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The Relationship Between Pre-School Teachers' Computational Thinking Skills and Their Use of Technology

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Abstract

This research was conducted in 5 central districts of Kayseri province in the 2022-2023 academic year in order to examine the pre-school teachers' levels of computational thinking skills and their attitudes towards using technological tools and the relationship between these two variables. The sample of the study consists of 210 preschool teachers. The survey model, which is one of the quantitative research methods, was used in the research. "Demographic Information Form", "Computational Thinking Skills Scale" and "Attitude Scale Towards the Use of Technological Tools in Preschool Education" were used to obtain research data. In this study, pre-school teachers' computational thinking skills and attitudes towards technology use were examined in terms of teachers' gender, educational status, seniority, technology-related education status, and it was tried to determine whether there was a significant relationship between these 2 variables. At the end of the research findings, it was revealed that there is a positive and moderate relationship between pre-service teachers' computational thinking skills and attitude towards technology use. In addition, it was concluded that the pre-school teachers' computational thinking skills and attitudes towards the use of technological tools and equipment did not make a significant difference according to the variables of gender, educational status, professional seniority, and education status related to technology.

Keywords: *Preschool Teacher, Computational Thinking Skills, Technology Usage, Attitude*

Öz

Bu araştırma, okul öncesi öğretmenlerinin bilgi işlemsel düşünme düzeyleri ve teknolojik araç kullanmaya yönelik tutumları ve bu iki değişken arasındaki ilişkiyi incelemek amacıyla 2022-2023 eğitim öğretim yılı içerisinde Kayseri ilinin 5 merkez ilçesinde (Melikgazi, Talas, Kocasinan, İncesu, Hacılar) yapılmıştır. Araştırmanın örneklemini 210 okul öncesi öğretmeni oluşturmaktadır. Araştırmada nicel araştırma yöntemlerinden birisi olan tarama modeli kullanılmıştır. Araştırma verilerini elde etmek "Demografik Bilgi Formu", "Bilgisayarca Düşünme Becerileri Ölçeği" ve "Okul Öncesi Eğitimde Teknolojik Araç-Gereç Kullanımına Yönelik Tutum Ölçeği" kullanılmıştır. Bu çalışmada okul öncesi öğretmenlerinin bilgi işlemsel düşünme becerileri ile teknoloji kullanımlarına yönelik tutumları öğretmenlerin cinsiyet, öğrenim durumu, kıdem, teknoloji ile ilgili eğitim alma durumu değişkenleri açısından incelenmiş ve bu 2 değişken arasında anlamlı bir ilişki olup olmadığı belirlenmeye çalışılmıştır. Araştırma bulguları sonunda öğretmen adaylarının bilgi işlemsel düşünme becerileri ile teknoloji kullanımları arasında pozitif yönde ve orta seviyede bir ilişki olduğu ortaya çıkmıştır. Ayrıca okul öncesi öğretmenlerinin bilgi işlemsel düşünme becerilerinin ve teknolojik araç-gereç kullanımına yönelik tutumlarının cinsiyet, öğrenim durumu, mesleki kıdem, teknoloji ile ilgili eğitim alma durumu değişkenlerine göre anlamlı bir fark oluşturmadığı sonucuna ulaşılmıştır.

Anahtar Kelimeler: *Okul Öncesi Öğretmeni, Bilgi İşlemsel Düşünme Becerisi, Teknoloji Kullanımı, Tutum.*

Introduction

With the advancements in the fields of technology and communication, access to information has become easier. However, this development has also caused the problems faced by individuals to become more complex. Thus, individuals are expected to both produce solutions to these problems and have characteristics called 21st century skills such as collaboration, creativity, critical thinking and entrepreneurship. In this context, the concept of "computational thinking", which includes many skills, has gained importance. Computational thinking is a multidimensional skill set that has an impact on the development of creative thinking, algorithmic thinking, critical thinking, problem solving, collaborative learning and communication skills (Brennan and Resnick, 2012). Computational thinking skill is a problem-solving and analytical thinking skill that is developed by combining technology with thinking skill (Wing, 2008).

Although introduced by Papert in 1980, computational thinking (CT) has become known with Wing's three-page article "Computational Thinking" published in 2006. There is no complete clarity about the definitions of the concept “computational thinking” in the literatüre. The researchers have not reached a definite consensus in the definition for this concept since it is new, and its content covers wide and complex areas. In Turkish literature, there are different translations of the concept such as “Bilgisayarca düşünme” (Akman & Bircan, 2021; Çatlak et al., 2015; Çakır & Yaman, 2018; Çimentepe, 2019; Kirmit et al., 2018; Korkmaz et al., 2015; Özkan Hıdıroğlu & Hıdıroğlu, 2021; Sade, 2020; Yünkül et al., 2017), “bilişimsel düşünme” (Çakır et al, 2019; Çiftci et al., 2018; Dolmacı & Akhan, 2020; Özkeş, 2016), hesaplamalı düşünme (Aydoğdu, 2020; Çelik Arslan, 2021; Özçınar, 2017; Özçınar & Öztürk, 2018; Ünsal Serim, 2019), “komputasyonel düşünme” (Şahiner & Kert, 2016). On the other hand, it can be stated that the concept of CT is more commonly translated as “bilgi işlemsel düşünme " in the Turkish literature (Demir & Seferoğlu, 2017, p. 470).

