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The effect of basic robotic coding in-service training on teachers' acceptance of technology, self-development, and computational thinking skills in technology use

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Abstract The purpose of this study was to investigate the technology acceptance, self-development, and computational thinking skills of teachers who participated in basic robotic coding in-service training from different branches in primary and secondary schools. The research was designed according to the causal comparative research method. The study group consisted of 217 teachers, 106 male and 111 female teachers from different branches working in Amasya and Samsun. Research scales "Self-Improvement in Technology Use in Education," "Technology Acceptance," and "Computational Thinking Skills" were used to collect data. Self-improvement scale in technology use in education was developed by Öztürk [Evaluation of social studies teacher nominees? Competency regarding their use of technology in education (Balikesir sample). Unpublished Master Thesis, Gazi University, Ankara, 2006]. There were 14 items in the scale, and internal consistency coefficient was 0.88. Technology acceptance scale for teachers was developed by Ursavaş et al. (J Theory Pract Educ 10(4):885–917, 2014). The scale in total consists of 11 factors and 38 items. The Cronbach's α coefficient for the factors in the scale was between 0.798 and 0.909. The computational thinking skills scale was developed by Korkmaz Çakır and Özden (2017). The scale consists of 5 factors and 29 items. Cronbach α internal consistency coefficient of the scale was 0.822. When the collected data were analyzed, it was seen that the teachers' self-improvement in technology use ($\bar{x}$= 3.99) and technology acceptance ($\bar{x}$= 3.96) were higher. There was statistical significance difference between attending in-service training and not attending in-service training in favor of attending in-service training in self-improvement in technology

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use in education. Furthermore, it is noteworthy that as teachers' time in the profession increases, the levels of self-improvement and technology acceptance in technology use decrease in non-attending in-service training group. It is seen that teachers get closer to new developments as they get older and their desire to use technological innovations decreases.

Keywords Use of technology · Self-development · Technology acceptance · Computational thinking · In-service teachers

Introduction

It is clearly seen that education should interact with technology. This interaction comes true with educational technology (Göktaş et al. 2012). Educational technology is defined as a discipline field which helps and improves the individual's learning process with the development of knowledge and knowledge transmission technologies. It can be said that the field of education technology is to increase or improve the effect and quality of learning and teaching processes (Alpan 2008). According to Seels and Richey (1994), educational technology is theory and practice in the design, development, use, management, and evaluation of learning resources and processes. Today, most of the studies in the field of educational technology are aimed at improving student success. According to Gülbahar and Alper (2009), educational software and similar technologies focused on motivating students and improving their success. As technology makes progress rapidly, its role in the field of education progresses at an equal rate and has been examined in terms of teachers and education (Gülbahar and Alper 2009). Fouts (2000) defined teaching content as "an integral part of the teaching environment and a tool that can be used for different purposes." The scope of teaching technologies consists of learning and teaching approaches, learning strategies, learning methods, and tools and materials used in the learning process.

In studies in the field of educational technologies, the study of Caffarella (1999) draws attention considerably. In his study, Caffarella studied the current tendency of that time in the doctoral thesis related to educational and instructional technologies in the USA between 1977 and 1998. The most remarkable part of his research is that the content of doctoral thesis published in the field of educational technologies is based on computer-based and computer-aided education, and that quantitative studies are conducted mostly (Caffarella 1999). In our country in the field of educational technologies, in the study carried out by Şimşek et al. (2008), the general evaluation of the doctoral theses published in the field of educational technologies in our country between 1998 and 2008 was made. According to the results of the research, the studies conducted in the field of educational technologies generally focus on learning and teaching approaches, online learning, and multimedia (Şimşek et al. 2008). Alper and Gülbahar (2009) who have also a similar study stated that the same result with the one, which Şimşek et al. (2008) had, emerged when they examined the articles published between

2003 and 2007. However, they stated that there was only one difference, and that this difference was one of the most frequently studied subjects of online education (Alper and Gülbahar 2009). In a study by Erdoğmuş and Çağıltay (2009), the theses published by universities with master's and doctoral programs in the field of computer and instructional technologies were examined. Consequently, they have focused on three main topics. These topics are media, media comparison, and student variables (Erdoğmuş and Çağıltay 2009). In another similar study examining the articles published in the field of educational technologies in 2014, Instructional Design, Information Technologies in Education, Game Use in Education, Mobile Learning, and Cooperative Learning were the most important subjects (Kılıç-Çakmak et al. 2016).

With the development of technology, new tendencies have appeared in educational technologies and these new approaches continue to progress along with the technological process (Baran 2016). Stehr (2005) states that "Knowing is a cognitive doing action." Learning environments where knowledge is transferred aim to provide a learning approach. In this approach, knowledge is more effective and creative, and critical thinking skills are prominent. Also, student is at the center of the student's learning process, and student-centered solutions are offered instead of traditional learning approaches (Baran 2016). It is necessary to review and use instructional technologies together with traditional learning methods in order to create a student profile who both creates information and helps to share it and to raise this student profile (Baran 2016). According to Baran (2016), the newest education and training technologies of today's world are classified under six topics such as "learning analytics, cloud computing, mobile applications, open educational resources, game-based learning and reversed learning."

In these new educational and instructional technologies, it is stated that young people can solve the given tasks in the fastest way through learning technology with block-based visual programming (Balcı et al. 2018). It is stated that it has a great effect on reaching the most logical result in problem situations given to them in this process. Young people solve complex problem situations as they are result oriented thanks to this learning technology. They also reach more effective results by working collaboratively and produce a new product or project according to their imaginary world (Balcı et al. 2018). According to Çatlak et al. (2015), individual's ability to make programming has an important role in problem solving and in acquiring high-level skills such as cooperative learning, original thinking, and critical thinking. In our today's world, Code Game Lab COMMUNITY or the more commonly used Scratch and Code.org visual programs can be given as examples of game-based learning environments. The most important block-based programs that provide the programming process to come in pieces that complement one on top of the other are Scratch and code.org visual programming (Grover and Pea 2013). From this definition, a logical programming process will be formed by combining code fragments like the process of combining jigsaw pieces. As mentioned in Yükseltürk's and Altıok's (2016) studies, scratch visual programming is the most commonly used block-based programming. In order to follow new technologies in educational technologies, individuals and teachers also need to develop themselves and not isolate themselves from this phenomenon (Budak and Demirel 2003).

