

Analysing the Technological Pedagogical Content Knowledge Levels of Physical Education and Sports Teachers

Beden Eğitimi ve Spor Öğretmenlerinin Teknolojik Pedagojik Alan Bilgisi Düzeylerinin İncelenmesi

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Abstract: The technological developments have led to the emergence of new technology-supported teaching techniques in the field of education and training as in every field. As a result, expectations from teachers, who are the most important actors in education and training processes, have also differentiated. In the process of effective teaching, teachers' having technological knowledge as well as field and pedagogical knowledge will make the learning process of students more efficient. In this study, it was aimed to determine the level of Technological Pedagogical Content Knowledge (TPCK) of physical education and sports teachers actively working within the Ministry of National Education, which includes the use of technological and pedagogical knowledge together. In determining the TPCK levels of teachers, the effect of gender, educational status, place of employment, professional seniority, computer ownership status and computer usage time variables were investigated. The study group of the research was formed by 506 physical education and sports teachers who worked in the 2023-2024 Academic year. The data were obtained using the personal information form and the TPCK scale. According to the results of the statistical analysis carried out with the descriptive screening model from the quantitative research methods, it was monitored that all sub-dimensional averages of the scale were high. PK and PCK have a higher score average than other sub-dimensions. It was obvious that male teachers were more competent than female teachers in TK size, teachers who received graduate education had a higher TPCK level than teacher candidates who received undergraduate education, and that teachers who completed their technology education were higher than the averages of other groups in all sub-sections compared to their computer usage time at TPCK levels. It has been understood that teachers who work between 21-25 years have a lower level of TPCK than teachers with lower professional seniority. It was observed that as the professional seniority and age of the teachers increased, their content knowledge was higher, and male teachers had higher TPCK levels than female teachers.

Keywords: Physical education, TPCK, technology, sport.

Özet: Yaşanan teknolojik gelişmeler her alanda olduğu gibi eğitim öğretim alanında da teknoloji destekli yeni öğretim tekniklerinin ortaya çıkmasına neden olmuştur. Bunun sonucunda eğitim ve öğretim süreçlerin en önemli aktörü olan öğretmenlerden beklentiler de farklılaşmıştır. Etkili öğretim sürecinde öğretmenlerin alan ve pedagojik bilgilerinin yanı sıra teknolojik bilgiye de sahip olmaları öğrencilerin öğrenme sürecini daha verimli hale getirecektir. Bu çalışmada Milli Eğitim Bakanlığı (MEB) bünyesinde aktif olarak görev yapan Beden eğitimi ve spor öğretmenlerinin teknolojik ve pedagojik bilgilerinin birlikte kullanımı içerikli Teknolojik Pedagojik Alan Bilgisi (TPAB) düzeylerinin tespit edilmesi amaçlanmıştır. Öğretmenlerinin TPAB düzeylerinin belirlenmesinde, cinsiyet, eğitim durumu, görev yapılan yer, mesleki kıdem, bilgisayar sahiplik durumu ve bilgisayar kullanma süresi değişkenlerinin etkisi araştırılmıştır. Araştırmanın çalışma grubunu 2023-2024 eğitim-öğretim yılında MEB bünyesinde aktif görev yapan 506 beden eğitimi ve spor öğretmeni oluşturmuştur. Veriler kişisel bilgi formu ve TPAB ölçeği kullanılarak elde edilmiştir. Nicel araştırma yöntemlerinden betimsel tarama modeli ile gerçekleştirilen istatistiksel analiz sonuçlarına göre ölçeğin tüm alt boyut ortalamalarının yüksek olduğu görülmüştür. PB ve PAB, diğer alt boyutlara göre daha yüksek puan ortalamasına sahiptir. Cinsiyet değişkenine göre erkek öğretmenlerin TB alt boyutunda kadın öğretmenlere göre daha yeterli oldukları, lisansüstü eğitim alan öğretmenlerin lisans eğitimi alan öğretmen adaylarından daha yüksek TPAB düzeyine sahip oldukları, teknoloji eğitimi alan öğretmenlerin TPAB düzeylerinde bilgisayar kullanma süresine (4 saat ve üzeri) göre bütün alt boyutlarda diğer grupların ortalamalarından yüksek bulunduğu görülmüştür. Mesleki kıdem yılına göre 21-25 yıl arası görev yapan öğretmenlerin daha düşük kıdeme sahip öğretmenlerden daha düşük düzeyde TPAB sahip oldukları belirlenmiştir. Öğretmenlerin mesleki kıdem ve yaşları arttıkça alan bilgilerinin yüksek olduğu, ayrıca erkek öğretmenlerin TPAB düzeylerinin kadın öğretmenlerden daha yüksek olduğu görülmüştür.

Anahtar Kelimeler: Beden eğitimi, TPAB, teknoloji, spor.

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INTRODUCTION

Technology affects every field it interacts with. The use of technology in the field of education centralizes students and increases their interest in the lessons (Dağdalan et al., 2021). The competencies that pre-service teachers should know and perform are denominated as Pedagogical Content Knowledge (PCK) (Baxter & Lederman, 1999). The notion of PCK is a concept that emerged from the perspective that having a subject hung up and salted knowing will fall short in order to teach that subject very well (Bilgin et al., 2012). While the teacher is under the performance of teaching act; s/he should take the issues into consideration affecting learning such as the conjuncture of the region where the study is done, the characteristics of the teaching environment, the age, the situation, the life and the capacity of the target audience (Baştürk & Dönmez, 2011).

