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Abstract

The aim of this study is to evaluate the processes of programming teaching in the context of Information Technologies and Software course. In the study where qualitative research method was adopted, teachers' answers to open-ended questions were subjected to content analysis and common themes were created. Within this scope, nine Information Technology Teachers graduated from different programs, working in different regions and different school types have answered open-ended questions. Teachers defined their knowledge as intermediate and above-sufficient in terms of block-based programming tools, and expressed themselves as beginner or not competent, especially for physical programming environments. There were both positive and negative responses for teaching computer science at an early age. Similarly, there are both positive and negative views on Information Network in Education Activity Books and Coding Guide. The number of students per computer is the most important problem raised regarding the instructional process. According to the opinions reported in terms of students, students are uninterested to the course and they do not have computers at home for practicing. The teachers stated that there is a need for teaching material for a more effective teaching process and laboratory conditions need to be improved.

Key words: Teaching programming, Opinions of teachers, Information technologies and software

Introduction

Nowadays, digital thinking, computational thinking and coding education at K-12 level has become one of the priority issues of most countries. In many countries, computer science and programming topics are included in different levels of curriculum starting from primary education, as justified by being the requirement of current era (Balanskat, 2015; Larke, 2019; Tairab, Huang, Chang, & Zheng, 2016). In Turkey, Information Technology and Software curriculum, which is updated during the academic year 2018-2019, has become mandatory for secondary school 5th and 6th grade level, and it was determined as an elective for other levels except for high schools with preparation and science high schools. In the updated curriculum, it is seen that, "Problem Solving and Programming" issues are emphasized in parallel with the trends in the World. The inclusion of computer science topics in information technology courses in schools can be considered as an innovation. Although the benefits of making computer science concepts accessible, engaging and entertaining and understandable deeply by students has been emphasized in the computer science education started to be given in schools, there is still some uncertainties and difficulties (Sentance & Csizmadia, 2017). For instance, when viewed in terms of Turkey, the appropriateness of teacher training to the new program and the pedagogical competencies of Information Technology Teachers for both the subject and the teaching of these topics are not clearly revealed. In this study, it is aimed to reveal the teachers' knowledge and skills related to computational thinking and programming at secondary school and high school level, their experience regarding the current teaching process, the main challenges and problems they faced during the teaching, and their expectations for the teaching processes to be more efficient during the implementation process of the Information Technologies and Software course curriculum. The results of the research are expected to reveal the challenges in the teaching of computer science and programming and the experiences of teachers in this process in Turkey and thus to contribute to the field.

Programming Education at K-12 Level

The orientation towards teaching computer science topics from an early age is based on the idea of providing individuals, who constitute the information society in the 21st century, with computational thinking skills. ISTE (2011) defines computational thinking as an approach that encompasses creative, algorithmic and critical thinking based problem solving, collaborative learning and communication skills and strengthens the combination of technology and thought. In addition, the purpose of students' gaining computational thinking in

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this definition is emphasized as not the advancement in the field of computer science, but rather that they adopt this thinking approach as a habit of practicing in different courses in their lives and educational processes.

While computational thinking is accepted as a concept put forward by Wing (2006) as using a series of thinking skills, processes and approaches in the field of computer science in solving complex problems, computer programming knowledge and computational thinking are issues that have been studied for a long time for different age levels. In the 1960s, Alan Perlis advocated that university students of all disciplines needed knowledge of programming and computation theory, while in the 1980s, Seymour Papert led the idea of children who developed procedural thinking skills through LOGO programming in K-12 classes (Buckingham, 1965; Papert 1980). In practice, computer programming is presented as a key application in supporting and developing computing thinking skills (Grover & Pea, 2013; Guzdial 2008). In this framework, the approaches that can be used for programming education at different age levels should be different than those that will be used for educating for professional programming. Countries have started to include this concept in their basic education programs, the number of tools developed has increased for programming knowledge and skills for different education levels. Lockwood and Mooney (2017) stated that there are 50 different tools being used, developed or integrated to gain computational thinking skills in their systematic literature review research. In addition, no consensus has yet been reached on how to acquire computing thinking skills in the easiest way by using tools and which methods should be used to measure these skills (Guzdial, 2008; Kale et al. 2018; Román-González, Pérez-González, & Jiménez -Fernández, 2017). Although there are various ongoing researches on these issues, the implementation of these topics differs in the curriculum of the countries.

Shailaja and Sridaran (2015) stated that students can understand what programming is by teaching with block-based tools such as Scratch for the algorithmic thinking and writing skills at the 3rd-5th grade levels, by writing simple programs at the 6th -8th grade levels, and then code-based programming environments such as Basic, Visual Basic can be introduced and finally programming languages such as Phyton and Java can be given at the 9th-12th grade levels. Hiltunen (2016), on the other hand, emphasized that programming should start first with logical “real life” games and digital game based learning environments, and that it can be continued with syntax based code based interfaces after activities with drag-and-drop interfaces. On the other hand, as a completely different approach, Mike Fellow in the 1980s defined the "unplugged" computer science approach, and it started to attract attention since 2003. In this unplugged approach; it is emphasized that mathematics and computer topics can be taught to children or adults through storytelling and drama, and primary school children can learn advanced computer science concepts with this method (Bell, Rosamond, & Casey, 2012). In Turkey, it is stated that open-source and free programming tools should be used for teaching programing concepts in the Information Technology and Software course curriculum which is mandatory for 5th and 6th grades (MEB, 2018). While studies that try to define what and how we should teach are ongoing, studies also emphasized the limitations such as lack of knowledge and experience of teachers about programming tools, infrastructure deficiencies in countries with insufficient resources, and lack of resources and tools that teachers can use in their teaching processes (Heintz, Mannila, & Färnqvist, 2016; Lockwood & Mooney, 2017).

Another prominent subject in programming education is that the levels of computer science education and pedagogical knowledge of teachers teaching in different primary and secondary schools differ from each other (Diethelm, Hubwieser, & Klaus, 2012). In Turkey, K-12 level, mostly secondary school level, computer teachers graduate from Computer Education and Instructional Technology (CEIT) Departments of Faculty of Education. With reference to the 2018-2019 curriculum, it is known that up to now, pre-service ICT teachers have not taken any courses related to programming education (such as tools and teaching approaches), although they have taken some courses related to programming. In addition, the Higher Education Council has updated CEIT curriculum which is valid since 2018-2019 academic year with adding some courses in the form of "Learning and Teaching Approaches in Informatics" and "Programming Teaching Approaches". Since the pre-service teachers who will take the specified courses will graduate approximately 3 years later, it can be said that the in-service Information Technology Teachers do not receive any training on programming teaching.

According to the research conducted by Yükseltürk and Altıok (2015, 2016) regarding the CEIT curriculum before the 2018-19 academic year; pre-service teachers believed that they did not have sufficient knowledge about visual tools and current methods related to programming, although they considered themselves sufficient to explain programming at K-12 level. Similar situations exist in other countries. In a study that investigates the successful teaching approaches and difficulties faced by 339 Computer Science Teachers who teaches programming at primary and secondary level in the UK, it is stated that some of the difficulties experienced by teachers in their teaching processes are due to their own internal and external reasons and the others is due to students (Sentance & Csizmadia, 2017). The internal difficulties are related with the lack of self-confidence of teachers on this topics and their inadequate knowledge in determining appropriate pedagogy; external difficulties are related with insufficient educational resources. In addition student-related difficulties are stated as their understanding the teaching content and problem solving. In this regard, it is stated that it is beneficial for teachers to get more detailed education in order to improve their pedagogical skills and to produce more instructional resources (Sentance and Csizmadia, 2017).