Considering that the teachers in our education system are necessary for the continuity of education, identifying the educational needs of teachers should be perceived as the duty of all educational institutions (Budak and Demirel 2003). It is stated that the relationship of digital thinking with intelligence is seen as understanding complex problems and solving general problem situations (Boom et al. 2018). Teachers may not be able to use new technologies immediately in their classes. Teachers may not know when and how to use new technologies in their courses and may not use them actively in their courses (Niess 2011). It can be said that in-service trainings will be beneficial for teachers to improve themselves in addition to basic education. According to the results obtained at the end of the in-service training, the basic training can be planned. According to Demirtaş (2010), in order to be able to adapt to new technologies more easily, teachers can come together with teachers from other branches both at work and out of work to share their knowledge with one another, and can have knowledge about new developing technologies and can have an idea whether these new technologies are suitable for their own courses. In-service training for teachers is needed in order to adapt to new technologies more easily and integrate these technologies into their courses (Demircioğlu and Yadigaroğlu 2011). Saban (2000) emphasized that the role of teachers in in-service training is very important and teachers can solve problems they encounter effectively by being together with more experienced teachers and by helping one another and by taking the lead to one another. First of all, teachers should train themselves well before the service. However, they should improve themselves by participating actively in in-service training programs (Seferoğlu 2001; Uçar and İpek 2006). Boydak (1995), who wanted to draw attention to the necessity of in-service training, emphasized that it is of great importance for teachers.

The in-service training given by the school or the Ministry of National Education can be seen as a means of development for teachers. When the literature is reviewed, there are many different definitions related to in-service training (Taymaz 1992; Aytaç 2000; Başaran 1994). Taymaz (1992) states that it is the training given to individuals working in any place to improve themselves in their tasks and to increase their knowledge, skills, and attitudes. In-service training is all education and training activities that provide harmony in the profession, progression in the profession and development in the profession (Aytaç 2000). In another definition, it is expressed as the training given to individuals to gain the knowledge and skills required by that job (Yıldırım et al. 2015). We can come through that the easiest and fastest way for them is to follow these new technologies and adapt them through in-service training (Yıldırım et al. 2015). In in-service training courses, new information is learned, discussed, and transferred to different individuals through their experiences (Tekin and Yaman 2008). With the development of new technologies, teachers can also find the opportunity to improve themselves by participating in in-service training programs. As a result, they can have a better relationship with students. On this occasion, robotic coding in-service training programs for teachers are organized by MEB. By participating in such an in-service training, teachers can both contribute to their individual development and meet the needs of students.

We can examine the teachers' in-service training together with pedagogy, andragogy, and heutagogy. Education has traditionally been seen as a pedagogical relationship between teacher and learner (Hase and Kenyon 2001). Bozkurt (2015) first considered the approaches of individual's learning processes in two sections such as child education (pedagogy) and adult education (andragogy). He then put forward the concept of heutagogy. Heutagogy is defined as an approach that takes the development of learning skills with a holistic approach, in other words, emphasizes lifelong learning and self-determination of the learner (Bozkurt 2015). Heutagogy is the study of self-determined learning and forms some parts of the ideas together (Hase and Kenyon 2001). It is also an attempt to challenge some of them. As Bill Ford (1997) makes it clear, it should be accumulating information instead of sharing information (cited by Hase and Kenyon 2001). In this respect, heutagogy looks which future of knowing and how to learn and believes that it will be a basic skill given to the speed of innovation and change (Hase and Kenyon 2001). On the basis of this approach, there is a learner, and the learner realizes all learning activities on his own. It emphasizes that the teacher-program curriculum is not in the center of learning, but the student is in the center of the learning process. The most basic question of heutagogy is how individuals will realize learning (Bozkurt 2015). Figure 1 (Hase and Kenyon 2000) shows the range of pedagogy, andragogy, and heutagogy.

Rogers (1969) puts forward that people perform learning throughout their lives and want to have a natural tendency to do so (cited by Hase and Kenyon 2001). According to Blaschke (2012), new technological applications, such as web 2.0 tools, support learners' ability to guide and determine their own learning experiences and enable individuals to be active in learning environments instead of passive learning (Bozkurt 2015). In this context, teachers' learning to follow new technological applications in line with lifelong learning processes and use them in educational environments can be evaluated in terms of heutagogy approach.

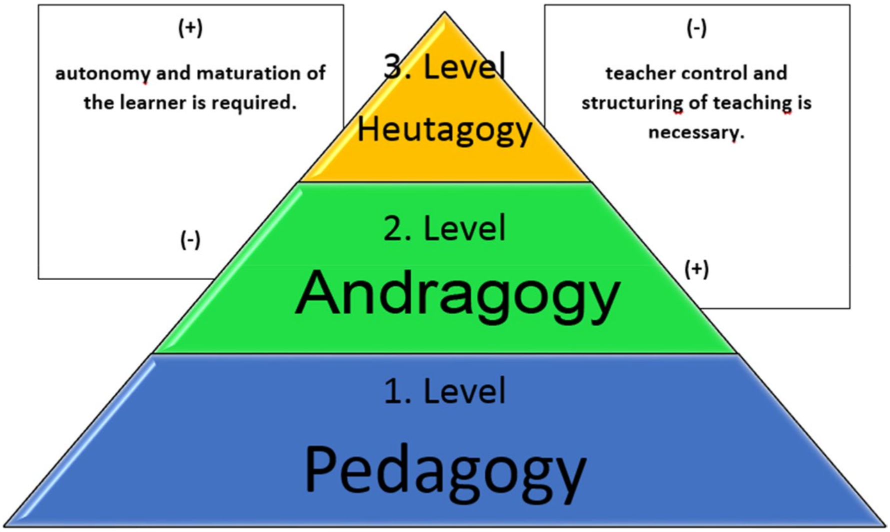

Fig. 1 Pedagogy, andragogy, and heutagogy range (Hase and Kenyon 2000)

Computational thinking, one of the current thinking skills in the twenty-first century (Korkmaz et al. 2015), is expressed as having information, ability, and attitude which we need in order to use computers as a production tool to solve problems we encounter in daily life. It has been stated that it can help teachers to develop a more accurate and refined understanding of how to apply information technology to the classroom (Yadav et al. 2017). Computational thinking is a method of understanding the behaviors of individuals by considering problem solving, designing a system and the basic concepts of computational thinking (Korkmaz et al. 2015). ISTE (2015) states that computational thinking is a problem-solving approach that strengthens the combination of technology and thinking. We can say that trainings such as robotic coding in-service trainings have an important role in the acquisition of skills such as computational thinking for teachers. With robotic coding training, teachers can both solve problems and create a brand new product. When the literature is examined, there are studies indicating that block-based coding training contributes to the development of individuals' computational thinking skills and also their problem-solving skills (Kalelioğlu and Gülbahar 2014; Kukul and Gökçearslan 2014).

It can be said that it is very important for teachers to accept new technologies in terms of improving themselves. Şahin and Alkaya (2017) explain individuals' acceptance of new technologies with perceived benefit, perceived ease of use, and behavioral intention variables. Technology acceptance model was created by Davis et al. (1989). According to this model, the greatest benefits of individuals to adapt new technologies are Davis et al. (1989) who defined desires, attitudes, and the determination of the effects of external factors on individuals' belief in themselves. The purpose of the technology acceptance model is to reveal the behaviors of individuals using computers (Serçemeli and Kurnaz 2016). Davis et al. (1989) developed technology acceptance models are shown in Fig. 2.

