53	.80	-2.55	.01
	Postgraduate	43	3.87	.81		
4- Practical Teaching	Bachelor	262	3.51	.81	-3.09	.00
	Postgraduate	43	3.92	.76		
5- Assessment	Bachelor	262	3.50	.82	-2.62	.01
	Postgraduate	43	3.86	.84		

df=303

Independent groups t-test results regarding whether teacher scores TPACK-Practical show a significant difference according to the school type variable are presented in Table 5. According to the statistical results obtained, the scores obtained from the learner, subject content, curriculum design, practical teaching, and assessment differ significantly in favor of teachers working in secondary schools [p<.05]. According to this result, it can be said that the level of application of TPACK of teachers working in secondary schools is higher than teachers working in high schools.

Table 5. T-test results of TPACK-Practical scores according to school type

Dimensions	School Type	n	X	SS	t	*p*
1- Learners	Secondary	154	3.77	.71	3.70	.00
	High school	147	3.43	.88		
2- Subject Content	Secondary	154	4.01	.76	4.54	.00
	High school	147	3.57	.91		
3- Curriculum Design	Secondary	154	3.73	.73	3.48	.00
	High school	147	3.41	.86		
4- Practical Teaching	Secondary	154	3.70	.75	3.01	.00
	High school	147	3.42	.86		
5- Assessment	Secondary	154	3.67	.76	2.71	.01
	High school	147	3.42	.89		

df=299

The Pearson product-moment correlation results, which was made to determine whether there is a meaningful relationship between the teachers' TPACK- Practical dimensions and the years of seniority and age variables, are presented in Table 6. When the correlations between teachers' years of seniority variable and their TPACK- Practical scores were examined, significant negative relationships were found between years of seniority variable, and TPACK dimensions as follows: learner [*r*=-. 16]; subject content [*r*=-. 16]; curriculum design [*r*=-. 14]; practical teaching [*r*=-. 15]; and assessment [*r* =-. 11]. These results show that the level of TPACK-Practical decreases as seniority of the teachers increases.

Table 6. Pearson product moment correlation matrix between TPACK-Practical scores and seniority and age variables

Dimensions	Years of seniority	Age
1- Learners	-.16**	-.17**
2- Subject Content	-.16**	-.15**
3- Curriculum Design	-.14*	-.13*
4- Practical Teaching	-.15**	-.14*
5- Assessment	-.11*	-.10

n =305, **p*<.05, ** *p*<.01

Teacher Performance

The means and standard deviation values of teacher performance scores are presented in Table 7. This shows that the mean scores of dimensions vary between 3.84 and 4.15. The standard for application of content (*x*= 3.84, sd = .68) has the lowest average, while the learner development standard (x= 4.15, sd= .60) has the highest average. Looking at the highest and lowest

averages, it is seen that the averages are close to each other. Although the averages are close to each other, it can be said that the performance of teachers towards the application of the content is somewhat less. Still, their performance in learner development is higher.

Table 7. Descriptive statistics of teacher performance

Dimensions	Standards	*n*	*X*	*sd*
1-Learner and Learning	Learner Development	305	4.15	.60
	Learning Differences	305	3.89	.66
	Learning Environments	305	4.11	.62
2- Content Knowledge	Content Knowledge	305	4.02	.66
	Application of Content	305	3.84	.68
3-Instructional Practice	Assessment	305	3.99	.62
	Planning for Instruction	305	3.99	.67
	Instructional Strategies	305	3.96	.66
4-Professional Responsibility	Professional Learning and Ethical Practice	305	4.09	.63
	Leadership and Collaboration	305	3.87	.67

The independent groups t-test results regarding whether teachers' performance scores differ significantly according to gender variable are presented in Table 8. As a result of the independent group t-test, it was determined that the scores obtained from the dimensions of learner and learning, content knowledge, instructional practice, and professional responsibility did not differ significantly according to gender [*p*> .05]. According to this result, the performances of female and male teachers do not change.