Today's technological development has caused to use technology unavoidable in the field of education. In almost every educational environment, there are technological devices such as computers, Cyclopes, smart boards. Many studies prove that the use of technology in education leads student to success (Bozkurt & Kaya, 2008; Murathan & Özdemir, 2017; Türkan et al., 2010). Undoubtedly, education system should be benefited from pedagogical

knowledge while especially using technology. This idea was first put forward by. TPCK model aims to make educational processes more efficient by enabling teachers to use technological tools effectively for pedagogical purposes (Koehler & Mishra, 2006). The TPCK model identifies the elements necessary for the effective use of technology in education; Technology Knowledge (TK): Understanding different technologies (computer, internet, various software, etc.) and their working principles, Content Knowledge (CK): Deep and up-to-date knowledge of the subject or area taught, Pedagogical Knowledge (PK): To have the ability to know and apply teaching methods and techniques. The combination of these elements enables teachers to maximize learning by using technology in a pedagogically effective way (Koehler & Mishra, 2009). Researchers have introduced the concept 'Technological Pedagogical Content Knowledge (TPCK)'. Accordingly, TPCK is divided into seven main constituents; Technology Knowledge (TK), Pedagogy Knowledge (PK), Content Knowledge (CK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK) and Technological Pedagogical Content Knowledge (TPCK) (Mishra & Koehler, 2006). Improving teachers' professional and technological

competence will have positive consequences for students. When the studies on TPCK are examined, it is noteworthy that the number of studies on physical education and sports teachers is quite low compared to other fields. In addition, it has been observed that there are few studies in the national and international literature that examine teachers' TPCK competence perceptions in the context of 21st century skills. For this reason, it was assumed that conducting a comprehensive study to examine the TPCK levels of physical education and sports teachers would be beneficial for teachers and prospective teachers. In addition, since the technologies used in education are changing day by day, it is thought that it will contribute to the literature and will help similar studies to be conducted in the future.

The objective of this study is to manifest the TPCK competencies of physical education and sports teachers who are actively working in schools within the Ministry of National Education in Turkey. When the literature was searched, several studies drew attention on TPCK competencies of physical education and sports teachers (Akkaya, 2021; Çar et al., 2022; Çar & Aydos, 2020, 2022; Karatut & Şentürk, 2022). When the results of these studies are taken into consideration, it becomes clear that measuring the level of technological pedagogical content knowledge of physical education and sports teachers is an issue that should be examined in terms of increasing efficiency in education. Also the universe and the sample are only physical education and sports teachers in a single province in these researches. In our study, the TPCK levels of 506 physical education and sports teachers working throughout Turkey have been taken into consideration that's why it makes the study valuable. There is a need for well-rounded teachers in order to achieve a high level of efficiency in education. In this direction, teachers who have TPCK competence are expected to realize an effective education.

METHODS

Research Model: The research is a descriptive study in the screening model. In this research, the descriptive screening model was applied so as to analyze and study the TPCK levels of physical education and sports teachers in terms of some variables. The descriptive screening model is quite appropriate for research that aims at describing a past or existing situation as it exists (Karasar, 1999). Stratified sampling method was used to determine the participants. In the stratified sampling method, it is expressed as representing the characteristics of the universe at the same rate in the sample (Balcı, 2005).

Purpose of the research: The objective of this study is to analyze the Technological Pedagogical Content Knowledge (TPCK) levels of physical education and sports teachers actively working within the Ministry of National Education.

Research Group: The population of the study consists of a total of 40223 physical education and sports teachers working under the Ministry of National Education in the 2023-2024 academic year (MEB, 2024). According to Büyüköztürk's (2023) sampling table, it was determined that a minimum of 381 participants should be included in the study with $\pm 5\%$ margin of error and 95% confidence interval. The sample of this study consisted of 506 (332

male and 174 female) physical education and sports teachers selected from the population by convenience sampling method.

Data Collection: A personal form containing demographic information of the participants was used. As a data collection tool, the TPCK scale developed by Şahin (2011) was used to determine the TPCK levels of physical education and sports teachers. The scale was applied to 348 pre-service teachers within the scope of validity and reliability study. The scale contains 47 items and 7 sub-dimensions in the likert type of 5. The first sub-dimension of the scale is Technological Knowledge (TK), the second sub-dimension is Pedagogical Knowledge (PK), the third sub-dimension is Content Knowledge (CK), the fourth sub-dimension is Technological Pedagogical Knowledge (TPK), the fifth sub-dimension is Technological Content Knowledge (TCK), the sixth sub-dimension is Pedagogical Content Knowledge (PCK), and the seventh sub-dimension is the Technological Pedagogical Content Knowledge (TPCK). The reliability coefficient (Cronbach Alpha) values of the sub-divisions on the scale were found to be .92 TK, .89 PK, .91 CK, .88 TPK, .87 TCK, 0.86 PCK, .90 TPCK. In this study, the cronbach alpha values of the sub-dimensions were 0.955 TK, 0.877 PK, 0.841 CK, 0.863 TPK, 0.877 TCK, 0.895 PCK, 0.867 TPCK and 0.971 for the whole scale. The highest score that can be gathered from the scale is 235 and the lowest score is 47. The research data was acquired from teachers working actively in different provinces of Turkey's seven geographical regions through the scale.

Analysis of Data: SPSS 22.0 package program was wielded in data analysis. The arithmetic average, frequency, standard deviation and percentage of physical education and sports teachers were analyzed in order to determine the gender, age, professional seniority periods, workplace, computer ownership status, technology education status, daily computer usage.