From this point of view, individuals can use these new technologies and develop themselves as well as accepting new technologies. The Internet can be used in order to reach these new technologies and to enable teachers to use technologies actively in their classes. In our country, the best example of this is the Education Information Network (EBA). It defined its definition as "Social Education Platform" (EBA 2017). For example, in-service trainings given to teachers at the beginning of the education and training period can be provided with EBA digital base. In another study, it was found that teachers made an important contribution to classroom

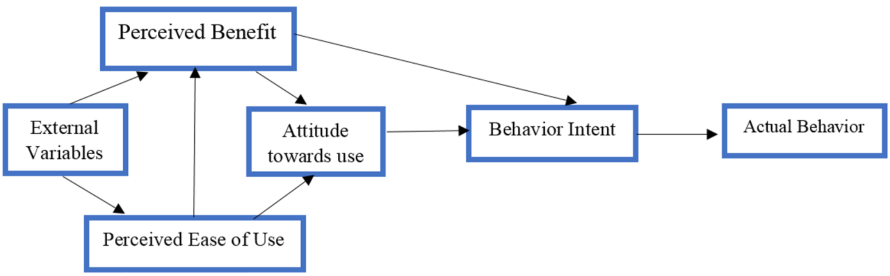

Fig. 2 Technology acceptance model (Davis et al. 1989)

management by using technology in education, it was an important tool for students to move to different fields, contributing to the reduction of the workload of teachers working in the school and exams were applied faster and feedback was given more quickly (Döğer 2016). It can be said that the interest and motivation of the students increased by means of technological tools when compared to the education given with the traditional method. Saklan and Ünal (2018) state that students can listen to the lesson more actively and learn the subject in depth with the use of technological tools. In this regard, it is seen that it is important for teachers to use new technological developments in their lessons. In a study conducted by Narayanan (2017), it was concluded that teachers' presentations made in the biology lesson with the Prezi Web 2.0 tool increased the motivation of the students. Likewise, it is stated that learning environments have more diversity and contribute to the formation of new educational environments by the active use of new technologies in the lessons (Kol 2012). Despite the multifaceted benefit of these new technologies, it is still the teachers who will teach students new knowledge using these technologies (Solak 2009). Therefore, it was decided that such a study should be carried out considering that teachers should improve themselves constantly and keep up with new technologies by participating in in-service training activities. Based on the definitions of teaching technologies, pedagogy, andragogy, and heutagogy above, this study aims to enable teachers to adapt to existing new technologies, to use these technologies in all areas of their lives and to reflect these new technologies to their students. It is important for teachers to prepare themselves for new technologies and to reflect these new technologies to children in the classroom environment by participating in programs such as in-service training. With the recent emergence of robotic coding as a new technology, it is aimed for teachers to be able to master this technology, thus, improving their computational thinking and problem-solving skills. From this point of view, the aim of this research is to reveal the effect of basic robotic coding in-service training, which is accepted as new technological application, on teachers' acceptance of technology, self-development, and use of computational thinking skills. For this purpose, answers to the following questions were sought.

Sub-problems

(1) What are the levels of self-improvement, technology acceptance, and computational thinking skills of teachers in using technology?
(2) Do teachers' self-development, technology acceptance, and computational thinking skills differ according to their situation of attending in-service training?
(3) Do self-improvement, technology acceptance, and computational thinking skills of teacher's who attended in-service training and who did not have it differ according to their branches?
(4) Do self-improvement, technology acceptance, and computational thinking skills of teacher's who attended in-service training and who did not have it differ according to their gender?

(5) Do self-improvement, technology acceptance, and computational thinking skills of teacher's who attended in-service training and who did not attend it differ according to their professional experience?

Method

Research design

Although this study is a quantitative study, it was conducted using causal comparative method. The causal comparative method is described as a correlational research method that examines at least two differentiating groups on this subject investigated by comparing each other. The causal comparative research method is used to determine whether the independent variable specified in the study has any difference on the dependent variables that make a difference in the subject (Gay et al. 2012). When the body of literature is examined, it is stated that there are studies to explain the causes of an existing or naturally occurring event or situation together with the causal comparison studies or the results of an effect (Büyüköztürk et al. 2008, p. 185). In this study, the differences between teachers who attended in-service training and the ones who did not attend it have been investigated.

Study group

The study group of this research consists of 185 teachers from 103 different branches, 103 women and 82 men who are actively working in Samsun and Amasya. Moreover, the study group consists of 113 teachers who attended in-service training and 72 teachers who did not attend in-service training. The teachers who participated in the in-service training were given lego robotic coding and mBlock programming training by researchers for 2 hs every weekday for 2 weeks. In education, it is aimed to teach robotic programming to teachers, to develop algorithmic thinking skills, to develop computational thinking skills, and to use new technologies in education and training curriculum. Robotic coding training includes teachers working at all educational levels. Branches of teachers have been categorized. Branches like primary school teacher and preschool teacher have been gathered under the name of primary school teachers. Branches such as mathematics and science have been gathered under the name of numerical course teachers. Courses such as Turkish and social studies have been gathered under the name of verbal course teachers. In the study, the variables affecting the causal comparison were determined as teachers who had in-service training and teachers who did not attend in-service training.

Instruments

The data were collected using a total of three measurement tools. All of these measurement tools have a total of 17 sub-factors. In addition, a 3-question questionnaire including demographic information was used. The scale of self-development consists of a single section in the use of technology. In the 11 sections of the technology acceptance scale, perceived usefulness, perceived ease of use, attitude towards use, subjective norm, self-efficacy, facilitating situations, technological confusion, anxiety, perceived entertainment, suitability, and behavioral intention were named and these abilities were measured. In five parts of the computational thinking scale, creativity, algorithmic thinking, collaboration, critical thinking, and problem solving were described and these skills were measured. In the survey section, demographic information including gender, professional experience, and branch information was obtained. The most important factor in choosing the measurement tools mentioned above is that they are suitable for adult levels. It was examined by the researchers that the items in the scales were questionnaires that could measure the robotic coding training skills provided in in-service training, and it was decided that these scales were valid and reliable measurement tools for the research.

Self-development in technology use in education

The scale was developed by Öztürk (2006). The scale is a 5-point Likert type and contains 14 attitude sentences. Items in the scale were scored from 5 to 1 with the options "Strongly Agree = 5," "Agree = 4," "I'm indecisive = 3," "Disagree = 2," and "Strongly Disagree = 1." In a Likert-type attitude scale, it is assumed that the score range obtained from one item is continuously variable. Besides, the scale has more than two response options, and there is no single correct answer. In addition, one of the main assumptions of this scale is that each item in the scale has a monotonic relationship with the measured attitude. This means that each item measures the same attitude. The reliability of the scale was determined by calculating the Cronbach's α coefficient. The Cronbach's α coefficient was 0.88 out of 60 items in the trial form of the scale. After selecting the items, Cronbach's α coefficients of 39 items were recalculated and found to be 0.90. This result shows that the scale performs reliable measurement. The scale consists of a single factor. Below are sample items related to the scale:

- The use of technological equipment does not contribute to students' learning processes.
- I cannot think of a situation where I can use technological equipment in my lessons.
- It relaxes me to know that I have the necessary knowledge and skills while using the tools and equipment in the lesson.
- I get bored when using equipment in lessons.