CT skill can be counted as one of the competencies needed to solve problems in all areas of human life. Thanks to computational thinking, an individual can develop an algorithmic mindset and find solutions to most problems. CT is an effective thought process that a computer or human needs in order to formulate a problem and find a solution directly (Kirmit et al., 2018, p. 18). Wing (2008) stated that CT can be accepted as an approach in which the basic terms related to computer science is utilized for the purpose of figuring out problems, developing systems and comprehending the behaviors of human beings. The core notion behind CT is to contemplate in the same way as a computer scientist would do when one confronts a difficult matter (Grover & Pea, 2013). According to Aho (2012), CT is the thought procedures necessary to formulate problems so that solutions can be symbolized by computational steps and algorithms. According to Şahiner and Kert (2016), CT skill is a competency that contributes to a better comprehension of the surroundings in which people live and to solving problems. Like reading, writing and arithmetic, Wing (2006) argued that CT is a fundamental skill for everyone and that this mindset must be made a part of all the children’s analytical ability.

CT skill has many components. Wing (2006) acknowledged that computational thinking includes different processes such as "problem solving, critical thinking, abstraction, analytical and algorithmic thinking". Kazimoğlu et al. (2012) described the five basic skills of computational thinking as "problem solving, algorithm building, debugging, simulation, and socialization". Kalelioğlu et al. (2016) emphasized that “abstraction, algorithmic thinking and problem solving” are the three most accepted components of CT. ISTE (2015) stated that CT is a combination of “creativity, algorithmic thinking, critical thinking, problem solving and collaboration”.

CT skills, which include many factors such as being able to critically look at a subject, think algorithmically, be creative, make decisions, solve problems, develop communication skills, work in cooperation, and achieve success, can be acquired in educational institutions during the teaching process (Akgün, 2020, pp. 635-636). According to Wing (2008), if it is desired to provide common and strong foundations for everyone to understand and apply computational thinking, the necessary

instruction should be given starting from the first years of the 0-8 years old period of the individual, which is called early childhood. In order for pupils to improve their CT skills, in the first place, instructors should be able to teach this skill in connection with their own fields, and thus they should have this skill themselves. Teachers' development of students' knowledge and skills in computational thinking depends on their ability to relate this competency to what their students have learned during the learning process (Yadav et al., 2017, p. 58). It is seen that one of the first actions to be taken in this context is teacher training. Besides, in order to support the professional development of educators, they should be provided with access to educational resources related to their fields, and their needs should be met in this sense. According to Voogt and Roblin (2012, p. 308), these knowledge and competences are 21st century skills in the education and that the main factor for developing these competencies is the teacher. In addition to the fact that teachers' information and communication technology competencies have an impact on student learning, it is also known that they have a positive effect on equipping pupils with the knowledge and skills demanded by the era and on their attitudes towards technology and their use of technology (Çakır & Önal, 2015, pp. 1028).

The concept of CT skills provides support to teachers and students on how to teach technology, to perceive where, in which process and how technology can be used to solve problems (Barr et al, 2011, pp. 23) and to offer the ability to benefit from technology in problem solving (Yadav et al., 2014, pp. 1-2). In this respect, it can be said that the concepts of CT skills and information and communication technologies competence are close to each other (Akgün, 2020, pp. 636).

Technology has become an inevitable part of education as an expected consequence of the rapid advances in the 21st century. The competencies that students acquire during their education period play a valuable role in preparing students for the business life they will enter in the following years. It can be said that information and communication technology competencies are the most important of these competencies (Eryılmaz, 2018, p. 38). In other words, it can be stated that educational institutions are obliged to prepare the generation in line with the needs of the society; that is, to provide the skills related to the information and communication technology (ICT) necessary to survive in the information society.

The inclusion of ICT in the education process provides great benefits not only for students but also for teachers. In order to provide students with information and communication technology skills, teachers must have ICT proficiency. Especially as the importance of technology increases in the domain of teaching, it is very crucial for teachers to utilize these tools in the classroom settings. Information and communication technologies possess a facilitating effect during course planning, course preparation, course execution and evaluation processes (Keaster & Metze, 2006). One of the factors that have the most important effect on educators' use of technological equipment is teachers' attitudes about this practice.

According to Topaloğlu (2008) and Mahajan (2016), teachers' attitudes towards technology are as important as the usage of technology in the education system. In their study, Zhao et al. (2001) reached the conclusion that the attitudes of teachers have a direct relationship with computer use in the classroom. In all activities to be carried out during the instructions in the class, teachers should hold a positive attitude 1towards technology if they are to use technology efficiently in their practices (Rana, 2012). According to Kıyıcı et al. (2012), the attitudes of individuals towards technology, their favorable or adverse views about technology are one of the most critical factors affecting their use of technology.