In Turkey, the number of studies revealing the positive and negative aspects of Information Technology and Software education program from various perspectives is still limited. The study carried out by Yecan, Özçınar and Tanyeri (2017), which can be considered similar to this research, focuses on the study of only visual programming teaching. It is also seen that the study is carried out for the curriculum before the 2018-19 academic year. Similarly, there is another research conducted by Cevahir and Özdemir (2017), which is conducted before the updated curriculum and is focused only at the level of Vocational and Technical Anatolian High School. In this context, although there are studies (Göncü, Çetin, & Şendurur, 2020) are similar to the scope of this research, there is no evaluation study regarding the Information Technologies and Software education program, which is started to be implemented since 2018-2019 academic year, and focusing on and especially problem solving and programming topics that have gained importance in the program from the perspective of teachers.

One of the most important factors that determine the successful implementation of the changes made in a curriculum is the level of teachers' adoption of the program and their opinions regarding the program. Although the updated curriculum started to be implemented in all schools since the 2018-2019 academic year, it is also known that some Information Technology Teachers still carries out their educational processes in the 5th and 6th grades according to the previous curriculum. It is important to reveal the reasons for this in order to contribute to the successful and qualified implementation of the program. In this context, it can be said that here is a need to determine the level of knowledge and skills of teachers, by focusing on their content-related and pedagogical competencies especially related to programming education topics which gain more importance for the implementation of the new curriculum.

Purpose of the Study

The aim of this research is to analyze the views of Information Technology Teachers based on their experience in programming teaching. In other words, it is the evaluation of the process of programming teaching within the scope of Information Technologies and Software course from the perspective of teachers. Knowledge and experience levels of teachers about programming environment and approaches (such as unplugged coding, text / block-based programming, physical programming and object-based programming), and their use cases in their lessons are examined. Teachers' opinions about Activity Books, Coding Guide and other teaching materials (video, animation, presentation, etc.) published in EBA for teaching the learning gains about programming, and the resources they use other than EBA were also examined. In addition, their views about programming teaching (such as, do they suggest teaching at early ages), their views on computational thinking, and interpreting the relationship between computer programming and computational thinking were analyzed.

Method

The study was carried out within the framework of a qualitative research paradigm. One of the qualitative research approaches, the research design has been determined as a phenomenology research. It is aimed to reveal common points in the experiences of the participants with phenomenology (Johnson & Christensen, 2004, p. 365). Descriptive analysis was applied to the data collected in the research. Descriptive analysis is a qualitative analysis method in which the data collected with qualitative data collection tools are summarized and interpreted according to previously determined themes (Yıldırım & Şimşek, 2013). In this context, it has been tried to systematically describe the opinions of information technology teachers with different demographic backgrounds about programming teaching.

Participants

The participants were selected via convenience sampling in accordance with the purpose of the study. In order to increase the diversity of the data obtained for the purpose of the research, in determining the participants, information technology teachers who teach at different school types, graduated from different degrees, and have different expertise levels tried to be determined. For example, although there were more teachers available in the province where the researchers were working, participants from different provinces were intentionally reached. The reason behind this strategy was to reduce the similarities and to increase diversity. Participant Teachers are coded with abbreviation PT.

The participants were tried to be chosen to represent the Information Technology Teachers (ITTs) at the maximum level, as can be seen from Table 1. Among ITTs, there are also graduates of Technical Education Faculty (TEF) (PT4 and PT7). Similarly, although ITTs generally work at the secondary level, there are also a small number of ITTs working at high school level (PT5). Although it is suggested to be taught as an elective course at the high school level, "Problem Solving and Programming" topics have gained importance in the

Computer Science curriculum as of 2018-2019 academic year. This was also taken into account when determining the sample and an Information Technology Teacher working in high school was also included in the participants, purposively. The participants expressed, in general, their school's academic quality around average. A teacher who worked in a district (PT2) in Muş and in the central district of Kocaeli (PT7) expressed it as "below average". The teachers' years of work experience ranged from 1 to 15 years. Six teachers had 10 years or more experience, while three teachers were in the first 3 years of their professional life (PT1, PT2, and PT3). All teachers, except two teachers (PT1 and PT3) who were working in a private school, were working in public schools

Table 1. Basic demographic information of the participants

Code	Graduated from	City	School	Type	Location	School Quality	Experience
PT1	CEIT	İstanbul	Secondary School	Private	Central District	Average	1 year
PT2	CEIT	Muş	Secondary School	Public	District	Below Average	2 years
PT3	CEIT	Kocaeli	Secondary School	Private	Central District	Above Average	3 years
PT4	TEF	Kocaeli	Secondary School	Public	Central District	Below Average	12 years
PT5	CEIT	Samsun	High School	Public	Central District	Average	13 years
PT6	CEIT	Samsun	Secondary School	Public	Central District	Average	13 years
PT7	TEF	Kocaeli	Secondary School	Public	Rural	Below Average	14 years
PT8	CEIT	Samsun	Secondary School	Public	Central District	Average	14 years
PT9	CEIT	Kocaeli	Secondary School	Public	Central District	Above Average	15 years

Data Collection and Analysis

The questions developed by the researchers were grouped in three categories. The first category questions were related to demographic information of the teachers. The second category included questions to reveal the knowledge and experience levels of teachers about programming teaching at K-12 level. The final category focused on instructional processes of teaching programming. This category had questions to examine teachers' experiences about instructional processes of programming teaching, to reveal the problems they faced and their expectations for better instructional environment.

In order to gain comprehensive data on programming teaching at K-12 level and on the implementation of the renewed curriculum, the diversity of teachers participating in the study was tried to be achieved. For this reason, the demographic questions in the interview form included questions about graduated university, city of work, level of school, type of school (private or public), level of teaching experience, the number of laboratories and computers in his/her school, the average number of students, etc.

Following the demographic questions, the questions were asked to the teachers in order to reveal their level of experience and competencies about programming in general and in particular programming teaching at K-12 level. For example, the participants were expected to express their level of knowledge about programming with the question: "Please write the names of the programming environments or tools you have experience with?" The form included questions about how long the participants have taught programming subjects for programming teaching at the K-12 level, whether they have participated in a training program on this topic, and their level of knowledge about the programming environment and tools at the K-12 level. Another question was "Please indicate your level of experience regarding the programming environments and approaches below (options such as unplugged coding, text-based coding tools or environments, block-based programming tools or environments, physical programming or microprocessor programming)". With this question, it was tried to reveal the knowledge levels of teachers about programming environment and tools at K-12 level.

In order to analyze their competencies related to programming teaching at K-12 level, the participants were asked open-ended questions about computational thinking, teaching programming at early ages, and programming environments, methods and approaches used at K-12 level. For example, the question "What do you think about frequently used concepts such as 'computational thinking, procedural thinking' in recent years? How would you describe it?" was related with computational thinking. "Can you provide an example explaining the teaching methods, techniques and activities you use in your lectures?" was asked to reveal the methods teachers' use in programming teaching. The question "what programming environments (unplugged, block-based, code-based, physical programming) do you think would be effective for programming teaching? Can you explain why? " was asked to analyze the knowledge levels and competencies of programming teaching approaches.