For the normality test, kurtosis and skewness values were analyzed. In this context, the kurtosis value was determined as -0.286 and the skewness value as -0.372 for the TK sub-dimension. The kurtosis value for the PCK subscale is 0.119, the skewness value is -0.556, the kurtosis value for the CK subscale is 0.164, the skewness value is -0.445, the kurtosis value for the TPK subscale is -0.421, the skewness value is -0.292, kurtosis value for TCK sub-dimension was -0.102, skewness value was -0.413, kurtosis value for PCK sub-dimension was 0.120, skewness value was -0.531 and kurtosis value for TPCK sub-dimension was -0.010, skewness value was -0.431. These values between +1.5 and -1.5 indicate that the data are normally distributed (Tabachnick, Fidell & Ulman). According to these results, it was decided to use parametric tests in the study.

While the Independent t test was utilized to decide whether TPCK levels differed according to gender and education variables, One Way Anova test to determine whether TPCK levels regarding their workplace, tenure, and those who received technology training and computer usage time variables. Additionally, HSD Tukey Post Hoc multiple comparison test was handled to conclude whether there was a difference between the groups. The significance level in the interpretation of the data in the study was taken as $p < 0.05$.

RESULTS

Table 1 depicts that the physical education and sports teachers who participated in the study; 65.61% are men and 34.39% are women. 83.99% have undergraduate degrees, 16.01% have graduate degrees. 3.16% work in the village, 24.90% in the town-district, 50.79% in the city center and 21.15% in the metropolitan city. 39.13% have 0-5 years of professional seniority, 26.88% have 6-10 years of

professional seniority, 16.60% have 11-15 years of experience, 9.68% have 16-20 years of experience, and 7.71% have 21-25 years of professional seniority. 72.53% stated that they received technology-related training, and 27.47% stated that they did not. While 85.38% have a computer, 14.62% do not. 36.76% use computers less than 1 hour per day, 48.42% use computers between 1-3 hours per day, and 14.82% use computers for 4 hours or more per day.

Table 1. Demographic characteristics of physical education and sports teachers

Variables	Sub-dimensions	Frequency	Pct. (%)
Gender	Male	332	65.61
	Female	174	34.39
Educational Background	Undergraduate	425	83.99
	Graduate	81	16.01
Workplace	Village	16	3.16
	Town-District	126	24.90
	City	257	50.79
	Metropolitan	107	21.15
Professional Seniority (Tenure)	0-5 year(s)	198	39.13
	6-10 years	136	26.88
	11-15 years	84	16.60
	16-20 years	49	9.68
	21-25 years	39	7.71
Has Technology Training Been Received?	Yes	367	72.53
	No	139	27.47
Owning a Computer	Yes	432	85.38
	No	74	14.62
Computer Using Time	Less than 1 hour per day	186	36.76
	1 to 3 hours per day	245	48.42
	4 hours or more per day	75	14.82
Total		506	100.00

When the descriptive statistics of the scores of physical education and sports teachers on the sub-dimensions of the TPCK scale were examined, it is seen that the teachers were between medium and high level in all sub-dimensions. In the TK (Technological Knowledge) sub-dimension, the average score of the teachers was 52.162 ± 12.568 and this value was evaluated as "high" level. In the other sub-dimensions, the mean scores were as follows; PCK (Pedagogical Knowledge) 23.352 ± 4.162 , CK (Content Knowledge)

23.518 ± 3.791 , TPK (Technological Pedagogical Knowledge) 15.336 ± 2.924 , TCK (Technological Content Knowledge) 15.194 ± 2.971 , PCK (Pedagogical Content Knowledge) 27.850 ± 4.589 and TPCK total score 19.405 ± 3.412 . These findings showed that teachers were generally competent in planning and implementing their lessons by integrating their technological, pedagogical and content knowledge and had particularly strong levels of technological knowledge (Table 2).

Table 2. Physical education and sports teachers' scores from the TPCK scale sub-dimensions

	N	Min.	Max.	Average	SD	Level
TK	506	15	75	52.162	12.568	High
PK		8	30	23.352	4.162	
CK		10	30	23.518	3.791	
TPK		6	20	15.336	2.924	
TCK		5	20	15.194	2.971	
PCK		11	35	27.850	4.589	
TPCK		8	25	19.405	3.412	

According to the results of the independent sample t-test conducted to determine whether physical education and sports teachers' TPCK levels differed according to gender variable, a statistically significant difference was found between genders only in the TK (Technological Knowledge) sub-dimension ($p=0.014$). In this sub-dimension, the score of male teachers ($\bar{X}=53.151 \pm 12.060$) was significantly higher than the score of female teachers ($\bar{X}=50.276 \pm 13.316$). No significant difference was observed in other sub-dimensions and TPCK total score ($p>0.05$). In PC sub-dimension, men 23.428 ± 4.155 , women

23.207 ± 4.185 ; in CK sub-dimension, men 23.536 ± 3.927 , women 23.483 ± 3.528 ; in TPK sub-dimension, men 15.337 ± 2.897 , women 15.333 ± 2.984 ; in TCK sub-dimension, men 15.223 ± 2.814 , women 15.138 ± 3.257 ; men 27.822 ± 4.472 , women 27.902 ± 4.818 in PCK sub-dimension; and men 19.512 ± 3.336 , women 19.201 ± 3.553 in TPCK total score. These findings showed that there was a significant difference in favor of male teachers only in the technological knowledge level, while there was no gender-related difference in all other dimensions (Table 3).