Table 8. T-test results of teacher performance scores according to gender

Dimensions	Gender	*n*	*X*	*sd*	*t*	*p*
1- Learner and Learning	Male	134	3.98	.57	-1.80	.07
	Female	171	4.10	.60		
2- Content Knowledge	Male	134	3.89	.64	-.87	.38
	Female	171	3.95	.65		
3- Instructional Practice	Male	134	3.93	.60	-1.30	.20
	Female	171	4.02	.63		
4- Professional Responsibility	Male	134	3.93	.62	-1.22	.23
	Female	171	4.01	.60		

df=303

The independent group t-test results regarding teacher performance scores show a significant difference according to the educational status variable and are presented in Table 9. According to the results obtained, the scores obtained from learner and learning, content knowledge, instructional practice, and professional responsibility dimensions do not differ according to educational level [p> .05]. Thus, teachers' overall performance with postgraduate education and teachers with only undergraduate education does not change.

Table 9. T-test results of teacher performance scores according to educational level

Dimensions	Educational level	*n*	*X*	*sd*	*t*	*p*
1- Learner and Learning	Bachelor	262	4.05	.58	-.24	.81
	Postgraduate	43	4.07	.67		
2- Content Knowledge	Bachelor	262	3.93	.63	.01	.96
	Postgraduate	43	3.93	.74		
3- Instructional Practice	Bachelor	262	3.98	.60	-.27	.79
	Postgraduate	43	4.01	.70		
4- Professional Responsibility	Bachelor	262	3.96	.60	-1.25	.21
	Postgraduate	43	4.08	.65		

df=303

The independent groups t-test results regarding whether teachers' performance scores show a significant difference according to the school type variable are presented in Table 10. According to the statistical results, teacher performance scores obtained from learner and learning, content knowledge, instructional practice, and professional responsibility dimensions differ significantly

in favor of teachers working in secondary schools [p <.05]. According to this result, it can be said that teachers' performances working in secondary schools are at a higher level than teachers working in high schools.

Table 10. T-test results of teacher performance scores according to school type

Dimensions	School Type	*n*	*X*	*sd*	*t*	*p*
1- Learner and Learning	Secondary	154	4.26	.48	7.30	.00
	High school	147	3.81	.60		
2- Content Knowledge	Secondary	154	4.15	.55	6.58	.00
	High school	147	3.69	.66		
3- Instructional Practice	Secondary	154	4.18	.53	6.39	.00
	High school	147	3.76	.63		
4- Professional Responsibility	Secondary	154	4.16	.53	5.97	.00
	High school	147	3.77	.62		

df=303

The results of the Pearson product-moment correlation, which was undertaken in order to determine whether there is a meaningful relationship between teacher performance and the variables of seniority and age, are presented in Table 11.

Correlations between the seniority variable of teachers and teacher performance dimensions were examined. Significant relationships have been identified between teachers' years of seniority and teacher performance dimensions as following; learner and learning [r=-. 27], content knowledge [r =-. 21], instructional practice [r=-. 23], and professional responsibility [r= . 23]. These results show that the higher the seniority of the teachers, the lower their performance.

When the correlations between the age variable of teachers and the scores they got from teacher performance subscales are examined; there are negative significance relationships have been identified between age and the following dimensions; learner and learning [r=-. 26], content knowledge [r=-. 20], instructional practice [r=-. 22] and professional responsibility [r=-. 23]. This case shows that teachers' performance is lower as their age increases.

Table 11. Pearson product moment correlation matrix between teacher performance scores and seniority and age variables

Dimensions	Years of seniority	Age
1- Learner and Learning	-.27**	-.26**
2- Content Knowledge	-.21**	-.20**
3- Instructional Practice	-.23**	-.22**
4- Professional Responsibility	-.23**	-.23**

n =305, **p*<.05, *** p*<.01

The Pearson product-moment correlation analysis results, which were carried out to determine whether significant relationships between the teachers' TPACK-Practical scores and teacher performance scores are presented in Table 12.