In addition to above questions, to reveal the experiences of teachers in instructional process; the programming environments, teaching methods and materials, assessment approaches they used in their lessons were asked. In order to find answers for the problems experienced by teachers in the teaching processes the questions asked were "What are the problems you faced with in your lessons in terms of instructional environment?" and "what are the difficulties you encounter in your lessons when you consider your students?" In order to reveal the teachers' expectations in terms of the efficiency of the teaching process, "what do you think you need for more efficient instructional processes? (e.g. textbook, materials, etc.)" and "If I have ...., I will teach this this course better? What do you think that you need?" questions were asked.

After developing the questionnaire based on the three categories mentioned above, an Information Technology Teacher, an expert from Computer Education and Instructional Technology, and an expert from informatics were consulted to examine the questionnaire. The questionnaire, which was finalized in line with the suggestions of the experts, was shared with the Information Technology Teachers who agreed to participate in the research. Due to teachers' presence in different provinces and their workload, the questionnaire was sent via e-mail. Questionnaires were e-mailed to teachers in the second week of April 2019, and their answers were received in the end of third week of April 2019. That is the data collection process was completed in two weeks.

During the analysis of the data, demographic data were mostly quantified. Open-ended questions were first subjected to content analysis by two researchers separately. Afterwards, the researchers' separate analyzes were combined and an agreement was tried to be reached. In this second round, a total of 29 open-ended questions were jointly analyzed. Within these 29 questions, there were 24 mismatches among the researchers' separate analysis of 81 answers of 9 questions. As a result, researchers' open-ended analysis mismatch was 29.6%. In line with the questions asked three main themes explained above, the results of the joint analysis were also brought together under these categories. In order to increase the credibility of the research due to the low number of participants and nature of qualitative research, the findings were mainly presented with direct quotations from the participants' opinions.

Results

Knowledge and Skill Levels of Information Technology Teachers about Programming Tools

Only one of the ITTs (PT2) participating in the study expressed his experience in the field of programming as average. All other participants stated their experience in the field of programming as above-the average. Two teachers (PT1 and PT8) were highly interested in programming, 6 teachers (PT2, PT3, PT5, PT6, PT7, and PT9) were moderately and 1 teacher (PT4) was very low. Knowledge and skill levels expressed by ITTs regarding their K-12 level programming tools are presented in Table 2.

As can be seen from Table 2, ITTs defined their knowledge and skills on block-based programming tools as intermediate and above, while expressing their knowledge and skills on physical programming environments as either beginner or not competent. Regarding unplugged coding, most teachers describe themselves as having a medium and higher level of knowledge and skills, while in text-based coding tools, the majority expressed themselves as beginner or not competent. Based on these findings, it can be stated that Information Technology Teachers participated in this research thought that they had competencies related to block-based tools and environments, but they were not competent in text-based environments and physical programming.

The teachers expressed the programming environments they had experience with as Scratch, VB / C #, Arduino, Mblock, Code.org, Blockly and ThinkerCad. As it can be seen from Figure 1 that 8 teachers indicated that they had experience with Scratch. Six teachers indicated that they had experience with Arduino, four with Mblock, four with Code.org, three with Blockly and 2 teachers had experience with ThinkerCad.

Table 2. ITTs' views on their knowledge and skill levels for programming tools

Code	Professional Experience	Unplugged Coding	Text-based coding tools	Block-based programming tools	Physical programming tools
PT1	1 year	Intermediate	Beginner	Advanced	Not competent
PT2	2 years	Intermediate	Beginner	Advanced	Not competent
PT3	3 years	Intermediate	Intermediate	Intermediate	Intermediate
PT4	12 years	Intermediate	Intermediate	Intermediate	Beginner
PT5	13 years	Intermediate	Intermediate	Intermediate	Not competent
PT6	13 years	Intermediate	Beginner	Intermediate	Beginner
PT7	14 years	Beginner	Intermediate	Intermediate	Intermediate
PT8	14 years	Not competent	Not competent	Advanced	Not competent
PT9	15 years	Above intermediate	Beginner	Advanced	Beginner

Considering these statements, it is noteworthy that the teachers mostly emphasized block-based tools as programming environments. The fact that they have expressed VB and C# as text-based programming environments may be because they had used these environments as programming tools during their teacher training programs. On the other hand, teachers stated that they also had experience with physical programming environments, but as it can be seen in Table 2, that they didn't see themselves competent for these environments.

As it can be seen in Figure 1, the number of teachers expressing their experience with Blockly was only 3 (PT1, PT4, and PT15). However, the source book of the Ministry of National Education, 5th grade Information Technologies and Software course have learning gains that include the use of the Blockly programming environment. The related learning gains are included in "5.2.12. Programming is a kids game", "5.2.13 Lost in the labyrinth", "5.2.14 I'm flying like a bird", "5.2.15 I'm as fast as a turtle","5.2.16 Problems we can solve with Blockly "and "5.2.17 I'm making a movie" topics.

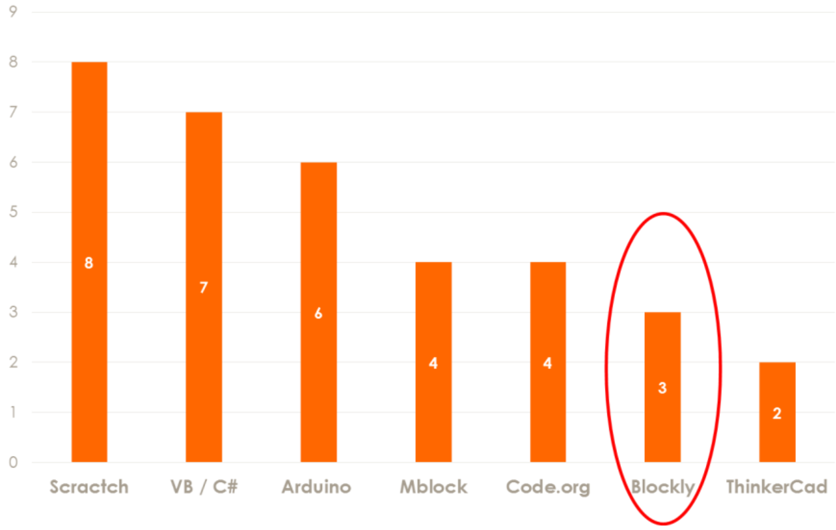

Figure 1. Tools experienced by Information Technology Teachers

Views of Information Technology Teachers on Teaching "Computer Science" Subjects at K-12 Level

Teachers' perceptions about a topic may affect how they value the topic and care about teaching process. In this study, Information Technology Teachers were asked about their opinions on teaching of computer science. The results about their opinions on teaching of computer science at an early age and whether other branch teachers can teach computer science or not are presented below.