Technology Acceptance Scale

The scale was developed by Ursavaş et al. (2014). The scale consists of 11 factors and 38 items. Factor names are as follows: perceived usefulness (1–5), perceived ease of use (6–8), attitude towards use (9–12), behavioral intent (13–16), easing situations (17–19), perceived entertainment (20–23), self-competence (24–26), technological confusion (27–29), conformity (30–32), anxiety (33–35), and subjective norm (36–38). There are 6 reverse items in the scale items; 27, 28, 29, 33, 34, and 35. Cronbach α internal consistency coefficient of the scale was 0.85. Below are sample items related to the scale:

- Using ICT in my lessons increases my performance.
- It is easy for me to use ICT in my lessons.
- I get technical support when I encounter a problem while using ICT.
- I think I will use ICT frequently.

Computational Thinking Scale

The scale was developed by Korkmaz Çakır and Özden (2017). There are 5 factors and 29 items in the scale. Factor names are as follows: creativity, algorithmic thinking, collaboration, critical thinking, and problem solving. Items 1–8 are the first factor, items 9–14 are the second factor, items 15–18 are the third factor, items 19–23 are the fourth factor, and items 24–29 are the fifth factor. Cronbach's α internal consistency coefficient was 0.82. Below are sample items related to the scale:

- I am eager to learn hard things.
- I believe that I can easily capture the relationship between figures.
- I am proud that I can think with great precision.
- I cannot develop my own ideas in a cooperative learning environment.

Data collection

In this study, data, determined scales, and questionnaires were collected face to face and by e-mail by applying to teachers from different branches in the provinces of Amasya and Samsun.

Data analysis

First, the mean scores of the sub-factors and overall scales were calculated. The Kolmogorov–Smirnov test was applied with the sub-factors and with general mean scores of teachers' self-actualization, technology acceptance levels, and computational thinking skills in the use of technology in education, and the normality value was evaluated. All values were between -1.5 and $+1.5$, and it was found to have normal range. Then, whether the mean scores of the factors show normal range or not was analyzed. Independent sample *t* test and ANOVA tests were used in the normal range results.

Results

In the light of the analyses, the general mean scores of the participants are given in Table 1.

Table 1 Mean scores of the results obtained in the scales

	Factors	N	Min	Max	$\bar{x}$	SS
Technology accepted	Perceived usefulness	187	1.00	5.00	4.29	.790
	Perceived ease of use	187	1.00	5.00	3.85	.889
	Attitude towards use	187	2.00	8.50	4.30	.839
	Behavioral intent	187	1.50	5.00	4.11	.809
	Facilitating situations	187	1.00	5.00	3.98	.971
	Perceived fun	187	1.00	5.00	4.13	.88
	Self-competence	187	1.67	5.00	4.01	.82
	Technological complexity	187	1.00	5.00	3.28	.95
	Suitability	187	1.00	5.00	4.13	.95
	Anxiety	187	1.00	5.00	3.81	1.07
	Subjective norm	187	1.00	5.00	3.73	.92
Computational thinking	Creativity	187	3.50	5.00	4.46	.40
	Algorithmic thinking	187	1.33	5.00	3.69	.95
	Cooperativity	187	2.00	5.00	4.26	.66
	Critical thinking	187	1.40	5.00	3.98	.68
	Problem solving	187	1.00	5.00	3.81	.95
Total	Self-development in technology use in education	187	1.71	5.00	3.99	.69
	Technology acceptance	187	2.16	4.94	3.96	.60
	Computational thinking	187	2.92	5.00	4.04	.47

When Table 1 is analyzed, the highest mean scores in the overall average of the participants were computational thinking skills ($\bar{x}$= 4.04). The total mean score of the level of technology acceptance is 3.96 and Self-Development in Technology Use in Education is 3.99. When Table 1 is examined, when the means of the sub-dimensions of the scales are considered, creativity ($\bar{x}$= 4.46), which is the sub-factor of computational thinking skills, is the highest. The lowest score was found in the technological complexity factor ($\bar{x}$= 3.28), which is a sub-factor of the level of technology acceptance.

The statistical data of the groups having in-service training and not having it are summarized in Table 2.

As it can be seen in Table 2, self-development, technology acceptance, and computational thinking skills sub-factors of teachers attending in-service training (IST) are considered, it is seen that the mean score is higher than those who do not attend in-service training. In terms of Self-development in technology use scale, while the average of teachers attending in-service training is 4.20, the average of teachers not having it is 3.84. According to independent sample t test analysis, there is statistical significance difference between attending in-service training and not attending in-service training in favor of attending in-service training, $t(185) = 3.55$; $p < 0.05$. When Table 2 is examined, according to the mean score technology acceptance level of teachers, the average of teachers attending in-service training (4.05) was higher than the average of those who did not (3.90). When the general

Table 2 Analysis of differences among self-development, technology acceptance, and computational thinking skills in education in terms of groups

	Group	*N*	$\bar{x}$	SD	df	*t*	*p*
Self-development in technology use in education	Not attending in-service training	113	3.84	.69	185	3.55	.00
	Attending in-service training	74	4.20	.64			
Technology acceptance	Not attending in-service training	113	3.90	.57	185	1.61	.10
	Attending in-service training	74	4.05	.63			
Computational thinking	Not attending in-service training	113	4.04	.48	185	.00	.99
	Attending in-service training	74	4.04	.46			

averages are examined, it is seen that in computational thinking skills, the average of teachers who attended in-service training and who did not attend it was equal ($\bar{x}$= 4.04–4.04). Independent sample *t* test results show that there are no significant differences between groups in terms of technology acceptance and computational thinking scales.

Table 3 summarizes the descriptive results according to the branches of teachers attending in-service training in terms of self-development, technology acceptance, and computational thinking in the use of technology in education.