Table 3. T-test table of physical education and sports teachers' TPCK levels according to gender variable

		N	X	SD	t	df	p
TK	M	332	53.151	12.060	2.456	504.000	0.014*
	F	174	50.276	13.316			
PK	M	332	23.428	4.155	0.566	504.000	0.571
	F	174	23.207	4.185			
CK	M	332	23.536	3.927	0.150	504.000	0.881
	F	174	23.483	3.528			
TPK	M	332	15.337	2.897	0.015	504.000	0.988
	F	174	15.333	2.984			
TCK	M	332	15.223	2.814	0.305	504.000	0.760
	F	174	15.138	3.257			
PCK	M	332	27.822	4.472	-0.186	504.000	0.852
	F	174	27.902	4.818			
TPCK	M	332	19.512	3.336	0.974	504.000	0.331
	F	174	19.201	3.553			

* p<0.05 - M: Male - F: Female

When the results of the independent samples t test applied to determine whether the Technological Pedagogical Content Knowledge levels differed according to the educational status variable were examined, it was determined that there was a significant difference in all sub-dimensions ($p<0.05$). Accordingly, it was determined that the mean scores of TK Undergraduate 50.915 ± 12.437 , Graduate 58.704 ± 11.211 ,

PC Undergraduate 23.073 ± 4.198 , Graduate 24.815 ± 3.661 , CK Undergraduate 23.304 ± 3.864 , Graduate 24.642 ± 3.175 , TPK Undergraduate 15.129 ± 2.942 , Graduate 16.420 ± 2.588 , TCK Undergraduate 14.967 ± 2.924 , Graduate 16.383 ± 2.948 , PCK Undergraduate 27.640 ± 4.651 , Graduate 28.951 ± 4.102 , TPCK Undergraduate 19.209 ± 3.402 and Graduate 20.432 ± 3.294 (Table 4).

Table 4. T-test table for the TPCK levels of physical education and sports teachers according to the educational background variable

		N	X	SD	t	df	p
TK	Undergraduate	425	50.915	12.437	-5.244	504.000	0.000**
	Graduate	81	58.704	11.211			
PK	Undergraduate	425	23.073	4.198	-3.490	504.000	0.001**
	Graduate	81	24.815	3.661			
CK	Undergraduate	425	23.304	3.864	-2.934	504.000	0.004**
	Graduate	81	24.642	3.175			
TPK	Undergraduate	425	15.129	2.942	-3.684	504.000	0.000**
	Graduate	81	16.420	2.588			
TCK	Undergraduate	425	14.967	2.924	-3.988	504.000	0.000**
	Graduate	81	16.383	2.948			
PCK	Undergraduate	425	27.640	4.651	-2.366	504.000	0.018*
	Graduate	81	28.951	4.102			
TPCK	Undergraduate	425	19.209	3.402	-2.979	504.000	0.003**
	Graduate	81	20.432	3.294			

* p<0.05, **p<0.01

According to the results of one-way analysis of variance (ANOVA) applied to determine whether the levels of Technological Pedagogical Content Knowledge differed according to the institution of employment, no statistically significant difference was found in all sub-dimensions ($p>0.05$). Accordingly, the mean scores for the TK sub-dimension were 54.125 ± 10.066 in the village, 51.159 ± 13.505 in the district, 52.669 ± 12.391 in the province and 51.832 ± 12.237 in the metropolitan area. In the PC sub-dimension, the mean scores were 21.688 ± 3.646 in the village, 23.524 ± 4.147 in the district, 23.307 ± 4.099 in the province and 23.505 ± 4.396 in the metropolitan area. The averages for the CK sub-dimension were 22.563 ± 2.279 in the village, 23.508 ± 3.666 in the district, 23.541 ± 3.835 in the

province and 23.617 ± 4.027 in the metropolitan area. In the TPK sub-dimension, the mean scores were 14.938 ± 1.731 in the village, 15.246 ± 2.922 in the district, 15.389 ± 2.880 in the province and 15.374 ± 3.191 in the metropolitan area. For the TCK sub-dimension, the averages were 14.250 ± 1.949 in the village, 15.056 ± 2.948 in the district, 15.307 ± 2.957 in the province and 15.224 ± 3.154 in the metropolitan area. In the PCK sub-dimension, the values were 26.125 ± 3.500 in the village, 27.873 ± 4.743 in the district, 27.817 ± 4.555 in the province and 28.159 ± 4.628 in the metropolitan area. In the total TPCK, the scores of the teachers working in the village were 18.063 ± 1.806 , in the district 19.079 ± 3.391 , in the province 19.486 ± 3.535 and in the metropolitan area 19.794 ± 3.270 (Table 5).

Table 5. One way anova test for the TPCK levels of physical education and sports teachers according to workplace variable

	Workplace	N	X	SD	Mean Square	f	p
TK	Village	16	54.125	10.066	88.759	0.560	0.641
	Town-District	126	51.159	13.505			
	City	257	52.669	12.391			
	Metropolitan	107	51.832	12.237			
PK	Village	16	21.688	3.646	17.018	0.982	0.401
	Town-District	126	23.524	4.147			
	City	257	23.307	4.099			
	Metropolitan	107	23.505	4.396			
CK	Village	16	22.563	2.279	5.267	0.365	0.778
	Town-District	126	23.508	3.666			
	City	257	23.541	3.835			
	Metropolitan	107	23.617	4.027			
TPK	Village	16	14.938	1.731	1.480	0.172	0.915
	Town-District	126	15.246	2.922			
	City	257	15.389	2.880			
	Metropolitan	107	15.374	3.191			
TCK	Village	16	14.250	1.949	6.692	0.757	0.519
	Town-District	126	15.056	2.948			
	City	257	15.307	2.957			
	Metropolitan	107	15.224	3.154			
PCK	Village	16	26.125	3.500	19.388	0.920	0.431
	Town-District	126	27.873	4.743			
	City	257	27.817	4.555			
	Metropolitan	107	28.159	4.628			
TPCK	Village	16	18.063	1.806	20.041	1.729	0.160
	Town-District	126	19.079	3.391			
	City	257	19.486	3.535			
	Metropolitan	107	19.794	3.270			