The ITTs participated in this study had both positive and negative responses about teaching of computer science at an early age. Teachers who responded positively said; "*It should be definitely provided as it will improve analytical thinking*" (PT4), "*It should be continuously provided starting from the elementary school just as English classes*" (PT7), "*It will be useful, it will contribute to students' problem-solving skills*" (PT5); whereas the teachers with negative responses claimed "*There is no need in primary school. It can be introduced with other courses from secondary school*" (PT6), "*It may be provided at an early age but the application must be done very carefully in order not to cause any kind of addiction since the game, social media, computer and technology etc. addictions are becoming more and more common nowadays*" (PT9) and "*These systems force children physiologically, psychologically and ergonomically to become addicted to the screen causing excessive attention loss and eye problems at a very young age*" (PT3). One of the participants (PT1) stated that the concepts focused on the process of teaching computer science were wrong, saying "*We are so obsessed with teaching tools and language while our aim should be gaining numerical thinking skills. Parents think no coding is possible without a computer. Ethics and Security issues are ignored (Digital Citizenship)*".

In addition, the level of knowledge and opinions of participants on computational thinking were investigated by asking "What do you think about frequently used concepts such as 'computational thinking, procedural thinking' in recent years? How would you describe it?" The ITTs defined computational thinking with some short conceptual expressions such as "problem solving, critical thinking, algorithmic thinking, coding, artificial intelligence interaction, producing different solutions, the process of solving problems with the help of a computer, thinking like a computer". It was observed that they could not deepen their definitions on the concept. For this reason, it was concluded that the teachers participated in this research did not have an idea that they could justify and express clearly on computer science teaching at K-12 level.

In the study, the opinions of the participants on whether other branch teachers can teach computational-thinking related subjects at K-12 level were also asked. As stated in Directorate of Basic Education official letter dated 25.09.2018, Information Technologies and Software Curriculum (Grades 1-4) prepared to be implemented in primary schools. The course was planned to be taught during free activities or extracurricular times on a voluntary basis. It was also stated in the same article that the curriculum would be taught by the primary school teachers and support from the ITTs could be asked if needed.

Primary school teachers do not get any training for programming teaching and specifically for algorithms during their undergraduate education. However, STEM (Science-Technology-Engineering and Mathematics) and STEAM with art added, have been frequently mentioned in recent years along with computer science teaching at K-12 level. It is pointed out that various branch teachers should include computational thinking approach and programming/algorithm skills in their courses. In this context, the views of ITTs on whether other branch teachers (especially primary school teachers) can teach programming related topics are examined in this research. While two of the participants (PT2 and PT4) sharply stated that "*they definitely cannot teach*", one participant (PT3) claimed "*No, they cannot teach, but different branch teachers (e.g. science teachers) are forced to teach.*" Another participant (PT5) said "*They should not get involved in teaching programming. I see this something for visibility*" Other teachers, on the other hand, said that they can "*teach*"; "*They can teach if they get education (with the necessary education, if they receive very good education, if they receive in-depth education)"* (PT1, PT6, and PT8), "*They can teach on primary level and at no-computer activities*" (PT7 and PT9). It can be said that the majority of ITTs participated in this research believe that programming can be taught by other branch teachers at a very limited level "*only if they get the necessary education*". In addition, one teacher who worked in the private school and had a professional experience for one year (PT1), gave a positive response about this issue but also claimed that they could not perform it well enough. PT1 stated his views as follows:

> "*I gave coding training to kindergarten and primary school teachers during the seminar period. But the most important thing I noticed during the training was that the teachers did not own this course. In other words, someone who has never done code-based programming in their life should not teach coding lessons. Arduino, which is just a tool for us, is a goal for them*."

It is a fact that regardless of the level of education, tool-based, popular practices that do not really support students/children's computational thinking skills are not useful when learning gains are taken away from the focus. The teacher's experience on the subject also constitutes the idea that there may be a compulsory orientation to teachers in different fields, especially in private schools. PT3, who teaches at a private school, also said that different branch teachers are forced to do so.

The teachers participated in this research thought that "problem solving and programming" topics in the Information Technologies and Software Course curriculum will be beneficial to the students. However, all of the participants emphasized that the compulsory courses in the 5th and 6th grades of secondary school are not sufficient for teaching these subjects. The teacher who teaches at a private school (PT1) stated that these courses started in kindergartens in private schools and they should also start at an earlier age in public schools; while all other participants said that the compulsory education given in the 5th and 6th grades within the scope of the Information Technologies and Software courses should be continued at the latter grades.

Teachers thought positively about programming issues gaining weight in the curriculum. However they stated that the current teaching process is inefficient. For example, a participant who teaches at a private school and has 3 years of experience (PT3) stated; "*It seems emphasized but we can't go beyond a robot following a black line. We cannot switch to algorithmic thinking*", and added:

> "*These attempts at public schools remain very superficial and the process does not operate efficiently since it is not based on any infrastructure. ... The field of information technologies seems more prominent in private schools, but only robotic coding is provided as an advertising campaign without considering its instructional efficiency*."

Similarly, a teacher who worked in a public school (PT5) said; "*More emphasis should be placed on algorithmic thinking, but we don't go beyond simple robotic applications*." PT7 and PT9, who had more experience than the other participants and worked at public schools at the western part of the country, emphasized the inadequacy of computer labs and stated that the time reserved for courses are not enough. PT8, who was also a public school teacher, underlined that "When it comes to the implementation of the curriculum teachers are left alone, and there is a lack of material for teachers and schools in all conditions."

Based on these statements, it can be summarized that the general views of the participants on Problem solving and programming gains given more weight in the curriculum were positive and they also agreed on introducing these subjects at an earlier age and to be continued later on. However, it was also derived that they emphasized the insufficiency of duration of lessons for the process of programming teaching, and that the current practices do not actually serve the knowledge and skills that are intended to be taught.

Information Technology Teachers' Views on Information Network in Education (EBA) Portal

Informatics Network in Education (known as EBA) Portal is defined as "an entertaining portal established to communicate between teachers and students and to provide materials they can use throughout their educational lives" (EBA, 2019). In this context, it is the primary reference source especially for course content and teaching materials for teachers in Turkey including ITTs. In this research, the questions were asked to the teachers to get their opinions about the Activity Books, Coding Guide and other instructional materials in EBA which they utilize in teaching process of problem solving and programming and if exists any other reference sources other than EBA.

Both positive and negative opinions were expressed about EBA Activity Books and Coding Guide. The teachers expressing positive opinions generally made superficial statements such as: ""*sufficient*" (PT2), "*good for the beginning*" (PT6), "*better than past*" (PT9), "*there are good examples*" (PT2). It can be said that negative expressions are also expressed as general terms. For example, they expressed their negative opinions as "*not enough*" (PT7, PT8), "*must be enriched by exemplary practices*" (PT4), "*there isn't any activity book at high school level*" (PT5).

The participant teachers were also asked about their opinions regarding the Coding Guide in the EBA. Although teachers were not entirely negative, it has been observed that they offered suggestions on how to improve this resource. There were three teachers who stated briefly and very positively about the Coding Guide. One of them made the statements as "*successful*" (PT2), the other as "*sufficient*" (PT6) and the last one as "*beginner*" (PT9). Other teachers expressed their views about the Coding Guide as follows: "*It could be a guide that could be explained by simplifying it more to student level* "(PT8),"*there are good examples but they are very inadequate*"(PT7) and "*must be enriched with sample applications with digital contents*"(PT4).