As the teachers' attitude towards the use of technology is important, the subject has drawn attention in the literature. There are many studies on teachers' attitude towards the use of technology (Aztekin, 2020; Çörekçi, 2020; Ardıç, 2021; Gülen, 2021; Kenar & Balcı, 2013; Kıyıcı et al., 2012; Koçak & Gülcü, 2013; Kol, 2012; Köroğlu, 2014; Miliazim Memet & Şentürk 2021; Sarı& Kartal, 2018; Topaloğlu, 2008; Yılmaz, 2016; Yılmaz, et al., 2016). Computational skill is also a popular subject among researchers. While many studies have been found on CT in the literature, these studies mostly concentrate on the definition and scope of this skill in addition to CT levels of learners and educators

in different branches (Akman & Bircan, 2021; Aydoğdu, 2020; Critten et al., 2022; Çakır & Yaman, 2018; Çakır et al., 2019; Çelik Arslan, 2021; Çiftci et al., 2018; Çimentepe, 2019; Dagienė et al., 2022; Dolmacı & Akhan, 2020; Fessakis & Prantsoudi, 2019; Gabriele et al., 2019; İbili, Günbatar, & Sırakaya, 2020; Kirmit et al., 2018; Korkmaz et al., 2015; Kousis, 2019; Oluk & Korkmaz, 2016; Oluk & Çakır, 2019; Özçınar & Öztürk, 2018; Özkan-Hıdıroğlu & Hıdıroğlu, 2021; Özkeş, 2016; Rehmat et al., 2020; Sade, 2020; Sayın, 2020; Ünsal Serim, 2019; Yang et al., 2020; Yünkül, et al., 2017).

Considering that the CT skill should be acquired in the pre-school age period, it is a must for pre-school teachers to be aware of these concepts and skills and focus on them. In this sense, the present research is believed to provide a contribution to the literature by promoting preschool teachers' recognition the concept of CT skills and leading them to give the necessary importance to integrate it into the education and training process. Likewise, while there are many studies in the literature on the use of technology in instruction, both in the preschool branch and in different branches (Akbaba & Ertaş Kılıç, 2022; Ardıç, 2021; Ardies et al., 2015; Chen & Hwang, 2019; Çetin et al., 2012; Dwivedi et al., 2019; Goh & Sandars, 2020; Gülen, 2021; Gündüzalp & Yıldız, 2020; Katrancı & Uygun, 2013; Kenar &Balcı, 2013; Köroğlu, 2014; Li et al., Miliazim Memet & Şentürk, 2021; Pazilah et al., 2019; Sarı & Kartal, 2018; Yılmaz et al., 2015; Yılmaz et al., 2016), no study has been found on the relationship between the CT skill and the attitude towards the use of technology of the preschool teachers or any other branches. In Turkish sources, only one study with pre-service teachers has been found (Akgün, 2020). Thanks to the rapid technological advances in recent years, computational thinking and concepts related to technology have become one of the basics of education such as literacy and mathematics. For this reason, it is important that teachers, who are the most important part of education, have CT skills and usage technology in their classrooms. For this reason, in this study, the relationship between CT skills and attitude towards the use technological tools and equipment was examined. In this context, answers to the following sub-problems were sought.

1. Is there a significant difference in preschool teachers' CT skills and attitudes towards the use of technological tools and equipment according to gender?
2. Is there a significant difference in pre-school teachers' CT skills and attitudes towards the use of technological tools and equipment according to educational status?
3. Is there a significant difference in pre-school teachers' CT skills and attitudes towards the use of technological tools and equipment according to their professional experience?
4. Is there a significant difference in the pre-school teachers' CT skills and their attitudes towards the use of technological equipment according to whether they received any technology-related education?
5. Is there a significant relationship between pre-school teachers' CT and their attitudes towards the use of technological equipment?

Method

In this section of the research, information about "the research model, universe and sample, data collection tools, data collection and analysis" were presented.

Model of the Research

In the present study, correlational survey model was preferred among the quantitative research methods. The correlational survey model is an approach which predicts the existence of a covariance between at least two variables, or even more and which tries to determine how the change occurs if there is any (Karasar, 2012).

Population and Sample of the Research

The population chosen for this research is the pre-school teachers working in public and private institutions of pre-school education in 5 central

districts of Kayseri (Melikgazi, Talas, Kocasinan, İncesu, Hacılar). 210 preschool teachers, who were determined by convenience sampling method constitute the sample in the research. In the convenient sampling method, which is based on accessibility and convenience, the researcher collects data from the most easily accessible subjects until the sample size is reached (Gürbüz & Şahin, 2015). In this study, data were collected from preschool teachers who were easily accessible by the researchers. The distribution of demographic information belonging to the study group is shown in Table 1.

Table 1. *Distribution of Demographic Characteristics of Preschool Teachers*

		f	%
Gender	Female	197	93.8
	Male	13	6.2
Educational status	Associate Degree	12	5.7
	Undergraduate	168	80.0
	Postgraduate	30	14.3
Years of experience	1-5 Years	23	11.0
	6-10 Years	35	16.7
	11-15 Years	104	49.5
	16-20 Years	30	14.3
	21 Years	18	8.6
Have you received any training on the use of technology?	Yes	117	55.7
	No	93	44.3
Total		210	1000

Table 1 shows the demographic characteristics of the preschool educators participating in the study. As seen in the table, 93.8% (197) of the educators taking part in the study are female while 6.2% (13) of the participants are male. 5.7% (12) of the teachers have associate degree, 80% (168) have undergraduate degree and 14.3% (30) have postgraduate degree. 11% (23) of the teachers participating in the research have between 1-5 years, 16.7% (35) have between 6-10 years, 49.5% (104) have between 11-15 years, 14.3% (30) have between 16-20 years and 8.6% (18) have 21 years or more of professional seniority. Finally, 55.7% (117) of the teachers have received training on technology use, while 44.3% (93) have not.