Table 12. Pearson product moment correlation matrix between TPACK-Practical scores and teacher performance

Dimensions	1	2	3	4	5	6	7	8	9
TPACK-Practical									
1- Learners	1	.84**	.90**	.85**	.85**	.19**	.23**	.25**	.25**
2- Subject Content		1	.88**	.84**	.81**	.18**	.24**	.24**	.23**
3- Curriculum Design			1	.92**	.87**	.19**	.26**	.25**	.27**
4- Practical Teaching				1	.89**	.17**	.23**	.22**	.23**
5- Assessment					1	.18**	.25**	.23**	.24**
Teacher Performance									
6- Learner and Learning						1	.85**	.89**	.83**
7- Content Knowledge							1	.90**	.83**
8- Instructional Practice								1	.90**
9- Professional Responsibility									1

The results of the test of H_1, H_2 and H_3 hypotheses, which express the differentiation of teachers' TPACK-Practical and performance scores according to the variables of *gender, education level,* and *school type*, and their relationship with *seniority* and *age* variables are presented in Table 13.

Table 13. Summary of hypothesis testing results

Hypotheses	Dimensions	Results	Findings	Hypotheses	Dimensions	Results	Findings
H_{1a} *Gender*	1- Learners	Rejected	-	H_{2a} *Gender*	1- Learner and Learning	Rejected	-
	2- Subject Content	Rejected	-		2- Content Knowledge	Rejected	-

	3- Curriculum Design	Rejected	-		3- Instructional Practice	Rejected	-
	4- Practical Teaching	Rejected	-		4- Professional Responsibility	Rejected	-
	5- Assessment	Rejected	-				
H_{1b} *Education Level*	1- Learners	Accepted	Postgraduate>Bachelor	H_{2b} *Education Level*	1- Learner and Learning	Rejected	-
	2- Subject Content	Rejected	-		2- Content Knowledge	Rejected	-
	3- Curriculum Design	Accepted	Postgraduate>Bachelor		3- Instructional Practice	Rejected	-
	4- Practical Teaching	Accepted	Postgraduate>Bachelor		4- Professional Responsibility	Rejected	-
	5- Assessment	Accepted	Postgraduate>Bachelor				
H_{1c} *School Type*	1- Learners	Accepted	Secondary>High	H_{2c} *School Type*	1- Learner and Learning	Accepted	Secondary>High
	2- Subject Content	Accepted	Secondary>High		2- Content Knowledge	Accepted	Secondary>High
	3- Curriculum Design	Accepted	Secondary>High		3- Instructional Practice	Accepted	Secondary>High
	4- Practical Teaching	Accepted	Secondary>High		4- Professional Responsibility	Accepted	Secondary>High
	5- Assessment	Accepted	Secondary>High				
H_{1d} *Age*	1- Learners	Accepted	-.16**	H_{2d} *Age*	1- Learner and Learning	Accepted	-.27**
	2- Subject Content	Accepted	-.16**		2- Content Knowledge	Accepted	-.21**
	3- Curriculum Design	Accepted	-.14*		3- Instructional Practice	Accepted	-.23**
	4- Practical Teaching	Accepted	-.15**		4- Professional Responsibility	Accepted	-.23**
	5- Assessment	Accepted	-.11*				
H_{1e} *Years of Seniority*	1- Learners	Accepted	-.17**	H_{2e} *Years of Seniority*	1- Learner and Learning	Accepted	-.26**
	2- Subject Content	Accepted	-.15**		2- Content Knowledge	Accepted	-.20**
	3- Curriculum Design	Accepted	-.13*		3- Instructional Practice	Accepted	-.22**
	4- Practical Teaching	Accepted	-.14*		4- Professional Responsibility	Accepted	-.23**
	5- Assessment	Rejected	-				
H_3	TPACK <-> Performance	Accepted					

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The aim of this study is to determine the relationship between teachers' TPACK-Practical competencies and their performance. For this purpose, three hypotheses were tested.