When self-development skills of teachers attending in-service training were examined according to their branches, the highest mean score was found in primary school teachers. Although the total mean score of secondary school numerical and secondary school verbal teachers were lower compared to primary school teachers, their scores were high separately. When the technology acceptance levels of teachers attending in-service training were examined according to their branches, the highest average was found in secondary school numerical teachers. When the mean scores are examined, it is seen that the highest difference is

Table 3 Descriptive results of self-improvement, technology acceptance, and computational thinking skills of teachers attending in-service training according to their branch

Branch		*N*	$\bar{x}$	SD
Self-development in technology use in education	Primary school	26	4.28	.59
	Secondary numeral	26	4.19	.61
	Secondary verbal	20	4.09	.76
	Total	72	4.20	.64
Technology acceptance	Primary school	26	4.02	.57
	Secondary numeral	26	4.21	.59
	Secondary verbal	20	3.83	.72
	Total	72	4.04	.63
Computational thinking	Primary school	26	3.94	.46
	Secondary numeral	26	4.23	.41
	Secondary verbal	20	3.88	.41
	Total	72	4.02	.45

between secondary school numerical teachers and secondary school verbal teachers. When computational thinking skills of teachers attending in-service training were examined according to their branches, it was found out that secondary school numerical teachers had a value of 4.23. As with the level of technology acceptance, there is a 0.4-point difference between secondary school numerical teachers and secondary school verbal teachers. When Table 3 is examined, it is seen that self-development, technology acceptance, and computational thinking skills of teachers attending in-service training differ in terms of use of technology in education according to the branch groups. One-way ANOVA test was used to determine whether this difference was significant. Table 4 shows the differences according to branch groups of teachers attending in-service training in terms of self-development, technology acceptance, and computational thinking skills.

As can be seen in Table 4, it can be concluded that the self-development skills of teachers attending in-service training in using technology in education do not differ in terms of branch groups. In other words, the self-development skills of the teachers in the use of technology in education do not show a significant difference in terms of branch groups [$F(2,71) = 0.513$; $p > 0.05$]. According to the Table 4, it can be concluded that the level of technology acceptance of teachers attending in-service training does not differ in terms of branch groups. In other words, there is no significant difference between the technology acceptance levels of the teachers in terms of branch groups [$F(2.71) = 2.04$; $p > 0.05$]. As it can be seen in Table 4, it can be concluded that computational thinking skills of teachers attending in-service training differ in terms of branch groups. In other words, it is seen that the computational thinking skills of the teachers receiving education show a significant difference in terms of branch groups [$F(2,71) = 4.45$; $p < 0.05$]. As a result of the difference seen in terms of computational thinking skills, post-hoc analysis was used for analysis. According to Tukey's test results,

Table 4 The differences of self-improvement, technology acceptance, and computational thinking skills of teachers attending in-service training according to branch groups

		Sum of squares	SD	Mean square	*F*	*p*	Difference
Self-improvement in technology use in education	Between groups	.43	2	.219	.513	.60	
	Within groups	29.50	69	.428			
	Total	29.94	71				
Technology acceptance	Between groups	1.60	2	.802	2.04	.13	
	Within groups	27.03	69	.392			
	Total	28.64	71				
Computational thinking	Between groups	1.67	2	.839	4.45	.01	
	Within groups	13.00	69	.188			Between groups 2 and 3
	Total	14.8	71				

there is a significant difference between middle school numerical teachers and middle school verbal teachers in favor of secondary school numerical teachers.

Table 5 shows the differences in the use of technology in education, self-improvement, technology acceptance, and computational thinking skills of teachers who do not attend in-service training according to the branch groups.

When the self-development skills of teachers who do not attend in-service training are examined according to their branches, the highest score is found in primary school teachers ($\bar{x}$= 4.07). The mean score of secondary school numerical course (Mathematics and Science, etc.) and secondary school verbal course teachers (Turkish and Social Studies and etc.) were lower than the primary school teachers' score. When the technology acceptance levels of the teachers who do not attend in-service training are examined according to their branches, the highest average is found in secondary school numerical course teachers ($\bar{x}$= 4.02). The highest difference was observed between secondary school numerical teachers and secondary school verbal teachers. When the computational thinking skills of the teachers who do not attend in-service training are examined according to their branches, the rate of 4.35 belongs to secondary school numerical teachers. As with the level of technology acceptance, there is a 0.55-point difference between secondary school numerical teachers and secondary school verbal teachers. When Table 5 is examined, it is seen that the teachers who do not attend in-service training have differentiation in terms of technology use, self-improvement, technology acceptance, and computational thinking skills according to the branch groups. One-way ANOVA test was used to determine whether these differences were significant. Table 6 shows the differences in the use of technology in education, self-improvement, technology acceptance and computational thinking skills of teachers who do not attend in-service training according to branch groups.

As it can be seen in Table 6, it can be concluded that the self-development skills of teachers who do not attend in-service training do not differ in terms of branch groups. In other words, there is no significant difference in terms of branch groups of

Table 5 Differences of self-improvement, technology acceptance, and computational thinking skills of teachers without in-service training according to branch groups

Branch		N	$\bar{x}$	SD
Self-development in technology use in education	Primary school	29	4.07	.68
	Secondary numeral	34	3.82	.75
	Secondary verbal	50	3.73	.63
	Total	113	3.84	.69
Technology acceptance	Primary school	29	3.95	.52
	Secondary numeral	34	4.02	.59
	Secondary verbal	50	3.80	.57
	Total	113	3.90	.57
Computational thinking	Primary school	29	4.08	.42
	Secondary numeral	34	4.35	.44
	Secondary verbal	50	3.80	.43
	Total	113	4.04	.48

Table 6 Differences of self-improvement, technology acceptance, and computational thinking skills of teachers without in-service training according to branch groups

		Sum of squares	SD	Mean square	F	p	Difference
Self-improvement in technology use in education	Between groups	2.07	2	1.03	2.21	.11	
	Within groups	51.76	110	.47			
	Total	53.84	112				
Technology acceptance	Between groups	1.10	2	.55	1.69	.18	
	Within groups	35.83	110	.32			
	Total	36.94	112				
Computational thinking	Between groups	6.16	2	3.08	16.43	.00*	Between groups 1 and 2
	Within groups	20.66	110	.18			
	Total	26.83	112				

*$p<0.05$

teachers' self-development skills in using technology in education [$F(2,112)=2.21$; $p>0.05$]. When Table 6 is examined, it can be concluded that technology acceptance levels of teachers who do not attend in-service training do not differ in terms of branch groups. In other words, it does not show a significant difference in terms of the branch of the technology acceptance levels of teachers attending education [$F(2,112)=1{,}69$; $p>0.05$]. Looking at Table 6, it can be concluded that computational thinking skills of teachers who do not attend in-service training differ in terms of branch groups. In other words, it is seen that the computational thinking skills of the teachers attending education show a significant difference in terms of branch groups [$F(2,112)=16.43$; $p<0.05$]. As a result of the difference seen in terms of computational thinking skills, post-hoc analysis was done. Tukey's test was used for post-hoc analysis. According to Tukey's test results, there is a significant difference in favor of numerical teachers between primary teachers and secondary school numerical teachers. There is a significant difference in favor of primary teachers between primary and secondary school teachers. Again, there is a significant difference among the secondary school numerical teachers and the primary teachers and secondary school verbal teachers in favor of the secondary school numerical teachers. Finally, there is a significant difference between secondary school verbal course teachers and secondary school numerical course teachers against secondary school verbal course teachers.