Data Collection Tools

In this study, "Demographic Information Form", “Computational Thinking Skills Scale" and "Attitude Scale Towards the Use of Technological Tools in Preschool Education" were utilized to collect the necessary data for the research. With the aim of obtaining some personal information about the participants, a demographic information form was devised and questions were asked about the participants' "gender, educational level, professional experience, whether they received education on the use of technology." Two different scales were conducted to obtain the essential date to make the calculations.

“Computational Thinking Skills” Scale

The "CT Skills Scale" developed by Korkmaz et al. (2017) was used to calculate the CT skills of the teachers. There are 29 items under 5 factors in the scale which is a five-point Likert. The factor called “Algorithmic Thinking” consists of 6 items and the coefficient of internal consistency is 0.869; the factor called “Critical Thinking” consists of 5 items and the coefficient of internal consistency is 0.784; the factor called “Creativity” consists of 8 items and the coefficient of internal consistency is 0.843; the factor called “Problem Solving” consists of 6 items and the internal consistency coefficient is 0.727; lastly the factor called “Collaboration” consists of 4 items and the internal consistency coefficient is determined as 0.865. The coefficient of internal consistency for the whole scale was calculated as 0.822 (Korkmaz et al., 2017).

The Cronbach Alpha reliability coefficient of the total "Computational Thinking Skills" scale used in the research was found to be .936. In addition, it was determined that the reliability coefficients of the sub-dimensions were between .867 and .954. While the lowest reliability coefficient was in the "Problem Solving" sub-dimension (.867), the highest reliability coefficient was in the "Collaborative Learning" sub-dimension (.954). The reliability coefficient was found to be .928 in the "Creative Thinking" sub-dimension, .936 in the "Algorithmic Thinking" sub-dimension, and .909 in the "Critical thinking" sub-dimension. Accordingly, it can be said that the

scale used in the research has a very high level of reliability.

"Attitude Scale towards the Use of Technological Tools and Equipment in Pre-School Education"

In order to measure the attitudes of educators towards the usage of technology in the education and training process, "Attitude Scale towards the Use of Technological Tools and Equipment in Pre-School Education", which was devised by Kol (2012), was preferred. In the scale, positive questions were graded as "I strongly disagree", "I do not agree", "I am undecided", "I agree" and "I totally agree" and scores were made from 1 to 5 for positive items, and vice versa for the negative items. As a result of the examination made by 6 preschool teachers and 11 experts with respect to content validity and the adequacy of the way of expression, some items were corrected in line with their opinions and suggestions, and some were taken out of the draft scale. The percentage of variance explained by the scale was found to be 41,181, and the eigenvalue was found to be 8,188. The Spearman Brown coefficient was calculated as 0.90 and the Cronbach Alpha reliability coefficient as 0.92 (Kol, 2012).

For the present study, it was determined that the Cronbach Alpha reliability coefficient of the total "Attitude Towards the Use of Technological Tools and Equipment in Preschool Education" scale was .909. Accordingly, it can be said that the scale used in the research has a very high level of reliability.

Data Collection and Analysis

After data collection tools were determined, first of all, the necessary approval was taken from the Ethics Committee of Erciyes University, and then the permission for the application was obtained from "Kayseri Provincial Directorate of National Education." The demographic information form and scales answered by the participants were created through Google forms and the participants could use their phones, tablets, computers, etc., where they have internet access. They participated by answering questions through technological tools. The demographic information form and scales used took approximately 10 minutes to complete for each participant. The results of the normality analysis of the scales are presented in Table 2.

Table 2. *Normality Test Results of the Scales Used in the Study*

	Kolmogorov-Smirnov		
	Statistic	sd	p
Creativity	.162	210	.000
Algorithmic Thinking	.071	210	.013
Cooperativity	.212	210	.000
Critical Thinking	.129	210	.000
Problem Solving	.102	210	.000
Computational Thinking Skills Scale total	.066	210	.028
"Attitude Scale towards the Use of Technological Tools and Equipment in Pre-School Education"	.082	210	.002

The Kolmogorof-Smirnov normality test results of the scales are shown in Table 2. According to this table, it was observed that the data did not reflect the characteristics of a normal distribution ($p<.05$). Besides, he skewness and kurtosis values of the data were examined and since these values were not between +1/-1, it was accepted that the data did not show a normal distribution. Non-parametric tests were carried out in cases where the data are not normally distributed. For this reason, Spearman Rank correlation analysis, Mann-Whitney U test in paired groups and Kruskal Wallis-H test in groups of three or more were used to determine the relationships between variables.