When the scores of the teachers from TPACK-Practical dimension were examined, it was seen that the mean scores were close to each other. While the planning ICT-infused curriculum has the lowest average score, using ICT to understand subject content has the highest average. This situation can potentially be explained by the teachers' lack of flexibility in terms of curriculum design. As is known, teachers follow a relatively rigid curriculum and do not have flexibility in reshaping this curriculum. Simultaneously, teachers' high tendency to use existing educational content in teaching may explain why using ICT to understand subject content has a higher average. In previous research, it is stated that teachers prefer to use existing content rather than developing and sharing content (Güvendi, 2014; Tüysüz & Çümen, 2016).

The findings regarding whether TPACK-Practical scores differ significantly according to the gender variable show that the scores obtained from the learner, subject content, curriculum design, practical teaching, and assessment dimension do not differ significantly according to gender. These results show that male and female teachers' competencies in TPACK-Practical are at a similar level. This matches existing research findings that TPACK self-efficacy of teacher candidates in various branches in the literature did not differ according to gender (Demirezen & Keleş, 2020; Gömleksiz & Fidan, 2013; İşigüzel, 2014; Jang & Tsai, 2012; Murat & Erten, 2016; Şad, Açıkgül, & Delican, 2015). Considering the differentiation of technology self-efficacy by gender, it can be said that a similar distribution in TPACK is balanced by pre-service education. Indeed, Çoklar, Kılıçer, and Odabaşı (2007) state that pre-service training does not differ according to gender.

In the TPACK-Practical the scores from dimensions do not differ according to the educational level in the subject content, the scores obtained from the learner, curriculum design, practical teaching, and assessment dimensions differ significantly in favor of teachers who have postgraduate education. The differentiation of teachers' subject content competencies with postgraduate education suggests that postgraduate education may not contribute to teachers' content knowledge. The differences seen in other dimensions are that postgraduate education supports the TPACK development of teachers. While some studies in the literature are in line with these results (Jang & Tsai, 2012; Burmabıyık, 2014), some of them in different sample groups conflict with the results (Bal & Karademir, 2013; Bilici & Güler, 2016).

The findings regarding whether the scores of teachers from TPACK-Practical dimensions differ significantly according to the school type variable show that the scores obtained from dimensions of learner, subject content, curriculum design, practical teaching, and assessment differ significantly in favor of teachers working in secondary schools. As discussed in the previous results,

it is known that the average age of teachers working in high schools is higher than teachers working in secondary schools. In this context, it can be said that teachers working in secondary schools can integrate technology, pedagogy, and content knowledge more easily and feel more competent. The conflict of the results of the research with the literature (Burmabıyık, 2014) can be explained by the different distribution of young and old teachers working at the educational levels regionally.

Significant negative relationships were found between TPACK scores and seniority and age. The relationship between scores only in the assessment dimension and seniority is not significant. Since it is known that age and seniority increase proportionally in professional life, these two variables are considered together in the literature. In the literature that deal with TPACK with the same and different models, it is seen that the TPACK of teachers with lower age and seniority differ significantly (Ay, 2015; Koh, Chai, & Tsai, 2010; Lee & Tsai, 2010; Şimşek, Demir, Bağçeci, & Kinay, 2013). In addition, seniority has a negative effect on TPACK dimensions related to technology knowledge (Avcı, 2014; Bal & Karademir, 2013; Mutluoğlu & Erdoğan, 2012). However, studies in the literature concluding that age does not make a difference on TPACK contradict these results (Bilici & Güler, 2016; Burmabıyık, 2014; Jang, 2010; Sabo & Archambault, 2012). These contradictory results suggest that the content knowledge of teachers with higher seniority improves their TPACK (Yeh et al., 2013). Conversely, in field knowledge-based practices TPACK skills of teachers may increase according to their seniority, and seniority puts teachers at a disadvantage in technology-based practices (Lee & Tsai, 2010). Naturally, content knowledge and pedagogical knowledge are among the determinants of TPACK (Chai, Koh, & Tsai, 2010); However, it should not be forgotten that technology knowledge is the introductory stage of the development of TPACK (Terpstra, 2009). The result that teachers with low seniority in the literature consider themselves more adequate in technology knowledge coincides with the findings (Asan 2003; Bal & Karademir, 2013; Çağıltay, Çakıroğlu, Çağıltay & Çakıroğlu, 2001; Ekici, 2008; Ocak, 2005). The results show that pre-service teachers who have higher technology usage frequency have higher technological pedagogy knowledge, technological content knowledge, and TPACK (Özgen, Narlı, & Alkan, 2013). The study supports the results, considering that young people have a higher frequency of technology use.