Apart from the Coding Guide presented on the EBA portal, the teachers' views on other teaching materials related to problem solving and programming were also found to be negative. In the opinions regarding the teaching materials in the EBA portal; it was seen that only two teachers stated positive opinions with the expressions of "*successful and functional*" (PT6) and "*there are good instructional videos and lesson content*" (PT2). On the other hand, 6 teachers stated negative opinions. These teachers expressed their opinions as "*amateur and inadequate*", "*there are few materials and they are inadequate*", "*although there are very good examples but still very inadequate*", "*inadequate*" and "*contents are below average*". One of the teachers teaching in private school (PT1) stated that he did not browsed the resources in EBA.

Based on the teachers' views about EBA, it can be concluded that the participant teachers place more emphasis on activity-based content than just content presentation. Considering the fact that the teachers presented their views about the teaching materials in EBA in the form of suggestions, it can be said that their need for instructional materials (video, audio, poster, infographic, etc.) they can use during the lesson process are quite high.

Instructional Processes of Information Technology Teachers

In order to examine the experiences of ITTs in the process of teaching problem solving and programming; the questions about programming environments, teaching methods, instructional materials, assessment approaches they used, problems they experienced, and their suggestions for possible solutions were asked.

When the responses of the teachers to the questions regarding the teaching methods and techniques used in their lessons were analyzed, it was revealed that they mostly (8 teachers) teach with demonstration. The teachers explained the teaching methods and techniques used in their lessons. They stated that they use demonstration method (9), problem-based scenarios (7), expository teaching (2) and flipped classroom strategies (1). Teachers stated that they use Youtube (5), Udemy (5), Scratch (1), Pinterest (1) and corporate resources (1) other than EBA while preparing their lessons. The teachers indicated that they mostly have their students watching videos presenting recorded screen (6) during the teaching process in their classrooms. Other main strategies the teachers utilized during teaching have emerged as PowerPoint presentation (5), worksheet (4), textbook and step-by-step instruction (1), and presenting problem-based scenarios (1). Eight teachers stated that they their learning environment was student-centered, while one teacher (PT9) stated that he teaches more teacher-centered.

The "How much time do you spend on introducing the interface of the programming tool you use in your lessons?" question was directed to the teachers. The teachers stated that they spent an average of 30% of their lesson time. According to the analysis of the answers to the questions about the activities and measurement and evaluation approaches used in their lessons; two teachers (PT7 and PT9) stated that they prepared the instructional activities themselves. It was revealed that the other six teachers stated that they adapt the examples from the Internet and EBA. However, a teacher (PT3) stated that he had to use corporate resources.

According to the analysis of the questions related to the measurement and evaluation approaches used, the teachers stated that they preferred to prepare two written exams for official grading. The Ministry of National Education requires teachers to enter two exam scores to their online system. In addition to this, 7 teachers (PT1, PT3, PT4, PT5, PT7, PT8, PT9) stated that they use project, 2 teachers (PT5 and PT6) stated that they prepared an exam to be held at computer, 2 teachers (PT4 and PT1) were using Kahoot activities and 4 teachers (PT3, PT6, PT8, PT9) were using rubrics for measurement-evaluation purposes.

According to the findings, although the majority of the participant teachers stated that they used student-centered methods in their lessons, it can be said that they use the student-centered learning approach to a limited extent when their expressions regarding the teaching methods and techniques they use are taken into consideration. However, it is also noteworthy that only two of the teachers stated that they develop the teaching materials. When the findings were evaluated in terms of measurement and assessment approaches, the majority of the participant teachers (7 teachers) stated that they design and implement a project study, but only four teachers stated that they used rubrics during the evaluation process. It was observed that they did not specify any measurement and evaluation activity other than Kahoot and computer-based examination for testing students' skill to accomplish a given task. According to this; it can be concluded that the assessment and evaluation methods used by teachers are not sufficient in terms of student-centered learning approach.

Basic Challenges and Problems Faced During Teaching Processes

The main challenges and problems faced by ITTs regarding the teaching of problem solving and algorithm were analyzed under two main categories, which were in terms of classroom environment and students. In terms of classroom environment, 5 teachers (PT1, PT4, PT6, PT7, and PT9) expressed that the number of students in their classes was more than they should have been. The teachers generally expressed their class sizes in 20-25 range. At this point, from the answers analyzed in detail; it was understood that they actually emphasize the number of students per computer. Based on the information provided by the teachers, the average number of students per computer in their classrooms was around 1.5. There were 4 teachers (PT4, PT5, PT6, and PT9) who stated that the computers in their computer laboratories were inadequate (old). In addition, one teacher (PT8) stated that he did not even have a computer laboratory that he taught his lessons on the interactive board. Only one of the teachers participating in the research stated that he had no problems with the hardware / physical environment during teaching (PT3), but it should be underlined that this teacher works in a corporate private school.

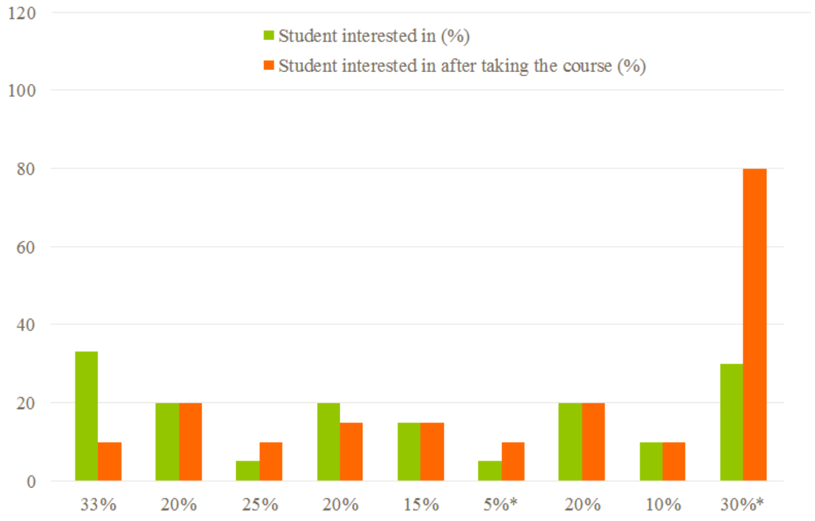

Figure 2. Students' interest in information technologies and software course

The problems expressed by the teachers in terms of students were that students were not interested in the lesson content and most students do not have computers at home. Five teachers (PT1, PT3, PT4, PT7, and PT9) stated that one of most important problems was that their students were not interested in the Information

Technologies and Software course. In order to deepen the answers, teachers were asked “How would you express the ratio of your students who are especially interested in computer programming in your lessons to the class size?” and “Do you have any students interested in computer programming after taking your course? If yes, how would you express the ratio of this situation to class size?” Based on the data graphed in Figure 2, it is seen that the highest interest expressed by the Information Technology Teachers is 33%. The Information Technology Teacher (PT8), who stated that the interest of his students in the course was 5%, was a teacher who worked in a school without a computer laboratory. When the opinions of the teachers are evaluated in general, the interest of their students in the course was determined as 19.8%.

In Figure 2, the percentage of students whose interest increased after the course was asked to determine the percentage of students whose interest increased after the students' participation in the course. Except for the teacher (PT2) working in Muş (he stated that the interest of his students increased by 80%), other teachers stated that their students' interest in problem solving and programming didn’t increase after participating to the course.

Based on these findings, it can be emphasized that the Information Technology Teachers who participated in the research had problems related to the hardware and physical environment for teaching problem solving and programming issues. The teachers thought that their students' interest in the course was insufficient than they expected.