Professional seniority of physical education and sports teachers: whether TPCK levels differ significantly according to the variable one-way analysis of variance (ANOVA) to determine whether there was a difference (Table 6). According to the results, statistically significant differences were observed in all sub-dimensions ($p < 0.01$). Between which groups were the differences The study conducted multiple comparisons (post-hoc) to determine if there was a significant difference between teachers with 21-25 years of seniority and other seniority groups. We found significant differences. Accordingly, in the TK sub-dimension, mean scores were 0–5 years of seniority (54.157 ± 11.220), 6–10 years (54.154 ± 11.349), 11–15 years (50.893 ± 13.442), 49.653 ± 13.556 in 16–20 years, and 40.974 ± 13.674 in 21–25 years. The score of teachers aged 21–25 was significantly lower ($p < 0.05$). In the PC sub-dimension, average scores decrease with increasing seniority; in the 0–5 years (23.177 ± 4.073) and 6–10 years (24.088 ± 3.713) groups, 21–25 years of seniority (20.077 ± 5.157) were significantly

higher ($p < 0.05$). The The CK sub-dimension also shows a similar trend, with the highest mean being 11–15 years of seniority (24.190 ± 3.612) and the lowest in the 21–25-year group (21.538 ± 4.833 , $p < 0.05$). In the TPK sub-dimension, 0–5 years (15.540 ± 2.723), 6–10 years (15.654 ± 2.845), and 21–25 years groups (13.564 ± 3.299) were higher than those with 0–5 years ($p < 0.05$). In the TCK sub-dimension, the 0–5 years (15.434 ± 2.674), 6–10 years (15.566 ± 2.941), and 21–25 years (13.282 ± 3.656) groups were significantly higher than the mean ($p < 0.05$). In the PCK sub-dimension, the mean of the 11-15 years seniority group (28.476 ± 4.082) was the highest, and the 21–25 years group (25.513 ± 6.270) was found to be the lowest ($p < 0.05$). When the TPCK total scores were analyzed, the average of the 11–15-year-old seniority group (20.000 ± 3.495) was the highest, and the average of the 21–25-year-old group (17.359 ± 3.970) was the highest. showed the lowest value ($p < 0.05$).

Table 6. One way anova test table for the TPCK levels of physical education and sports teachers according to professional seniority variable

	Professional Seniority (years)	N	X	SD	MeanSquare	f	p	Group Difference
TK	0-5	198	54.157	11.220	1663.174	11.397	0.000**	1-5
	6-10	136	54.154	11.349				2-5
	11-15	84	50.893	13.442				3-5
	16-20	49	49.653	13.556				4-5
	21-25	39	40.974	13.674				
PK	0-5	198	23.177	4.073	141.223	8.645	0.000**	1-5
	6-10	136	24.088	3.713				2-5
	11-15	84	24.226	3.608				3-5
	16-20	49	23.122	4.480				4-5
	21-25	39	20.077	5.157				
CK	0-5	198	23.495	3.638	56.631	4.035	0.003**	1-5
	6-10	136	23.904	3.686				2-5
	11-15	84	24.190	3.612				3-5
	16-20	49	22.959	3.594				
	21-25	39	21.538	4.833				
TPK	0-5	198	15.540	2.723	37.908	4.557	0.001**	1-5
	6-10	136	15.654	2.845				2-5
	11-15	84	15.381	2.961				3-5
	16-20	49	14.959	3.136				
	21-25	39	13.564	3.299				
TCK	0-5	198	15.434	2.674	46.538	5.459	0.000**	1-5
	6-10	136	15.566	2.941				2-5
	11-15	84	15.214	3.034				3-5
	16-20	49	14.673	2.968				
	21-25	39	13.282	3.656				
PCK	0-5	198	27.657	4.515	71.305	3.452	0.009**	1-5
	6-10	136	28.265	4.254				2-5
	11-15	84	28.476	4.082				3-5
	16-20	49	28.265	4.595				4-5
	21-25	39	25.513	6.270				
TPCK	0-5	198	19.601	3.346	50.401	4.448	0.002**	1-5
	6-10	136	19.324	3.229				2-5
	11-15	84	20.000	3.495				3-5
	16-20	49	19.449	3.062				4-5
	21-25	39	17.359	3.970				

* p<0.05, **p<0.01

According to the results of one-way analysis of variance (ANOVA) conducted to determine whether the TPCK levels of physical education and sports teachers differed significantly according to the duration of computer use as individuals who received technology education, statistically significant differences were found in all sub-dimensions and total TPCK score ($p<0.05$). The mean scores were 50.084 ± 12.569 for <1 hour, 53.704 ± 11.868 for 1-3 hours and 61.719 ± 9.021 for 4 hours or more in the TK sub-dimension; 23.183 ± 4.624 , 23.899 ± 3.492 and 25.018 ± 3.598 in the PK sub-dimension; 22.519 ± 3.987 , 24.475 ± 3.484 and 24.895 ± 3.731 ; 14.786 ± 3.234 , 15.911 ± 2.638 and

16.754 ± 2.473 in the TPK sub-dimension; 14.733 ± 3.417 , 15.804 ± 2.538 and 16.895 ± 2.462 in the TCK sub-dimension; and 27.328 ± 5.137 , 28.665 ± 4.219 and 29.439 ± 4.101 in the PCK sub-dimension. Similarly, TPCK total scores were 19.099 ± 3.654 for <1 hour, 20.307 ± 3.080 for 1-3 hours and 20.439 ± 2.988 for 4 hours or more. These findings reveal that as teachers' daily computer usage time increases, their TPCK levels and their competencies related to sub-dimensions increase significantly. Especially teachers who use computers for 4 hours or more have the highest scores in terms of technological pedagogical content knowledge (Table 7).