It was concluded that the average performance scores of the teachers were close to each other. When the scores obtained from dimensions were examined, although the teachers got higher scores from the dimensions for theoretical knowledge, they got lower scores from the practical dimensions. This situation points out the imbalance between theory and practice, which is one of the biggest discussion points of teacher education in the literature (Yıldırım, 2011). Küçükahmet (2007) stated that practical activities in teacher education should be carried out more carefully and teacher education should be done according to certain standards. Among the problems teachers experience when they start their duties is their inability to apply theoretical knowledge, they have learned (Balkar, 2014). Criticisms include the lack of studies on how to use and apply the competencies put forward by the MoNE (Atik Kara, 2012; Özoğlu, 2010) and teacher competencies are not associated with teacher education. In the context of raising teacher competencies to a higher level, teacher education is the application and research-oriented proposed to be (Balkar, 2014; Conroy, Hulme, & Menter, 2013; Hollins, Luna, & Lopez, 2014; Küçükahmet, 2007; Yavuz, Özkaral & Yıldız, 2015; Yıldırım & Vural, 2014). In this way, it is stated that teachers can specialize in professional ethics and leadership issues, which are rarely emphasized, apart from being more successful in teaching practices (Hollins et al., 2014; Tirri & Ubani, 2013).

If we look at teachers' practical deficiencies from another perspective, Bourdieu (1979) suggests that with the Habitus Theory, an individual's feelings, thinking, and behaviors are shaped by past experiences. Accordingly, based on the studies that concluded that teachers' teaching behaviors were affected by their experiences when they were students (Marsh, 2006; Noyes, 2004), it can be suggested that teacher education has both direct and indirect effects on teachers' teaching performance. This inference is supported by studies that conclude that teachers use teacher-centered traditional approaches in the teaching process, even though they had received training for contemporary approaches such as constructivism (Shriki & Lavy, 2005; Windschitl, 2002).

The findings show that teachers' scores on the performance dimension of learner and learning, content knowledge, instructional practice, and professional responsibility do not significantly differ according to gender. According to these findings, it can be said that the performances of female teachers and male teachers did not differ. How teacher competencies, which express the knowledge, skills, and attitudes that teachers should have, and will be put into practice, are determined by performance indicators. Perhaps most importantly, self-efficacy belief affects the behavior of the individual (Bandura, 1997). In this direction, it has been revealed that self-efficacy belief causes differentiation in teachers' performance (Yılmaz, Ayyıldız & Baltacı, 2020) and teaching behaviors (Küçükyılmaz & Duban, 2006; Tschannen-Moran & Woolfolk-Hoy, 2001; Woolfolk & Hoy, 1990; Tschannen-Moran, Woolfolk-Hoy & Hoy, 1998). Although obtaining data on teachers' professional self-efficacy is relatively easy, as self-efficacy can be directly evaluated by the individual, evaluating the performance in which teachers turn their competencies into behavior requires a much more complex and lengthy process. Although teacher performance evaluation is not the subject of much research in the literature, teachers' professional competence has been deemed worthy of research. It is known that performance evaluations made by official institutions cannot be accessed. In this context, teacher performances will be discussed together with the most cited teacher self-efficacy in the literature. The Ohio Teacher Efficacy Scale, which is one of the frequently used teacher efficacy measurement tools, consists of three sub-dimensions: competence in instruction; competence in management; and competence in engagement (Tschannen-Moran & Woolfolk-Hoy, 2001) and was adapted to Turkish by various researchers (Baloğlu and Karadağ, 2008; Çapa, Çakıroğlu and Sarıkaya, 2005). In many studies conducted with these similar measurement tools, it was concluded that the self-efficacy of teachers and teacher candidates did not differ