Information Technology Teachers' Expectations in Terms of Efficiency of Teaching Process

In order to reveal the expectations and opinions of ITTs especially for teaching computer science subjects at the K-12 level, which gained weight with the updated program, “what do you think you need for more efficient instructional processes? (e.g. textbook, materials, etc.)” and “if I have ...., I will teach this this course better? What do you think that you need?” questions were asked. As can be seen in Figure 3, the expectations of the teachers participating in the study were gathered under 5 themes: teaching materials (6), learning environment conditions (6), interested student (2), time (2) and parent support (2). In their responses to above question, 5 of the 9 teachers emphasized the need for teaching materials for their course processes. For example, the teacher (PT1), who had 1 year of professional experience, underlined the need for instructional materials by stating “*I am having trouble finding materials. There are a lot of examples on the internet, but there are no materials to be shared with students*”. The other teachers who also emphasized the need for material expressed their views as “*we need course materials*” (PT5), “*textbook and material*” (PT4), “*textbook, lack of resources*” (PT2), “*activities appropriate for the age group*” (PT3), “*course book with rich digital content*” (PT8).

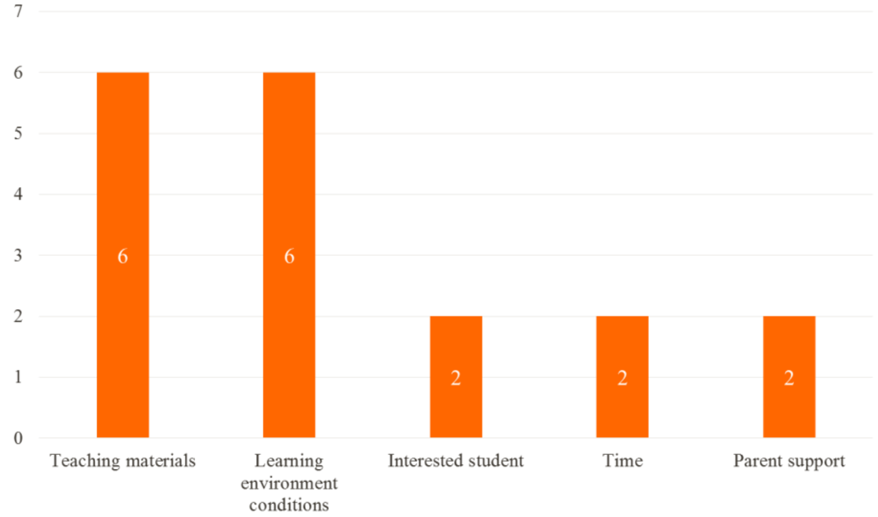

Figure 3. Teachers' expectations for their lessons to be more effective and efficient

The most coded second theme was “learning environment conditions” under the expectations of the participant teachers, can be seen in Figure 3. Under this theme, four teachers (PT4, PT6, PT7, PT9) expressed the need for improvement of their laboratory conditions. Another teacher (PT8) stated that there was no computer laboratory in his school and emphasized the need for financial resources for laboratory equipment. One teacher (PT3) suggested that class sizes should be reduced under the same theme, for reducing the number of students per computer. Some of the opinions of the participant teachers coded under the theme of learning environment conditions were “*the PCs are insufficient and the materials to be taught are not as many as the number of students*” (PT4), “*the class sizes should be less*” (PT6) and “*the number of computers is not adequate and there should be one computer for each student.*” (PT9)

Other themes created under the expectations of teachers were interested student, time and parent support. The teacher who emphasized the importance of the interest of students to the course was teaching in a school in a central district in the west (PT7) and stated his opinion as "*students are naughty and not want to learn. If they would eager...*" Another teacher (PT9), who worked in the secondary school of the city center of the same province said "we cannot cope with students' perception of computer equals games and social media. We try to convince students who are afraid to touch the keyboard; I wish they were curious lambs with shining eyes." The teachers emphasizing student interest also emphasized parent support. They expressed their opinions as "*parents should not be the only ones who hand over the students to the teacher. They need to support the student's learning process*" (PT7), and "parents should be as eager and concerned as a student" (PT9). Teachers whose opinions were coded under the theme of time stated their opinions as "*a wide time period, sufficient time should be given for efficient teaching*" (PT3) and "*we need more hours of teaching*" (PT6).

Based on these findings, the expectations of the teachers participating in this research regarding their courses, especially for teaching of problem solving and programming subjects were the need for instructional materials, hardware equipment and laboratory conditions and class sizes. In addition, it can be said that for effective and successful teaching processes teachers emphasized the need for interested students in the course subjects, increasing lecture hours, and student-parent participation.

Discussion

The aim of the research is to analyze the opinions of Information Technology Teachers based on their experience in programming teaching. In other words, it is the evaluation of the process of programming teaching within the scope of Information Technologies and Software course from the perspective of teachers. The knowledge and skill levels of the teachers regarding the subjects gaining weight in the program were examined. Their experiences about programming teaching and problems regarding their teaching-learning processes were revealed. Teachers' expectations were examined for a better teaching process.

It was seen that ITTs participating in the study considered their knowledge and skills levels for block-based programming environments intermediate and above, but their knowledge and skills levels for text-based and physical programming environments were not sufficient. Göncü, Çetin, and Şendurur (2020) also reported in their studies that teachers also lack of knowledge in terms of technological, pedagogical and content area knowledge regarding coding education. The current Information Technologies and Software course curriculum, which is taught as a compulsory subject in the 5th and 6th grades of secondary school, is on block-based tools. In addition, block-based programming environments have a simplified structure in terms of teaching programming (Dağ, 2019). For these reasons, teachers are thought to develop themselves on block-based tools. The teachers' emphasis on Scratch among other block-based programming environments may also be due to the fact that Scracth is one of the most preferred block-based environments (Hsu, Chang, and Hung, 2018), which is also included in the current curriculum.

On the other hand, it is important to emphasize and discuss that the level of knowledge and skills of the participating teachers in other programming environments is limited, except for block-based environments. Similarly, Göncü, Çetin, and Şendurur (2020), in their work with 22 Information Technology Teachers, stated that teachers do not have sufficient knowledge of other programming environments. Considering the secondary and high school education programs starting from 2018-2019 academic year, it is seen that Small Basic is used as a text-based programming environment in the teaching of programming concepts at the secondary school level, and Phyton language is the focused programing language in the high school textbook. However, the teachers participated in this research never mentioned about these programming environments when they expressed their knowledge and experiences. In recent years, interest in physical programming (national / international robot competitions activities, private schools extra courses and etc.) has increased. In addition, as mentioned above, there are learning gains that include text-based and physical programming in both secondary and high school level computer science teaching programs. Considering all these, it can be stated that it is necessary to provide professional development in text based programming environments and physical programming that can be used especially for K-12 level.

In this study, knowledge levels of Information Technology Teachers related to computer science teaching at K-12 level were also examined. Considering the findings of the research, although the perspectives of Information Technology Teachers towards teaching computer science from a young age were positive, it was seen that their knowledge level was not sufficient in terms of computational thinking as a concept that reflects their professional competencies regarding this perspective. In addition, it has been noticed in the in-depth analysis that teachers have limited knowledge about the methods and approaches used in developing computational thinking. Computational thinking is expressed as a form of literacy, but it is also a multidimensional and complex concept (Barr & Stephenson, 2011; Bundy, 2007; Selby, Dorling, & Woollard, 2014). In Turkey and many more countries, new studies related to computational thinking has been carried out.