Table 7. One way anova test table for the TPCK levels of physical education and sports teachers according to the variable of duration of computer use of those receiving technology education

	Computer Using (hours)	N	X	SD	Mean Square	f	p	Group Difference
TK	< 1	131	50.084	12.569	2688.924	19.511	0.000*	1-2
	1-3	179	53.704	11.868				1-3
	4 or >	57	61.719	9.021				2-3
PK	< 1	131	23.183	4.624	67.996	4.362	0.013	1-3
	1-3	179	23.899	3.492				
	4 or >	57	25.018	3.598				
CK	< 1	131	22.519	3.987	182,063	13,236	0,000**	1-2
	1-3	179	24.475	3.484				2-3
	4 or >	57	24,895	3,731				
TPK	< 1	131	14.786	3.234	89.688	11.100	0.000**	1-2
	1-3	179	15.911	2.638				1-3
	4 or >	57	16.754	2.473				
TCK	< 1	131	14.733	3.417	100.759	12.213	0.000**	1-2
	1-3	179	15.804	2.538				1-3
	4 or >	57	16.895	2.462				2-3
PCK	< 1	131	27.328	5.137	110.699	5.344	0.005*	1-2
	1-3	179	28.665	4.219				1-3
	4 or >	57	29.439	4.101				
TPCK	< 1	131	19.099	3.654	65.110	6.040	0.003*	1-2
	1-3	179	20.307	3.080				1-3
	4 or >	57	20.439	2.988				

* p>0.05 - **p>0.01

DISCUSSION

In this section, the data obtained from the research are explained and discussed in relation to the studies in the literature. By gender it was clear that the TPK and TCK sub-dimensions were lower than the other sub-dimensions (Table 2). It can be inferred that in these dimensions, where technology is included with pedagogical knowledge and content knowledge, teachers express that they are partially inadequate compared to other sub-dimensions. Archambault & Crippen (2009) found out that teachers had high levels of knowledge in the field of pedagogy and related fields, but when technology came into play, they were less confident in their knowledge. In general, the score averages acquired from the scale were found to be high. For this reason, it can be asserted that the technological pedagogical content knowledge levels of physical education and sports teachers are buoyant (Table 2). In the research, in which the technological pedagogical content knowledge of those who teach Turkish as a foreign language was analyzed, it determined that the highest average score was content knowledge and the lowest average was in the technology dimension (Türker, 2020). In the study on Physical education teachers, the sub-dimension of technology knowledge was lower than other sub-dimensions (Çar & Aydos, 2020).

Accordingly, it is clear that the technology knowledge of male teachers is higher than female teachers (Table 3). Demir et al., (2020), Çar & Aydos (2020), Arslantas & Cubukcu (2022), Başbüyük & Akgün (2016), Karatut and Şentürk (2022) reported that male teachers are higher than CK, TK, PK, PCK than female teachers in their studies. In some studies with different branch and primary education teacher groups, the level of pre-service teachers transferring technological pedagogical content knowledge did not demonstrate a significant difference regarding gender (Akgün, 2013; Çam & Saltan, 2019; Çifçi & Dikmenli, 2018; Kaya et al., 2011; Mutluoğlu, 2012; Sancar Tokmak et al., 2013). In some studies, it was ascertained that there was a significant difference in terms of gender (Gömlüksiz & Fidan, 2011; Kazu & Erten, 2014; Koh et al., 2010). In the Gündoğmuş's (2013) study, pre-service teachers embodied that the TK, TPK and PCK levels were 'benevolent'. He also discovered that the TK, PK, TPK and TCK levels of male pre-service teachers were higher than women. All over, Avcı (2014) determined that the levels of TK, CK, TPK, TCK and TPCK, one of the TPCK components of Science teachers, indicated a significant difference in gender in favor of male teachers. According to the study, PK and PCK levels from TPCK components manifested no significant differences by gender.

Furthermore, it is comprehended that teachers who receive graduate education have a better level of TPCK than teachers who receive undergraduate education (Table 4). Unlike our study, Bilici & Güler (2016), Karataş & Akgün (2018), Çar et al. (2022) and Bıçak (2023) deduced that they did not detect any significant differences based on educational background in their studies. Bağdiken & Akgündüz (2018), Karatut & Şentürk (2022) reached parallel results with our study.

Which were performed to determine whether there were differences according to the workplace of the participants, there were no statistically significant differences in Technological Pedagogical Content Knowledge Levels (Table, 5). Çam & Saltan (2019) determined that the TPCK levels of primary education teachers vary according to the workplace. Accordingly, the TPCK levels of the teachers working in the village/town were found to be higher than the teachers working in the district center. Avcı (2014) proved that the TK level from the TPCK components of the Science teachers demonstrate a significant difference in regards to workplace (center, district, and village). This difference is in favor of the teachers working in the village. It was remarked that there was no significant difference in the scale and in the sub-dimensions of PK, CK, TPK, TCK, PCK and TPCK. In our research, no significant difference was found according to the workplace variable. Nonetheless, in the interviews we had with physical education and sports teachers during the data collection process, they unfolded that the IT infrastructure of some schools is unsatisfactory, there are hardware and software deficiencies, and these schools have limited opportunities. Physical education and sports teachers mentioned that they do not have technological devices to use and that they are disadvantaged in this sense. Considering the conditions of Turkey, it can be claimed that the majority of teachers working in rural areas consist of new graduates, and that teachers working in provincial centers and well-qualified schools consist of teachers with higher age and professional seniority. It is an expected consequence that teachers with high age and professional seniority have high knowledge of the technological pedagogical content compared to young teachers. Çar et al. (2022) reported in their study that age did not have an influence on the level of TPCK.