according to gender (Azar, 2010; Çakır, Kan & Sünbül, 2006; Erişen & Çeliköz, 2003; Jennett, Haris & Mesibov, 2003; Kahyaoğlu & Yangın, 2007; Recepoğlu & İbret, 2020; Telef, 2011). Considering the relationship between teacher self-efficacy and performance, it is seen that these studies support the research results. However, there are studies in the literature showing that professional self-efficacy differs in favor of female teachers and teacher candidates (Çapri & Çelikkaleli, 2008; Şeker, Deniz & Görgen, 2005).

The scores of teachers' learner and learning, content knowledge, instructional practice, and professional responsibility sub-scales do not differ according to their educational status. This result overlaps with the research results in the literature showing that teachers' professional self-efficacy do not differ according to their education level (Çimen, 2007; Gençtürk, 2008; Özgün, 2007; Telef, 2011). It can be said that postgraduate does not contribute to teachers' self-efficacy and, consequently, it has no effect on transforming the competencies expected of them into performance. This situation may be related to teachers' motivation to do postgraduate because research shows that the factors that affect teachers' graduate education are the desire to pursue a career and self-development (Demirbolat- Ottekin, 2005), to take advantage of student rights, to obtain an academic career, and to gain an advantage in being recruited (Savaş & Topak, 2005).

Teachers' performance differs significantly in favor of teachers working in secondary schools. There are no comparative results in the literature regarding teachers' performances or self-efficacy working at different educational levels. However, within the research scope, it can be predicted that this result shows a higher level of performance than teachers working in high schools due to the low age and seniority of teachers working in secondary schools.

It was observed that the scores of teachers' performance were negatively related to the teachers' age and seniority. This situation indicates that the performance of teachers decreases with the increase of age and seniority. When examined in the literature, there are studies that reached various results self-efficacy perceptions increase with increasing age and seniority (Campbell, 1996; Daughetry, 2005; Gençtürk, 2008; Say, 2005; Tschannen-Moran & Woolfolk-Hoy, 2002) or the perception of self-efficacy does not differ according to age and seniority (Celep, 2002; Chacon, 2005; Çimen, 2007). In this study, results that contradict both results were obtained. Based on the relationship between incompetence beliefs and professional burnout (Tschannen-Moran & Gareis, 2004), it is possible to say that teachers' self-efficacy decreases through professional burnout as their seniority increases.

The TPACK dimensions were found to be associated with teacher performance dimensions. In this case, it can be said that teachers' performance with high TPACK competencies is also high. Since it is known that this relationship can work both ways, it can be contended that teachers with high TPACK can perform better by using this knowledge, or they can become more competent in TPACK with the improvement of teachers' performance. Following these results, it is suggested that teacher performance indicators contain TPACK in terms of effective technology integration (InTASC, 2013). In addition, teachers' professional competencies and field knowledge can support the development of TPACK (Yeh et al., 2013). As a result, thanks to technology integration, teacher performance can be improved, and student achievement, which is seen as the most concrete output of teacher performance, can be improved. In this respect, it can be suggested that TPACK is considered as a whole, and it can be developed theoretically and practically. This study suggests that technology, pedagogy, and content knowledge should not be included separately in teacher education, but presented in an integrated way. In future studies in the context of the development of TPACK in pre-service and in-service training, studies on teachers' beliefs and attitudes could be conducted. Whatever form future studies take, we suggest that at all stages of the teaching process it is important to evaluate teachers with measurable, observable, and concrete indicators to comprehend the importance of performance improvement and the transparency of the process.

Ethics Committee Approval Information

It was decided that this study complied with the ethical rules of Education and Humanities due to the meeting dated 14.03.2016 by Eskişehir Osmangazi University Institute of Educational Sciences, Education and Humanities Ethics Committee.

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