On the other hand, there is a need for qualified evidence for students' learning. Similarly, there is a need for studies on how teacher education should be carried out. There is also a need for evidence to help decide on the effectiveness of all these initiatives for information technologies (Snow et al., 2019).

Although computational thinking and programming issues are expressed as learning gains in curriculums, different approaches are required in teaching these gains. Because training a computer programming and teaching computational thinking are different. There is no complete consensus worldwide about which programming environments and methods should be used in order to teach computing thinking skills in the easiest way and how to evaluate it (Guzdial, 2008; Kale et al., 2018; Román-González, Pérez-González, & Jiménez-Fernández, 2017).

To help teachers develop a clearer, theoretical and practical understanding of computational thinking skills, in addition to the computational thinking skills in the curriculum, issues such as determining the effective methods and techniques that teachers can use for the development of computational thinking at different levels of education, and how to evaluate the development of computational thinking are still being explored (Ching, Hsu, & Baldwin, 2018; Grover & Pea, 2013). In this framework, as it is aimed in this research, there is a need for analyzing the situation of teachers in terms of programming teaching at K-12 level and determining their needs. It can be said that findings such studies will be useful in planning the activities for professional development of teachers.

The teachers participating in this research; in fact, stated that they are qualified for teaching unplugged coding, an approach to teaching computer science. Unplugged coding is an approach that allows students to focus on variety of problems for problem solving skills (Bell, Alexander, Freeman, & Grimley, 2009). This approach is an activity-based approach in which students can participate actively through individual or group work, and it is an approach that should be taken into account in terms of its contribution to the development of computational thinking as it is based on activities that can be applied in class or outside the classroom (Bell et al., 2009; Lamagna, 2015).

In the current curriculum and various sources, mostly maze-type unplugged activities for teaching the logic of the algorithm are included and these activities are used by the teachers. Accordingly, it can be thought that the teachers participating in this study interpret their competencies in unplugged coding mostly within the framework of maze-type activities. While expressing opinions about the possible competencies of different field teachers in programming teaching, participants' (PT7 and PT9) statements that “other fields teachers can teach with unplugged activities” might be presented as an evidence to support the idea of maze-type activities. At this point, it can be said that ITTs who participated in this research did not think deeply about unplugged computer science. Computational thinking, which forms the basis of the emphasis on computer science at the K-12 level in the world, is not necessarily a thinking approach used to solve problems related to a computer, but a thought approach used to solve problems in the real world. In particular, considering the expectations of teachers for efficient teaching processes as need for material, laboratory / learning environment, student participation, it can be predicted that unplugged computer science can be direct or indirect effective approach in meeting these expectations of teachers. For example, for schools without a computer laboratory, including more unplugged computer science practices may be an approach that eliminates the physical impossibilities of schools. Accordingly, as an approach that can be a more rational solution to teachers’ expectations such as student participation and financial opportunities, and taking into account its contribution to the development of computational thinking skills, more emphasis can be placed on teaching materials compatible with the curriculum within the framework of unplugged computer science. For this, it can be said that activities aiming professional development of ITTs will be useful both in order to produce their own unplugged materials and gain more in-depth knowledge and experience about the application of this approach. However, it should also be noted that further research is needed on unplugged computer science, both conceptually and in its application in schools, and evidence supporting these views is needed.

According to the research findings, it can be concluded that teachers' knowledge and skills on computer science and programming teaching at the K-12 level are superficial. Content knowledge covering a teaching discipline is very important for a teacher (Mishra & Koehler, 2006). It can be stated that there is a need to develop teachers' knowledge and skills about unplugged activities for the development of computational thinking, plugged activities for block-based programming. It is necessary to state that teachers' knowledge and skills need to be developed especially for text-based and physical programming environments.

In this context, as suggested in similar studies (Göncü, Çetin, & Şendurur, 2020), in-service trainings that contribute to improving the content knowledge of ITTs in the field of computer science at K-12 level should be planned. Along with the curriculum updated by the Higher Education Council as of the 2018-19 academic year, some courses related to the developments in the field of teaching computer science in K-12 level have been added in the Computer Education and Instructional Technology curriculum. Two examples of these changes are programming and teaching approaches and physical programming courses which were added to the teacher training curriculum. On the other hand, in-service teachers like the one participated in this study and pre-service teachers who will graduate from undergraduate programs until 2023 have not taken the courses mentioned above. For this reason, in-service training programs for Information Technology Teachers should focus on professional development related to the unplugged approach, block-based, text-based, visual programming environments and physical programming, which of these have already found place in MEB learning gains. Considering the fact that the level of knowledge of the teachers participating in this research about computational thinking is limited, the in-service trainings recommended for Information Technology Teachers should not be focused solely on the teaching of tools and environments, rather should focus on teaching of computer science education with recent approaches.

According to the research findings, ITTs have the belief that different branch teachers (primary school teachers) can teach programming at a very limited level. In addition, it was revealed that different branch teachers do not adopt programming issues (e.g. the opinion of PT1). It has been stated that the teachers who teach programming have given such trainings because the administration made it compulsory (e.g. the opinion of PT3).

Dağ (2019) stated that the perceptions and academic achievements of pre-service ITTs for a course they take in programming teaching are not affected by previous knowledge and perception levels of programming. Primary school teachers who have limited experience in the field of computer science participated in a training program to integrate computational thinking into their lessons. At the end of this four-month training period, teachers made significant progress in terms of both their attitudes towards computer science and the products they produced (Israel, Pearson, Tapia, Wherfel, & Reese, 2015). In this study, it was concluded that for teaching of computer science subjects at the K-12 level, ITTs did not have a clear positive view, although they had opinions about that different field teachers can teach these subjects. It should be taken into consideration that computer science education is a separate discipline and the opinions of Information Technologies Teachers about why different branch teachers can teach the contents of their own subject area should be analyzed in depth. For this reason, it is thought that there is a need to investigate the perspectives of Information Technology Teachers on programming teaching and to reveal more clear findings about this subject that will examine the collaborations they have experienced with different branch teachers on these issues.

In this research, the experiences of ITTs in teaching processes on problem solving and programming were also examined. The participants' opinions on EBA portal about programming could not be determined at a level that would significantly contribute to the literature. Information Technology Teachers participating in the research stated both positive and negative opinions about EBA, but used superficial expressions in their explanations. In the literature, no research has been found that examines the opinions of ITTs regarding the teaching materials in EBA within the framework of computer science subjects, especially at K-12 level. For this reason, it is thought that the opinions of ITTs regarding the teaching materials in EBA need to be examined in depth. In this context, it can be said that it would be useful to carry out an in-depth needs analysis on which sections of EBA teachers find useful and what they need for their teaching processes. In addition, examining the views on educational content such as textbooks, activity books and many others in EBA will also contribute.