Findings

In this section of the article, the scores of the preschool educators taking part in the study were examined according to their demographic characteristics and presented in tables, and then the results were discussed using the literature.

Preschool Teachers' "Computational Thinking (CT)" Levels and "Attitudes Towards the Use of Technological Tools and Equipment (ATUTTE)" Evaluation by Gender

Table 3. shows the differentiation of preschool teachers' CT levels and ATUTTE by gender.

Table 3. *Mann-Whitney-U Test Results Regarding the Difference Between the Mean Scores of the Scales According to the Gender of the Teachers*

	Gender	N	Mean Rank	Sum Of Ranks	U	p
Creativity	Female	197	105.03	20690.00	1187.0	.658
	Male	13	112.69	1465.00		
Algorithmic Thinking	Female	197	103.70	20429.50	926.5	.095
	Male	13	132.73	1725.5		
Cooperativity	Female	197	105.32	20749.00	1246.0	.866
	Male	13	108.15	1406.00		
Critical Thinking	Female	197	104.77	20640.50	1137.5	.499
	Male	13	116.50	1514.50		
Problem Solving	Female	197	105.69	20820.50	1243.5	.861
	Male	13	102.65	1334.50		
CT Skills Scale Total	Female	197	104.75	20636.50	1133.5	.488
	Male	13	116.81	1518.50		
ATUTTE	Female	197	105.19	20722.00	1219.0	.772
	Male	13	110.23	1433.00		

As seen in the table, no significant difference was detected for the gender variable of the teachers in the total score of the "CT Skills" scale (U=1133.5, p>.05), in the "Creativity" sub-dimension (U=1187.0, p>.05), in the "Algorithmic Thinking" sub-dimension (U=926.5, p>.05), "Cooperativity" sub-dimension (U=1246.0, p>.05), "Critical Thinking" sub-dimension (U=1137.5, p>.05) and in the "Problem Solving" sub-dimension (U=1243.5, p>.05).

As for the total scores obtained from "Attitudes Scale towards the Use of Technological Tools and Equipment in Pre-School Education", it has been detected that the groups did not differ from each other in terms of gender (U=1219.0, p>.05), either.

Differentiation of Preschool Teachers' CT Skills and ATUTTE by Educational Status

The differentiation of pre-school teachers' CT skills and ATUTTE according to their educational status is presented on Table 4.

Table 4. *Kruskal Wallis-H Test Results Regarding the Difference Between the Mean Scores of the Scales According to the Educational Status of the Teachers*

	Education level	N	Mean Rank	sd	X^2	p	Meaningful Difference
Creativity	Associate Degree	12	78.67	2	2.533	.282	
	Undergraduate	168	106.83				
	Postgraduate	30	108.80				
Algorithmic Thinking	Associate Degree	12	65.17	2	6.895	.032*	1<2 1<3
	Undergraduate	168	105.89				
	Postgraduate	30	119.43				
Cooperativity	Associate Degree	12	99.58	2	.169	.919	
	Undergraduate	168	106.20				
	Postgraduate	30	103.93				
Critical Thinking	Associate Degree	12	98.63	2	2.855	.240	
	Undergraduate	168	102.93				
	Postgraduate	30	122.62				
Problem Solving	Associate Degree	12	108.67	2	.503	.778	
	Undergraduate	168	104.06				
	Postgraduate	30	112.28				
CT Skills Scale Total	Associate Degree	12	78.92	2	3.249	.197	
	Undergraduate	168	105.47				
	Postgraduate	30	116.32				
ATUTTE	Associate Degree	12	82.75	2	2.649	.266	
	Undergraduate	168	105.18				
	Postgraduate	30	116.37				

*p<.05, (1) Associate degree, (2) Undergraduate, (3) Postgraduate)

According to Table 4, in the total score of the "CT Skills" scale (X^2=3.249, sd=2, p>.05), in the "Creativity" sub-dimension (X^2=2.533, sd=2, p>.05), in the "Cooperativity" sub-dimension (X^2=.169,

sd=2, p>.05), in the "Critical Thinking" sub-dimension (X^2=2.855, sd=2, p>.05) and in the "Problem Solving" sub-dimension (X^2=.503, sd=2, p>.05), the groups did not differ in a significant way according to the educational status of the teachers. Only in the "Algorithmic Thinking" sub-dimension, the groups differed from one another in a significant way according to the educational status of the teachers (X^2=6.895, sd=2, p<.05). For this sub-dimension, to find out which groups differ from each other, Mann Whitney-U test was carried out. The analysis has revealed that there was a difference between the teachers with an associate degree and those with an undergraduate degree and between teachers with an associate degree and post graduate degree in favor of the latter (p<.05). In the total score (X^2=2.649, sd=2, p>.05) of the scale of "Attitudes towards the Use of Technological Tools and Equipment in Pre-School Education", it was seen that the groups did not differ in a significant way according to the educational status of the teachers.

Differentiation of Preschool Teachers' CT Skills and ATUTTE by Professional Seniority

The differentiation status of pre-school teachers' CT skills and ATUTTE according to their professional seniority is presented on Table 5.