Table 7 shows the differences among teachers attending in-service training in terms of gender, self-development, technology acceptance, and computational thinking skills in the use of technology in education.

According to table, it is seen that male teachers ($\bar{x}$= 4.25) have higher mean score than female teachers ($\bar{x}$= 4.15) when it is examined in terms of gender in terms of self-development in technology use in education. In order to see whether

Table 7 Differences of self-improvement, technology acceptance, and computational thinking skills of teachers attending in-service training according to gender

	Gender	N	$\bar{x}$	SD	df	t	p
Self-development in technology use in education	Male	32	4.25	.67	70	.62	.53
	Female	40	4.15	.63			
Technology acceptance	Male	32	4.20	.61	70	1.88	.06
	Female	40	3.92	.63			
Computational thinking	Male	32	4.14	.47	70	2.01	.04
	Female	40	3.93	.41			

this difference is significant, independent samples *t* test was run. According to the results of the analysis, although the mean score of male teachers is high, there is no statistically significant difference between them [$t(70) = 0.62$; $p > 0.05$]. When the technology acceptance levels of teachers attending in-service training are examined in terms of gender, it is seen that the average of male teachers ($\bar{x}$=4.20) is higher than that of female teachers ($\bar{x}$=3.92). According to the independent samples *t* test results, although the mean score of male teachers is high, there is no statistically significant difference between them [$t(70) = 1.88$; $p > 0.05$]. As it can be seen in the table, when the computational thinking skills of the teachers attending in-service training are examined in terms of gender, it is seen that the mean score of male teachers ($\bar{x}$ = 4.14) is higher than that of female teachers ($\bar{x}$= 3.93). In order to see whether this difference is significant, independent samples *t* test was used. According to the analysis results, there is a statistically significant difference between genders in favor of male teachers [$t(70) = 2.01$; $p < 0.05$].

Table 8 shows the gender differences in the teachers' self-development, technology acceptance, and computational thinking skills in the use of technology in education.

When Table 8 is examined, it is seen that male teachers ($\bar{x}$= 4.07) have higher mean score than female teachers ($\bar{x}$= 3.67) when it is examined in terms of gender for self-development of teachers who do not attend in-service training. In order to see whether this difference is significant, independent samples *t* test was used. According to the results of the analysis, there is a significant difference in favor

Table 8 Differences of self-improvement, technology acceptance, and computational thinking skills of teachers without in-service training according to gender

	Gender	N	$\bar{x}$	SD	df	t	p
Self-improvement in technology use in education	Male	50	4.07	.63	111	3.12	.002
	Female	63	3.67	.70			
Technology acceptance	Male	50	4.07	.60	111	2.87	.005
	Female	63	3.77	.53			
Computational thinking	Male	50	4.09	.49	111	.92	.361
	Female	63	4.00	.49			

of male teachers [$t(111)=3.12$; $p<0.05$]. As it can be seen in Table 8, when the technology acceptance levels of teachers not attending in-service training are examined in terms of gender, it is seen that the mean score of male teachers ($\bar{x}$= 4.07) is higher than that of female teachers ($\bar{x}$= 3.77). According to the independent samples *t* test results, there is a significant difference in favor of male teachers [$t(111)=2.87$; $p<0.05$]. When Table 8 is examined, it is seen that the mean score of computational thinking of male teachers ($\bar{x}$= 4.09) is higher than female teachers ($\bar{x}$=4.00). In order to see whether this difference is significant, independent samples *t* test was analyzed. According to the analysis results, there is no statistically significant difference between them [$t(111)=0.92$; $p>0.05$].

Following table shows the differences among teachers attending in-service training according to their self-development, technology acceptance, and computational thinking skills in terms of their professional experience.

Non-parametric analysis was performed in categorized professional experience groups because the groups did not show a normal range (because there were less than 10 person). Kruskal–Wallis test was performed from non-parametric analyzes (Büyüköztürk et al. 2008). Table 9 shows that teachers with the highest average (41.94) in the self-development levels in the use of technology in education were the ones who had 16–20 years of professional experience. On the other hand, the lowest average (34.23) was found in teachers with 6–10 years of professional experience. When Table 9 is examined, the highest average (49.19) technology acceptance levels were observed in teachers with 16–20 years of professional experience. On the other hand, the lowest average (29.73) was found in teachers with 6–10 years of professional experience. As it can be seen in Table 9,

Table 9 Differences in self-improvement, technology acceptance, and computational thinking skills of teachers attending in-service training according to their professional experience

	Experience (years)	*N*	Average ranking
Self-improvement in technology use in education	1–5	27	36.69
	6–10	32	34.23
	11–15	5	41.30
	16–20	8	41.94
	Total	72	
Technology acceptance	1–5	27	41.85
	6–10	32	29.73
	11–15	5	30.60
	16–20	8	49.19
	Total	72	
Computational thinking	1–5	27	38.31
	6–10	32	36.61
	11–15	5	46.50
	16–20	8	23.69
	Total	72	

the highest average computational thinking skills (46.50) were observed among teachers with 11–15 years of professional experience. On the other hand, the lowest average (23.69) was found in teachers with 16–20 years of professional experience. According to the Kruskal–Wallis test results, there were no statistical differences between groups in terms of professional experiences.

Table 10 shows the differences in the teachers' self-development, technology acceptance, and computational thinking skills in terms of their professional experience in the use of technology in education.

When self-development skills of teachers attending in-service training were examined according to their professional experiences, the highest (4.02) mean score belonged to two groups which are 1–5 years of professional experience and 6–10 years of professional experience. The lowest score (3.56) was found as teachers with 16–20 years of professional experience. When the table is examined, and the technology acceptance levels of the teachers who do not attend in-service training are examined according to their professional experience, the highest (4.05) average is obtained for the teachers with an average of 6–10 years of professional experience. The lowest average (3.10) was found as teachers with 1–5 years of professional experience. When computational thinking skills of teachers attending in-service training were examined according to their professional experience, the highest (4.15) average was found as teachers with 6–10 years of professional experience. The lowest average (3.95) was found as the teachers with 11–15 years of professional experience. One-way ANOVA test was used to determine whether these differences were significant. Table 11 shows the differences among teachers not attending in-service training in terms of self-development, technology acceptance, and computational thinking skills according to their professional experience.