According to the findings of this research, the teaching materials on EBA received more negative opinions compared to the activity books. The reason why teachers' opinions about teaching materials other than Activity Books and Coding Guide is more negative is that the Activity Books have been prepared by the relevant commissions of the Board of Education, within the framework of the learning gains in the curriculum. On the other hand, other materials are published by teachers who are EBA users and these materials do not go through such an examination process. For this reason, it is thought that teaching materials should be presented by matching them with the course outcomes. Thus, teachers can be able to directly and practically access the necessary teaching materials for the units and learning gains they need. In addition, a search feature similar to the filter performed on the basis of branches in content search pages in EBA can be used to search by filtering according to the publisher of the teaching materials (EBA or other users). In this way, it can be easier for teachers to access approved and appropriate learning outcomes.

In this study, it was determined that ITTs generally use demonstration techniques in the teaching process, and they mainly teach with PowerPoint and worksheets. Another finding of the research that emerged about the teaching processes and considered important is that teachers focus on tool-based teaching. Teachers stated that they spend an average of 30% of their time to teach the interfaces of the programming tools they use in their lesson processes. They stated that they generally utilize activities for the teaching process by adapting ready-made activities. Apart from the exams required by the Ministry of National Education, the project was used as the most frequently used assessment method. In order to increase the interaction and communication in the classroom, it was observed that Kahoot and similar applications were preferred in classroom activities. In the evaluation of student products, only four of the nine teachers who participated in the research stated that they used rubrics. Based on these findings, it was concluded that although the teachers who participated in the research stated that they used student-centered methods when asked, in fact, when they were analyzed in depth, they carried out the teaching process mostly with traditional approaches, and mostly maintained a teacher-centered and tool-oriented approach. Therefore, the need for training programs for the development of pedagogical content knowledge of ITTs can be emphasized once again.

In this study, the findings that reveal the expectations of teachers towards making the teaching process efficient are as follows; teaching material, classroom environment and increasing student interest. In this context, the teachers who participated in the research emphasized their need for teaching materials especially in teaching problem solving and programming issues. In recent years, a separate pool of materials with the name "EBA Coding" has been created in EBA and various resources including algorithm and block-based coding examples with the name of coding guide and student workbooks prepared according to the updated program have been offered to teachers in EBA. Despite the fact that the number of materials published in the problem solving and algorithm issues in EBA have increased significantly, the teachers emphasize the insufficiency of the materials they reach from the EBA and other sources (internet, etc.). In this context, it is considered that what kind of teaching materials do teachers need and in what extent the existing teaching materials published in EBA respond to the needs of teachers should be examined in depth. To achieve this, studies can be carried out with the ITTs perhaps throughout the country, in order to reveal which teaching materials (video, worksheets, etc.) are needed for which learning gains.

The main problems that negatively affect the teaching processes are reported in two categories: physical environment and student-related issues. Accordingly, in terms of classroom environment, the participants stressed the need for improving laboratory facilities. Even, a teacher (PT8) stated that because of the lack of a computer laboratory in his school, he had to teach his lessons in the classroom environment and mostly using the interactive board as a demonstrator tool. Although this is not a direct finding of this research, it is thought that the number of teachers faced with the situation of teaching information technology lessons in schools that do not have a computer laboratory or that are inadequate in terms of computer laboratories is much higher than expected. In this context, as stated earlier, studies on unplugged computer science can be a solution for schools with physical impossibilities. In addition, it can be said that there is a need to increase digital teaching materials compatible with the learning gains that teachers can use in programming teaching in EBA.

In line with the findings regarding the teaching process, it was found out that Information Technology Teachers thought that students' interest was low in the Information Technology and Software course. It is a remarkable finding that teachers stated that their students' interest level is low for their own lessons. In this regard, it should be taken into consideration that the perception of teachers may differ from the perception of students. On the contrary, in his study with secondary school students, Sırakaya (2018) stated that students are pleased to receive coding education and define education as fun. Course content mainly include programming and algorithm topics and therefore this might not be matching student expectations. In the teaching process, mostly teacher-centered teaching approaches are used and this situation is insufficient in increasing the students' interest in the course. Other reasons might be that the course does not have official grade and national exams do not include questions within the scope of the course. However, it is not possible to develop a solution proposal for this finding of the research, since it is not within the scope of this research to examine the factors affecting the students' interest in the course apart from the opinions expressed by the teachers about their students during the teaching process. The success rate of a course that cannot meet the expectations of teachers, students and curriculum at a common point will be less than expected. It can be said that research is needed to reveal students' level of interest and the reasons for their disinterest, if any.

Conclusion

As a result of this research conducted for the preliminary analysis of the current situation of programming teaching at secondary school and high school level, there are two main outcomes based on the opinions of the teachers about the application of the Information Technologies and Software Teaching curriculum, which was updated and implemented as of 2018-2019 academic year.

First of these two outcomes is that the knowledge and skills of Information Technology Teachers on programming teaching at secondary school and high school level, which has gained importance within the framework of computational thinking along with the renewed curriculum, are limited. Besides, the results obtained by investigating the experiences of teachers participated in the research about the teaching process support this outcome. Teachers focus on tool-oriented and teacher-centered approaches in teaching programming topics. It can be emphasized that there is a need for the development of content knowledge and pedagogical content knowledge of ITTs' in terms of teaching of problem solving and programming. Consequently, it is recommended to focus on the studies about the development of pedagogical content knowledge of ITTs at secondary school and high school level in the field of computer science, especially within the light of current developments.

In informatics education, pedagogical content knowledge is an undiscovered area (Saeli, Perrenet, Jochems, and Zwaneveld, 2011). Although the number of researches on programming education at K-12 level has been increasing in recent years, the questions like what kind of teaching methods and techniques should be used especially in teaching processes, what kind of learning activities contribute positively to the learning and participation of students, and what kind of programming environment and tools in computer science will contribute positively to the teaching processes at which levels of age still remain unanswered. For this reason, there is a need for further researches on the in-depth analysis of programming teaching processes at K-12 level with the dimensions of teachers, students and environments.

The second main outcome is that although they try to carry on with their current knowledge and skills, ITTs experience problems with the teaching processes related to programming. In this research, these problems are were found as lack of teaching materials, insufficient lab facilities, and low level of interest of students in the course. The teachers participated in this study emphasized that they did not have any difficulties in finding sample materials for programming teaching, but they had difficulty in finding "teaching materials" and "teaching activities suitable for the student's level". Therefore, it can be underlined that there is a need to increase the number of teaching materials which focus on learning outcomes for teaching problem solving and programming. In addition, it can be emphasized that resources are needed to improve and create physical environments and more in-depth research is needed to both reduce the impact of physical impossibilities and increase student interest.

Within the framework of the outcomes of this research, it is recommended to evaluate the application dimension of the curriculum with a wider number of participant teachers. It is concluded that the research focusing on the different dimensions of the application process, such as the problems experienced by the teachers during the application process (e.g. physical environment, students, etc.), the teaching materials they need, the in-service trainings they need, will contribute to the literature.

One of the important limitations of this research is that, although it was conducted with Information Technology Teachers who have different qualifications in terms of professional experience, graduation area, the type of school they work, the type of institution they work, and the type of task; the research was carried out with a small number of easily accessible participants. Accordingly, it was preferred to collect data from the participants through a semi-structured interview form in order to enable teachers to answer openly and comfortably. However, this situation limited the ability to make in-depth analyzes on some results of the research. For this reason, for further researches, it is suggested to include various data collection methods such as focus group discussion, observation, etc. to the research process.

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