When Table 6 was taken into consideration, it was obvious that the average of teachers working between 21-25 years was significantly lower than the averages of other groups. Unlike the result of our study, it was presented that in the study of Karataş & Akgün (2018), Topçu & Masal (2020), Çar & Aydos (2020), Çar et al. (2022) and Bıçak (2023) that professional seniority demonstrated no significant difference in any of the TPCK sub-dimensions ($p>0.05$). Mutluoğlu (2012) reported that the TPCK levels of primary school mathematics teachers changed significantly according to their tenure. Avcı (2014) stated that the TK level of science teachers from the TPCK components constituted a significant difference according to the duties of the teachers in the profession. This difference is in favor of teachers with seniority of 1-5 years, 6-10 years and 11-15 years. The levels of PK, CK, TPK, TCK, PCK and TPCK, one of the TPCK components of the science teachers, did not clarify a significant difference in terms of professional seniority of teachers, that. Again, Karakaya, (2013) found that TK, TCK, TPK and TPCK levels were negatively related to seniority (the decrease in these levels as seniority increases) in chemistry teachers. In our research, it was determined that the average of teachers working between 21-25 years was significantly lower than the averages of other groups. As it is known, the average age of teachers with high professional seniority has the same parallelism. Considering that the

changes and transformations experienced in technological terms are renewed day by day, it is understood that older teachers have difficulty in following these developments compared to young people.

When Table 7 was looked over, it was accepted that the average of those who used computers for 4 hours or more was significantly higher than the averages of other groups. In parallel with our researches with technological pedagogical content knowledge, it was inferred that there is a significant difference in favor of those with high computer usage times (Karataş & Akgün, 2018; Şad et al., 2015; Turgut, 2017). Bıçak (2023) and Çar et al. (2022) stated that there was no significant difference in their studies in relation to computer usage time.

Usta & Korkmaz (2010) reported that the positive perception levels of pre-service teachers towards technology also positively affect their attitudes towards the profession. As the technology usage levels of teacher candidates advanced, their attitudes towards the use of technology in the education process also improved positively. Öztürk (2012) held a web-based teaching activity for history pre-service teachers and encouraged candidates to be informed about TPCK. Likewise Chai et al., (2011) reported that pre-service teachers receiving computer training had higher TPCK qualifications than those who did not. In another study, it was signified that TPCK competencies develop as the computer use levels of pre-service teachers increase (Yurdakul Kabakçı, 2011). Özgen et al., (2013) determined that the TPCK scores of Mathematics pre-service teachers displayed significant differences according to the frequency of use of technology. Significant differences were found between TK, TPK, TCK and TPCK factors. Nevertheless, it was marked that there were no significant differences between PK, CK and PCK sub-dimensions.

In our study, in which the technological pedagogical content knowledge of physical education and sports teachers was analyzed, it was emerged that many variables imposed on this phenomenon. It has been shown that the knowledge of the technological pedagogical field of male teachers is higher than that of female teachers. It has been observed that as teachers' professional seniority and age increase, their

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field knowledge becomes super ordinate. It has been clearly understood that one of the most substantial components of training qualified teachers is pedagogical content knowledge. Scarcely, how important technology is and the requisiteness of being included in educational environments has once again come into sight. It is assumed that software and hardware competence have pivotal status in the teaching profession, as in every professional group. Physical education and sports teachers evaluated technological developments as opportunities for their professional and personal development. Teachers who are well trained in the dimensions of technological knowledge, pedagogical knowledge, content knowledge, technological content knowledge, which are the sub-divisions of technological pedagogical content knowledge, will make great contributions to sports education by giving past and up-to-date trainings. Teachers have stated that there is a lack of infrastructure in terms of technology as a problem. In this context, the lack of such a large study on physical education and sports teachers has made the research much valuable.

In this study, physical education and sports teachers' TPCK levels were limited to TK, PK, CK, TPK, TCK, PCK and TPCK dimensions. Interaction should be provided by creating environments where senior teachers with age and professional experience can convey their knowledge and experience to teachers with less seniority and age in the profession. It should be ensured that more qualified education and training activities should be maintained by providing educational and technological materials in schools and/or increasing their number. The positive effects of information, communication, technological tools and orientations required by the age in the lessons should be determined and the planning of the trainings should be designed in this direction.

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GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı

Yaşanan teknolojik gelişmeler her alanda olduğu gibi eğitim öğretim alanında da teknoloji destekli yeni öğretim tekniklerinin ortaya çıkmasına neden olmuştur. Bunun sonucunda eğitim ve öğretim süreçlerin en önemli aktörü olan öğretmenlerden beklentiler de farklılaşmıştır. Etkili öğretim sürecinde öğretmenlerin alan ve pedagojik bilgilerinin yanı sıra teknolojik bilgiye de sahip olmaları öğrencilerin öğrenme sürecini daha verimli hale getirecektir. Bu bağlamda araştırmada Milli Eğitim Bakanlığı (MEB) bünyesinde aktif olarak görev yapan Beden Eğitimi ve Spor öğretmenlerinin teknoloji ve pedagojik bilgilerini birlikte kullanımı içerikli Teknolojik Pedagojik Alan Bilgisi (TPAB) düzeylerinin tespit edilmesi amaçlanmıştır. Bu amaçla Beden Eğitimi ve Spor öğretmenlerinin TPAB yapısının içeriğinde yer alan, Teknolojik Bilgi (TB), Pedagojik Bilgi (PB), Alan Bilgisi (AB), Teknolojik Pedagojik Bilgi (TPB), Teknolojik Alan Bilgisi (TAB), Pedagojik Alan Bilgisi (PAB) ve Teknolojik Pedagojik Alan Bilgisi (TPAB) seviyeleri tespit edilmeye çalışılmıştır. Öğretmenlerinin TPAB düzeylerinin belirlenmesinde, cinsiyet, eğitim durumu, görev yapılan yer, mesleki kıdem, bilgisayar sahiplik durumu ve bilgisayar kullanma süresi değişkenlerinin etkisi araştırılmıştır.