Table 10 Descriptive results according to professional experience of self-improvement, technology acceptance, and computational thinking skills of teachers without in-service training

Experience		*N*	$\bar{x}$	SD
Self-improvement in technology use in education	1–5 years	15	4.02	.71
	6–10 years	48	4.02	.45
	11–15 years	25	3.71	.61
	16–20 years	25	3.56	.99
	Total	113	3.85	.69
Technology acceptance	1–5 years	15	3.10	.48
	6–10 years	48	4.05	.48
	11–15 years	25	3.81	.55
	16–20 years	25	3.68	.72
	Total	113	3.91	.57
Computational thinking	1–5 years	15	3.96	.52
	6–10 years	48	4.15	.53
	11–15 years	25	3.95	.39
	16–20 years	25	3.97	.44
	Total	113	4.04	.48

Table 11 The differences of self-improvement, technology acceptance, and computational thinking skills of teachers without in-service training according to their professional experience

		Sum of squares	SD	Mean square	*F*	*p*	Difference
Self-improvement in technology use in education	Between groups	4.32	3	1.44	3.17	.027*	
	Within groups	49.52	109	.45			Between groups 2 and 4
	Total	53.84	112				
Technology acceptance	Between groups	2.55	3	.85	2.69	.050*	Between groups 2 and 4
	Within groups	34.39	109	.32			
	Total	36.94	112				
Computational thinking	Between groups	1.05	3	.35	1.48	.224	
	Within groups	25.79	109	.24			
	Total	26.84	112				

*$p < 0.05$

When Table 11 is examined, it can be concluded that the self-development skills of teachers who do not attend in-service training differ in terms of their professional experience. In other words, it is seen that there is a significant difference in terms of professional experience of teachers' self-development skills in using technology in education [$F(3,112)=3.17$; $p<0.05$]. As a result of the difference seen in terms of self-improvement in the use of technology in education, post-hoc analysis was applied. Post-hoc Tukey's test was used as post-hoc analysis. According to the Tukey test results, there is a significant difference between the teachers with 6–10 years of professional experience and the teachers with 16–20 years of professional experience in favor of the teachers with 6–10 years of professional experience. When Table 11 is examined, it can be concluded that technology acceptance levels of teachers who do not attend in-service training differ in terms of their professional experience. In other words, there is a significant difference between the technology acceptance levels of the teachers in terms of branch groups [$F(3,112)=2.69$; $p=0.05$]. As a result of the difference in technology acceptance level, post-hoc analysis was applied. According to the Tukey test results, there is a significant difference between the teachers with 6–10 years of professional experience and the teachers with 16–20 years of professional experience in favor of the teachers with 6–10 years of professional experience. According to Table 11, it can be concluded that computational thinking skills of teachers who do not attend in-service training do not differ in terms of their professional experience. In other words, it was seen that the computational thinking skills of the teachers who had education did not show a significant difference in terms of their professional experiences [$F(3,112)=1.48$; $p>0.05$].

Conclusions and discussions

In this study, the purpose of this study was to investigate the differences between self-development, technology acceptance, and computational thinking skills of teachers who attended in-service training and who did not attend in-service training from different branches in primary and secondary schools.

Regarding self-development in technology use in education, there is statistical significant difference between attending in-service training and not attending in-service training in favor of attending in-service training. On the other hand, although mean scores were high, there are no significance differences between groups in terms of technology acceptance and computational thinking scales. While there is a positive difference in the level of self-development in using technology in education compared to the teachers who do not attend in-service training, there is no difference in technology acceptance and computational thinking skills. In-service trainings, which are necessary for almost all occupational groups and have a different importance for teachers, enable teachers to gain direct experience and to interact informally with other teachers and to acquire professional knowledge and skills, so they are very important at this point. (Hamilton and Richardson 1995; Marker 1999; Wight and Buston 2003). Therefore, it was seen that teachers who attended in-service training had higher self-development, technology acceptance, and computational thinking skills in terms of technology use in education than those who did not attend in-service training. Selimoğlu and Biçen-Yılmaz (2009) observed that the motivation and labor force of individuals attending in-service training increased by 90% at the end of education.

When self-development skills of teachers attending in-service training were examined in the use of technology in education, the average of primary teachers was higher than other branches. Similarly, it was found that the average level of technology acceptance of the secondary school numerical course teachers who attended in-service training was higher than the other branches, and the average computational thinking skills of the secondary school digital course teachers who attended in-service training were higher than the other branches. Despite the high average, when the range of teachers attending in-service training according to the branches is examined, there is no significant difference in the level of self-development and technology acceptance in technology use while there is a significant difference in computational thinking skills. Bundy (2007) stated in his study that the concept of computational thinking affects all fields and explained this with the study fields of the articles examined in the research are different. When self-development skills of teachers attending in-service training were examined in the use of technology in education, the average of primary teachers was higher than other branches. Similarly, it was found that the average level of technology acceptance of the secondary school numerical teachers who do not attend in-service training is higher than the other branches, and the average computational thinking skills of the secondary school numerical teachers who do not attend in-service training is higher than the other branches. Despite the mean scores are high, when the range of teachers who do not have in-service training according to branches is examined, there is no significant difference in self-development and technology acceptance levels while there is a significant difference in computational thinking skills. In a study conducted by Gökdere and Çepni (2003), they stated that the individuals attending in-service training programs had a great effect on the increase of knowledge and acquirement about the given content. Gauraba (2004) stated that there are two dimensions of in-service training in teacher and trainer training. The first of these is expressed as "a gap filler in teacher education." From this point of view, it was emphasized that it means an option that will complement the difference between the old knowledge of teachers and the new knowledge they need. Another dimension is "updating information to increase the performance and effectiveness of employees."

On the other hand, in this study, teachers' acceptance of technology was examined. As a result, in the acceptance of new technologies, the mean scores of male teachers were higher than female teachers. Due to the rapid advancement of technology, the technology acceptance model has produced different results against different technologies and individuals (King and He 2006; Šumak Heričko and Pušnik 2011). For example, a content analysis study made by King and He (2006) showed that TAM is a valid and durable model that is widely used and it has a wider applicability potentially. The technology acceptance model (TAM), a model developed by Davis (1989), was created to demonstrate how individuals accept technology and use it. When the literature is examined, studies related to TAM have been made and the power of TAM has been tried to be proved with these studies. However, in our country, it has been studied on students in general because of the difficulties in reaching sampling and because of the high cost (Turan and Haşit 2014; Şahin et al. 2019).

Considering the range of in-service teachers' self-development, technology acceptance, and computational thinking skills in terms of gender, the mean scores of male teachers are high, but it cannot be said that this relationship is significant. In a study conducted by Arslan and Şahin (2013), they stated that male teachers wanted to participate in in-service training programs slightly more than female teachers. When the range of self-development, technology acceptance, and computational thinking skills of teachers attending in-service training according to gender is seen, it is perceived that the average of male teachers is high. However, while there is a significant difference in favor of male teachers, self-development, and technology acceptance levels of teachers who do not attend in-service training, there is no significant difference in computational thinking skills according to gender. As a result of the study, it was found that there was a positive difference in the level of self-development of male teachers in educational technologies compared to the average of female teachers. In the literature, Özçiftçi and Çakır (2015) found that there is a significant difference in lifelong learning tendencies of teachers in the study of lifelong learning tendencies and self-sufficiency of educational technology standards. It was stated by Blaschke (2012) that web 2.0 tools allow teachers to direct their experiences and support the heutagogical approach by enabling them to participate actively in individual learning experiences. Thus, it is seen that heutagogy is an accurate point of view to explain the concepts of social relations and lifelong learning. In a different study, Öztürk (2006) found that the average of female teacher candidates is higher than male teacher candidates in the attitude scale towards the use of technology in education. In the study, it is seen that there is a positive meaningful relationship between teachers' acceptance of technology and self-improvement in technology usage.