Table 5. *Kruskal Wallis-H Test Results Regarding the Difference Between Scores of the Scales According to the Professional Seniority of the Teachers Participating in the Research*

	Years of Seniority	**N**	**Mean Rank**	**sd**	X^2	**p**
Creativity	"1-5 Years"	23	92.85	4	2.410	.661
	"6-10 Years"	35	97.79			
	"11-15 Years"	104	107.82			
	"16-20 Years"	30	110.03			
	"21 Years and above"	18	115.69			
Algorithmic Thinking	"1-5 Years"	23	77.78	4	7.312	.120
	"6-10 Years"	35	121.49			
	"11-15 Years"	104	105.78			
	"16-20 Years"	30	104.80			
	"21 Years and above"	18	109.36			
Cooperativity	"1-5 Years"	23	94.17	4	2.515	.642
	"6-10 Years"	35	98.47			
	"11-15 Years"	104	111.07			
	"16-20 Years"	30	106.67			
	"21 Years and above"	18	99.50			
Critical Thinking	"1-5 Years"	23	89.20	4	2.207	.698
	"6-10 Years"	35	107.59			
	"11-15 Years"	104	109.06			
	"16-20 Years"	30	106.32			
	"21 Years and above"	18	100.33			
Problem Solving	"1-5 Years"	23	99.61	4	7.475	.113
	"6-10 Years"	35	95.26			
	"11-15 Years"	104	112.40			
	"16-20 Years"	30	115.42			
	"21 Years and above"	18	76.56			
CT Skills Scale total	"1-5 Years"	23	78.43	4	5.584	.232
	"6-10 Years"	35	106.36			
	"11-15 Years"	104	110.41			
	"16-20 Years"	30	110.88			
	"21 Years and above"	18	101.06			
ATUTTE	"1-5 Years"	23	94.67	4	3.513	.476
	"6-10 Years"	35	117.30			
	"11-15 Years"	104	104.87			
	"16-20 Years"	30	111.47			
	"21 Years and above"	18	90.08			

According to Table 5, the groups did not differ from each other in terms of their work experience in the total score of the "CT Skills" scale (X^2=5.584,

sd=4, p>.05), in the "Creativity" sub-dimension (X^2=2.410, sd=4, p>.05), in the "Algorithmic Thinking" sub-dimension (X^2=7.312, sd=4, p>.05), in the "Cooperativity" sub-dimension (X^2=2.515, sd=4, p>.05), "Critical Thinking" sub-dimension (X^2=2.207, sd=4, p>.05) and in the "Problem Solving" sub-dimension (X^2=7.475, sd=4, p>.05). This finding suggests that teachers' year of seniority is not a statistically meaningful variable for their CT skills.

Similarly, no significant difference was found in the total score (X^2=3.513, sd=4, p>.05) of the scale of "Attitudes towards the Use of Technological Tools and Equipment in Preschool Education" according to the professional seniority of the teachers.

Differentiation of Preschool Teachers' CT Skills and ATUTTE According to the Status of Receiving Technology-related Education

The differentiation status of pre-school teachers' CT skills and their ATUTTE according to their attending technology-related training is presented in Table 6.

Table 6. *The Mann-Whitney-U Test Results Regarding the Difference Between the Scores of the Scales According to their Attendance to the Technology-Related Education*

	Receiving education	N	Mean Rank	Sum Of Ranks	U	p
Creativity	Yes	117	110.06	12877.00	4907.0	.220
	No	93	99.76	9278.00		
Algorithmic Thinking	Yes	117	110.48	12926.00	4858.0	.182
	No	93	99.24	9229.00		
Cooperativity	Yes	117	102.07	11942.50	5039.5	.341
	No	93	109.81	10212.50		
Critical Thinking	Yes	117	111.66	13064.00	4720.0	.098
	No	93	97.75	9091.00		
Problem Solving	Yes	117	105.92	12392.50	5391.5	.911
	No	93	104.97	9762.50		
CT Skills Scale total	Yes	117	108.43	12686.50	5097.5	.433
	No	93	101.81	9468.50		
ATUTTE	Yes	117	107.82	12614.50	5169.5	.535
	No	93	102.59	9540.50		

According to Table 6, in the total score of the "CT Skills" scale (U=5097.5, p>.05), in the "Creative Thinking" sub-dimension (U=4907.0, p>.05), in the "Algorithmic Thinking" sub-dimension (U=4858.0, p>.05), "Collaborative Learning" sub-dimension (U=5039.5, p>.05), "Critical Thinking" sub-dimension (U=4720.0, p>.05) and "Problem Solving" sub-dimension (U=5391.5, p>.05) no significant difference was found in terms of teachers' technology-related education status.
According to the findings, there was also no significant difference in the "Attitude Scale towards the Use of Technological Tools and Equipment in Pre-School Education" regarding the teachers' having education related to technology (U=5169.5, p>.05).

The Relationship Between the CT Skills and the ATUTTE in Pre-School Education

In the study, the relationship between the CT skills and the ATUTTE in pre-school education was also examined and the obtained results were presented in Table 7.