Araştırmanın Alt Problemleri

Beden eğitimi ve spor öğretmenlerinin teknolojik pedagojik alan bilgi seviyeleri hangi boyuttur?

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Beden eğitimi ve spor öğretmenlerinin teknolojik pedagojik alan bilgi düzeyleri demografik değişkenlere göre farklılık göstermekte midir?

Literatür Araştırması

Günümüzde yaşanan teknolojik gelişim eğitim alanında da teknoloji kullanımını zorunlu hale getirmiştir. Hemen her eğitim ortamında bilgisayar, tepegöz, akıllı tahta gibi teknolojik cihazlar mevcuttur. Yapılan birçok araştırma göstermektedir ki eğitimde teknoloji kullanımı öğrenci başarısını artırmaktadır (Bozkurt ve Kaya, 2008; Bakaç vd., 2010; Türkan vd., 2010; Murathan ve Özdemir, 2017). Eğitim-öğretimde teknoloji kullanılırken pedagojik bilgilerden yararlanılmalıdır. Bu düşünce ilk olarak Koehler ve Mishra (2005) tarafından ortaya atılmıştır. Araştırmacılar “Teknolojik Pedagojik Alan Bilgisi (TPAB)” terimini ileri sürmüşlerdir.

Beden eğitimi ve spor öğretmenlerinin TPAB yeterliliklerine yönelik birkaç çalışmaya rastlanmıştır (Çar ve Aydos, 2020; Akkaya, 2021; Çar ve Aydos, 2022; Çar vd., 2022; Karatut ve Şentürk, 2022). Ancak bu çalışmalarda evren ve örneklem sadece tek bir ildeki Beden eğitimi ve spor öğretmenleridir. Araştırmamızda ise evren geniş tutularak Türkiye genelinde görev yapan 506 Beden eğitimi ve spor öğretmenin Teknolojik Pedagojik Alan Bilgisi düzeylerinin belirlenmesi çalışmanın özgünlüğünü değerli kılmaktadır.

Yöntem

Araştırma, tarama modelinde betimsel bir çalışma olarak dizayn edilmiştir. Araştırmanın evrenini 2023-2024 eğitim öğretim yılında Türkiye’de görev yapan tüm Beden eğitimi ve spor öğretmenleri oluşturmakta olup, örneklemi ise aktif gören yapan ve tabakalı örneklem yöntemi ile

belirlenmiş) toplam 506 Beden eğitimi ve spor öğretmeni oluşturmuştur. Veri toplama aracı Beden eğitimi ve spor öğretmenlerinin Teknolojik Pedagojik Alan Bilgilerini belirlemek için Şahin (2011) tarafından geliştirilen “Teknolojik Pedagojik Alan Bilgisi (TPAB) ölçeği kullanılmıştır. Ölçek 5’li likert tipinde 47 madde ve 7 alt boyuttan oluşmaktadır. Araştırma verileri ölçek aracılığı ile Türkiye’nin yedi coğrafik bölgesinin farklı illerinde aktif görev yapan öğretmenlerden elde edilmiştir. Verilerin analizinde SPSS 22.0 paket programı kullanılmıştır. Verilerin analizlerinde Beden eğitimi ve spor öğretmenlerinin cinsiyet, yaş, mesleki kıdem süreleri, görev yaptıkları yer, bilgisayara sahip olma durumları, teknolojiye yönelik bir eğitim alma durumu, günlük bilgisayar kullanma süreleri ilgili bilgileri belirlemek amacıyla aritmetik ortalama, frekans, standart sapma ve yüzde analizleri kullanılmıştır. TPAB düzeylerinin cinsiyet ve eğitim değişkenine göre farklılık gösterip göstermediğini belirlemek için bağımsız t testi, TPAB düzeylerinin görev yaptığı yere, görev süresine, teknoloji eğitimi alan ve

almayanların bilgisayar kullanma süresi değişkenlerine göre farklılık gösterip göstermediğini belirlemek için One-Way Anova testi uygulanmıştır. Ayrıca gruplar arasında farklılık olup olmadığını belirlemek için HSD Tukey Post Hoc çoklu karşılaştırma testi kullanılmıştır. Araştırmada verilerin yorumlanmasında anlamlılık düzeyi $p<0.05$ olarak alınmıştır.

Sonuç ve Değerlendirme

Erkek öğretmenlerin teknoloji pedagojik alan bilgisinin kadın öğretmenlerden daha yüksek olduğu görülmüştür. Öğretmenlerin mesleki kıdem ve yaşları arttıkça alan bilgilerinin yüksek olduğu görülmüştür. Bununla birlikte teknolojinin ne denli önemli olduğu ve eğitim ortamlarında mutlaka yer verilmesinin gerekliliği bir kez daha ortaya çıkmıştır. Beden eğitimi ve spor öğretmenleri teknolojik gelişmeleri meslek ve kişisel gelişimleri için fırsat olarak değerlendirmişlerdir. Öğretmenler sorun olarak teknolojik açıdan altyapı yetersizliği olduğunu ifade etmişlerdir.