Another result of this study is that the difference between professional experiences and measured variables was examined. When we look at the professional experience of teachers attending in-service training, it is seen that the levels of self-development in technology use in education are the highest between 16 and 20 years; it is seen that the level of acceptance of technology by teachers is between 1 and 5 years, and teachers' computational thinking skills are between 11 and 15 years. On the other hand, results showed that there were no significant differences in self-improvement, technology acceptance, and computational thinking skills of teachers attending in-service training according to their professional experience.

When the professional experience of the teachers who do not attend in-service training is examined, it is seen that levels of self-development in the use of technology in education are the highest between 6 and 10 years; it is seen that the level of teachers' acceptance of technology is the highest between 6 and 10 years and teachers' computational thinking skills are between 6 and 10 years. As a result, it is seen that teachers attending in-service training have more professional experience than teachers without in-service training. Arslan and Şahin (2013) state that teachers who have attended in-service training have acquired professional experience by learning new topics in terms of professional development and acquiring new experiences in professional terms. Moreover, there were significant differences of self-improvement, technology acceptance, and computational thinking skills of teachers without in-service training according to their professional experience. It is seen that as the male and female teachers' ages and experiences in the profession increase, the average decreases at the same rate according to teachers' professional experience. In other words, as teachers gain experience, it is seen that the average level of acceptance of technology and self-development levels decrease. There is a negative relationship between the professional experience of teachers and their level of acceptance of technology and self-improvement in the use of technology in education. There is a significant difference between the groups in terms of teachers' self-improvement in the use of technology in education. However, there is no difference between the groups in terms of teachers' computational thinking skills. It states that there is a significant difference in favor of individuals attending in-service training seminars at the end of the seminar. The reason why teachers with middle professional experience who have not participated in in-service training have higher computational thinking skills and technology acceptance levels compared to more experienced teachers and less experienced teachers may be due to the teachers not receiving in-service training. As a matter of fact, in a study by Sayın (2020), it states that face-to-face training will be more successful in developing coding skills. In other words, it can be said that in-service training is important in the development of these skills of teachers.

When the literature is examined, it is stated that teachers use technology as close to their own practices as possible without changing the existing educational sciences (Cuban 2001; Zhao et al. 2002). They have also tried to integrate into traditional teaching (Cuban et al. 2001; Baki 2002; Bauer and Kenton 2005; Ertmer 2005). In the studies conducted, it was stated that classroom management changed positively and significantly when educational technologies were used in the lessons and teachers who faced technical errors a few times showed negative attitude about using educational technologies (Sandholtz et al. 1997; Cuban et al. 2001; Ayvacı Bakırcı and Başak 2014; Kaplan et al. 2016). It has been revealed that teachers need the support of school administration in order to integrate educational technologies into the classroom (Becker 1994; Office of Technology Assessment, OTA 1995; Kuşkaya Mumcu and Koçak Usluel 2004; Demiraslan and Koçak Usluel 2005). It was stated that teachers need more time to plan the courses using educational technologies (Bauer and Kenton 2005). In the studies, it is stated that in order to integrate information technologies effectively, students should have information technology self-efficacy, but teachers need to devote extra time for this (Karagiorgi and Charalambous 2004; Waite 2004; Bauer and Kenton 2004; Demiraslan and Kocak Usluel 2005).

When the qualitative data obtained from teachers were examined, teachers stated that they were affected more positively by it on technology acceptance levels than quantitative data. By looking at this, clearer data can be obtained that teachers are more positive by increasing their education time or lesson hours. In the comments of the participants, it was stated that computational thinking skills and the level of self-improvement in technology use increased. As can be seen in the light of qualitative data, it can be said that education has a positive effect. Therefore, the results can be looked at by increasing the frequency of in-service training of institutions.

When the teachers who do not attend in-service training have professional experience among the groups, there is a significant difference in the levels of self-development and technology acceptance of teachers' use of technology in education. This differentiation is directed towards teachers with more professional experience than teachers with less professional experience. When the teachers who do not attend in-service training have professional experience between groups, there is no significant difference in their computational thinking skills. In the interview with teachers, it was stated that in-service training programs were beneficial for them, but they could not benefit from in-service trainings sufficiently (Yurdakul 2019). The teachers found in-service trainings necessary and useful, but the instructors were not specialized enough, the practice was far from seriousness, the practice was not included that much, errors were made on time basis, and technological equipment was insufficient (Şahin 2017). It has been stated that teachers can be used remotely (Whatsapp, mail, skype, etc.) when necessary in addition to face-to-face studies as a solution to the problem of time and space independence (Bozkuş et al. 2016). They highlighted that in-service training programs should be done regularly and at certain times in order for teachers to keep up with the reflections of the continuous changes of science and technology in education, but this cannot be done because the current in-service training is seen as a waste of time (Ayvacı et al. 2014a, b). Gültekin et al. (2018) pointed out that the teachers found it useful to announce changes in the system in in-service training programs. E-learning environments offer many advantages such as the realization of learning at the desired speed, reduced cost, and being independent of time and space (Gürpınar and Zayim 2008).

As a result of the literature, it can be seen that there is a difference in gender, branches, professional experience, and branch groups of teachers attending in-service training compared to teachers not attending it. When the technology acceptance averages of verbal course teachers are examined, the practices and trainings that will increase the technology acceptance and technology usage of verbal course teachers should be given on the result. If necessary, sources of motivation should be used. Trainings that can improve computational thinking and algorithmic thinking skills can be given to primary school teachers and verbal course teachers who are below 4.0 average in computational thinking skills. It should be stated that skills such as algorithmic thinking and computational thinking can contribute positively to problem-solving skills.

Suggestions

It is seen in the variables evaluated in terms of gender that the females have a low average. On the other hand, in-service trainings can be provided for women to improve their use of technology in education, to improve their technology acceptance and computational thinking skills, and to make them use technological products in a private classroom.

In order to benefit from the experiences of teachers who have insufficient knowledge in current technological developments, studies can be made to complete missing points they lack from developing technology.

Current course designs can be developed or existing course designs can be improved, which includes teachers who are not self-sufficient or unwilling to use new technologies.

Experienced teachers can work with teachers who have better computational thinking skills in order to improve themselves after in-service training. This working environment can enable experienced teachers to develop such skills.

Teachers who try to stay away from technology due to reasons such as lack of self-confidence and fear of using technology can be more open to use technology and if work environments with more enthusiastic teachers can be developed, teachers who are insufficient can improve themselves faster and can increase their motivation and self-confidence.

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