Table 7. *Correlation Test Results for the Relationship Between CT Skills and Attitude Towards the Use of Technological Tools and Equipment in Pre-School Education*

	1	2	3	4	5	6	7
Creativity	1						
Algorithmic Thinking	.507*	1					
Cooperativity	.587*	.420*	1				
Critical Thinking	.672*	.659*	.630*	1			
Problem Solving	.155*	.242*	.161*	.168*	1		
CT Skills Scale Total	.755*	.790*	.706*	.811*	.519*	1	
ATUTTE	.308*	.156*	.355*	.290*	.233*	.349*	1

Table 7 shows the Spearman Rank correlation analysis results, which were conducted to determine the relationship between the "Computational Thinking Skills" scale and its sub-dimensions and the "Attitude towards the Use of Technological Tools and Equipment in Preschool Education" scale. Considering the results of the analysis, a positive and moderately significant relationship was determined between the total

score of the "Computational Thinking Skills" scale and the "Attitude towards the Use of Technological Tools and Equipment in Preschool Education" [r= .349; p<.05]. When the relationship between the sub-dimensions of the "Computational Thinking Skills" scale and the "Attitude towards the Use of Technological Tools and Equipment in Pre-School Education" scale was examined, it was observed that there were positive and significant relationships between all sub-dimensions and "Attitude towards the Use of Technological Tools and Equipment in Preschool Education" scale (p<.05). Besides, it was seen that the lowest relationship was in the "Algorithmic Thinking" sub-dimension (r=.156), and the highest relationship was in the "Cooperative Learning" sub-dimension (r=.355).

Discussion and Conclusion

The examination of preschool teachers' CT skills according to their gender revealed that male and female educators did not differ from each other both at the total scores and the sub-dimensions of the "Computational Thinking Skills Scale" used in the research and that the means of the teachers who took part in the study were similar to each other. The absence of difference is thought to result from the fact that male and female teachers benefit from the same educational opportunities in the process of teacher training and inequality in the society decreases in this sense. When the literature on CT was reviewed, it was identified that Atmatzidou and Demetriadis (2016), Alsancak Sırakaya (2019), Yıldız Durak et al. (2019) and Yağcı (2018) also obtained similar results in their research and concluded that gender had no effect on CT. Unlike these results, Akgün (2020) found in his research that there is a significant difference in the CT skills of teachers according to their gender and concluded that male pre-service teachers' CT skill means are higher than female pre-service teachers. Similarly, Roman Gonzalez et al. (2016), Sarıtepeci (2017) and Kirmit et al. (2018) also concluded that the gender variable had a significant effect on CT skills.

When "the attitudes of preschool teachers towards the use of technological tools and equipment" in the classrooms was examined according to their gender, it was seen that the male group did not differ from the female group in terms of their means scores. It is thought that the different findings in the literature examining the "Attitudes towards the use of technological tools and equipment (ATUTTE)" in instruction in the context of gender may result from the fact that the selected sample groups and sample numbers are not the same, and that there is no balanced distribution based on gender due to the fact that the pre-school teachers are mostly women. When the literature on the ATUTTE in classroom settings was examined, it was observed that Gujjar et al. (2013), Rana (2012), Çelik and Bindak (2005), Koçak and Gülcü (2013), Köroğlu (2014), Çınarer et al. (2016), Aztekin (2020) and Konca and Tantekin Erden (2021) had similar results and did not find any relationship between gender and attitudes towards using technology in the preschool education process. In the study of Can and Namlı (2019), which did not coincide with the results of the research, it was found that the attitude scores of male pre-service teachers were higher compared to the attitude scores of female pre-service educators. Likewise, Gülen (2021), Markauskaite (2006), Houtz and Gupta (2006), Campbell (1990) determined that male educators had a higher level of ATUTTE in the education process than females. In his study, Yılmaz (2016), on the other hand, found that unlike Gülen (2021), Can & Namlı (2019), female teachers' attitudes towards the use of technological equipment were more positive than male group.

When the CT skills of preschool teachers according to their education levels were examined, it was seen that while the education status of the teachers working in pre-school education institutions did not lead to any difference in "creativity", "problem solving", "cooperativity " and "critical thinking" sub-levels of the "Computational Thinking Skills Scale", it was determined that the educational status created a significant difference on the algorithmic thinking sub-level. According to this finding, it was observed that pre-school teachers with associate degrees have lower algorithmic thinking skills.

Algorithmic thinking is the process of considering all the possible possibilities and solutions for the solution of a problem and

revealing them step by step (Aydoğdu, 2020, pp. 5). Considering that algorithms surround most of the daily life, it is clear that the development of this step will be an important gain for the individual (Korkmaz et al., 2015, pp. 70).

In addition, it was seen that the educational status of the preschool did not make a significant difference in the educators' attitude towards the use of technology. The reason for this can be that the teachers received similar education on the use of technology during their educational activities at the university. When examining the literature on the ATUTTE in education, it was seen that there are studies with similar results. Köroğlu (2014), Çınarer et al. (2016) and Yılmaz et al. (2016) concluded in their research that the educational levels of the teachers did not make a significant difference on their attitude towards using technological equipment in education. Gülen (2021), who reached a conclusion different from the results obtained from present research, concluded that educational status made a significant difference on the instructors' attitudes and that preschool teachers with a postgraduate degree have a more positive attitude towards the use of technological tools and equipment in the education process. Aztekin (2020), on the other hand, concluded that undergraduate teachers have a more positive attitude towards using technology in the education process compared to teachers at other education levels.

When CT skills of preschool teachers and their attitudes towards the use of technology tools and equipment seniority were examined according to their professional, it was concluded that there was no significant difference according to the seniority of the pre-school teachers who participated in the research. When the literature on teachers' attitudes towards the use of technological equipment in the educational process was examined, it was seen that Çınarer et al. (2016), Çörekçi (2020) and Gülen (2021) reached similar results showing there was no significant relationship between the years of seniority of teachers and their use of technology. Çakmaz (2010), on the other hand, stated in his research that he reached a significant difference in this regard and the result was that teachers who are new to the profession use new technological tools, while senior teachers choose old technological tools and equipment with classical methods. Aztekin (2020) also determined that the attitude scores of teachers who are 21 years or more of professional seniority were lower in this regard. The reasons for the different results in the literature examining the levels of "Attitudes towards the Use of Technological Tools and Equipment in Pre-School Education" in the context of seniority may be due to the different sample groups and sample numbers participating in the research and whether they received in-service education on using technological tools.

When the computational thinking skills of pre-school teachers and their attitudes towards using technological tools and equipment in the educational process is examined in terms of whether they have received any training on the use of technological tools and equipment, it has been seen that there is no meaningful difference according to that variable. The mean scores of the preschool teachers who participated in the survey were similar to each other. When relevant literature was examined, unlike the results of the current research, Akgün (2020) concluded that there was a relationship between two variables in his study investigating the effect of receiving technology-related training on computational thinking skills. When the literature was examined, it was observed that the results of the present study were similar to those of Çakmaz's (2010) and Köroğlu's (2014). The researchers reached the conclusion that there was no significant difference between the teachers' attitude towards technology use according to getting education on the use of technological tools and equipment. However, Gülen (2021) stated in her research that the attitudes of teachers who received training on the use of technological tools and equipment in the pre-school education process were higher than the attitude levels of those who did not receive any training. Similarly, Aztekin (2020) found a significant difference in favor of the trained teachers in this regard. Yıldırım (2000), on the other hand, stated that the teachers' attitudes towards technology increased after various computer courses according to the data he obtained as a result of his research. These findings differ from the findings of the present research. When the literature is examined for studies

investigating the relationship between the teachers' receiving technology-related training and their level of "Attitude Towards the Use of Technological Tools and Equipment in Pre-School Education", different results have been reached. It is thought that teachers who receive training on the use of technology in education can offer a higher quality education to their students by providing a learning process enriched with technological tools and equipment (Gülen, 2021, p. 55).

Finally, when the relationship between pre-school teachers' CT skills and their attitudes towards the use of technology tools in the education process was analyzed, it was identified that there was a positive correlation between the sub-dimensions of the "Computational Thinking Skills" scale and the "Attitude towards the Use of Technological Tools and Equipment in Preschool Education" scale. It can be said that there was a moderately significant relationship. As a result of this, it was concluded that as the CT skills of preschool teachers increased, their attitudes towards the use of technology also increased. In the literature, Akgün (2020), in his research in which he evaluated teachers' ICT and ICT skills in terms of different variables, concluded that there is a positive and weak relationship between CT competencies and ICT skills. While the positive correlation found between the two variables is similar to the findings of the presents study, its being low differs from this study's findings. A thorough review of the literature has shown that while there are many studies on the use of technological tools and equipment in education, the studies on CT are not enough. Likewise, there are not enough studies that measure the relationship between teachers' CT skills and their use of technological equipment in education.

Recommendations

Based on the results obtained from the research, the following suggestions can be made for new research to be carried out:

Preschool teachers' CT skills and their attitudes towards the use of technology in education can also be examined through their different demographic characteristics.

Teachers who have a high level of attitude towards the use of technology in pre-school education can be examined by comparing the activity practices that include technology.

Based on the different results obtained in the studies in the literature, it can be stated that much more studies are needed to reveal the relationship between the gender variable and CT skills. In addition, if, as a result of the researches, it is determined that one of the female or male teachers is more advanced in computational thinking skills, in order for the students to receive a similar quality education from all their teachers regardless of male or female, it is necessary to plan the solution process by making a deeper research on the subject.

In this study, one data collection tool was used to determine teachers' computational thinking skills. In order to obtain deeper and more comprehensive data in future research, evaluations can be made by using different data collection tools such as "observation" and "interview". Since it is a high-level mental skill, making deep and comprehensive evaluations can provide better quality results by observing the research from different angles.

It has been seen that studies on CT skills mostly focus on students of different age groups. In this sense, it is important to increase the number of studies in this field in order to better understand computational thinking and to see its benefits.

It is thought that this research will contribute to researchers who want to work on the relevant subject and in the context of different variables. By investigating the relationship between teachers in different branches and their CT skills and their use of technology, a contribution can be made to the very limited literature on this subject.

Sub-dimensions of CT skills can be used to improve the quality of all courses, and these skills can be reflected in the teaching process, objectives and evaluation. For this, practical in-service trainings can be given to teachers for the application of this skill in curricula, and projects can be realized.

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