Thematic and Methodological Trends of Computational Thinking Skills-Related Graduate Theses in Turkey

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Abstract. The purpose of this research is to analyse the thematic and methodological trends of computational thinking skills-related graduate theses in Turkey. Within the scope of this purpose, a total of 38 works, including 30 Master’s and 8 doctoral studies, published in the National Thesis Centre database of YÖK (Council of Higher Education), were analysed using a document analysis model, one of the qualitative research methods. A descriptive content analysis technique was used to examine graduate theses. According to the results of the research, it has been concluded that the effects of programming teaching, robotics, and block-based visual programming on computational thinking skills are examined in graduate theses. It has been determined that a very limited number of design and development studies have been carried out to develop computational thinking skills. It has been observed that the majority of graduate theses were made in the field of Computer Education and Instructional Technology and most theses were published in 2019. It has been concluded that graduate theses are mostly designed by using the quantitative research method and quasi-experimental design, and secondary school sample profile is mostly preferred in the studies. However, it has been seen that the data collected by using a scale, interview, and observation data collection tools are analysed in accordance with predictive analysis techniques. As a result of the research, it has been recommended that design studies should be carried out in which qualitative or mixed research methods are used and especially pre-school sample profiles are preferred.

Keywords: Computational thinking, graduate theses, content analysis.

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1. INTRODUCTION

In today’s world that evolves from the industrial society to the information society, a global race has begun with intense competition based on technology production. The ability of societies to come out of this global race with an effective struggle is directly related to the information and communication competencies of individuals who make up the society (Tosik-Gün & Güyer, 2019). For, societies consisting of individuals who only consume technology cannot be expected to take an active part in this race. Therefore, societies have made reforms in many areas, especially in educational policies, for the human profile they need (Israel, Pearson, Tapia, Wherfel, & Reese, 2015; Mannila et al., 2014; Wong et al., 2015). The reforms aim to raise individuals equipped with effective problem-solving skills and capable of designing complex systems (Tosik-Gün & Güyer, 2019). In this context, some competencies defined as 21st-century skills provide a dynamic framework for the human profile that societies need (Üzümcü & Bay, 2018). Computational thinking skills have recently been added to this framework, which includes competencies such as collaboration, problem-solving, critical thinking, analytical thinking, and design thinking (International Society for Technology in Education, 2015). There are many definitions made in different contexts for computational thinking, whose popularization process started with the study of Janette Wing in 2006 (Gonzalez, 2015; Grover & Pea, 2013; Kalelioğlu, Gülbahar, & Kukul, 2016, Wing, 2008). One of these definitions was made by ISTE (International Society for Technology in Education) and CSTA (Computer Science Teachers Association). As is specified within this definition, computational thinking is explained as the problem-solving process in which editing, analysis, formulation, automatization, transfer, and generalization processes are performed by means of computers (ISTE & CSTA, 2011). Another definition was made by the Carnegie Mellon University Computing Thinking Centre. According to the definition, computational thinking is the process of understanding the problem using the basic concepts of computer science, developing effective solutions to the problem, and the application and generalization of the solution through the system design approach (Centre for Computational Thinking Carnegie Mellon, 2019). Riley and Hunt (2014) express computational thinking as a problem-solving process based on algorithmic thinking by emphasizing cognitive processes. Although the definitions differ, it is understood that the focal point is structured on the axis of problem-solving.

Problem-solving is an important skill not only for a certain discipline or professional group, but also for individuals from all walks of life (Care, Scoular, & Griffin, 2016; Griffin, 2017). Especially the fact that the problem situations encountered in daily life have turned into a more complex structure compared to the past has increased the need for new solution strategies (Griffin, 2017). One of these new solution strategies is the work done to develop computational thinking skills (ISTE, 2015). Computational thinking skills are aimed at increasing the life success of the individual, preparing them better for business and education life, and ensuring that they can compete on a global scale (Lee et al., 2011; Snalune, 2015; Wing, 2008). For this purpose, activities and applications, in which content such as programming, robotics, computer games, simulation, and coding are used.
extensively to improve computational thinking skills, have been developed (Bers, 2010; Magana & Silva Coutinho, 2017; Oluk, Korkmaz & Oluk, 2011).

The development of computational thinking skills has recently become the focus of the attention of researchers and policymakers in Turkey, as in all countries (Gulbahar and Kalelioglu, 2018; Tang Chou and Tsai, 2020). In this context, new course contents are prepared for the development of computational thinking skills, and the teaching programs are renewed. For example, America, Estonia, South Korea, and some European Union countries have updated their curricula and added new contents such as programming and coding (Demirer & Sak, 2016; Gulbahar & Kalelioglu, 2018). The "Information Technologies" course curriculum has been enriched with software and coding contents by the Board of Education and Discipline in Turkey.

Similarly, new activities continue to be prepared for different disciplines (Kaan, Caliskan, & Yetisir, 2017). In addition, it is known that there has been a significant increase in articles, master's theses, and doctoral dissertations on computational thinking skills (Ilic, Haseski, & Tugtekin, 2018; Kalelioglu, 2018). In the study conducted by Tang, Chou, and Tsai (2020), considering the studies on computational thinking skills between 2006 and 2018, it was observed that the number of studies on computational thinking skills increased significantly after 2013. Similarly, in the content analysis study conducted by Haseski, Ilic, and Tugtekin (2018) using Web of Science and ERIC databases, it was found that the number of publications for computational thinking skills increased more than twice after 2010. Referring to the results of research conducted worldwide, it is seen that Turkey ranks in the top ten with the number of publications between 2020 and 2010 (Tang Chou and Tsai, 2020).

Researches show a remarkable increase in the number of studies in recent years regarding computational thinking skills in Turkey (Ilic, Haseski and Tugtekin, 2018; Kalelioglu, 2018). In this context, there is a need for studies that will provide a general framework in determining the tendencies, gaps, and clutter for studies on computational thinking skills. Turkey has seen a limited number of research studies on computational thinking skills, (Haseski, Ilic and Tugtekin, 2018; Kalelioglu, 2018; Kalelioglu, Gulbahar and Kukul, 2016; Tosik-Gun and Guyer, 2019). However, there is no study that investigates graduate theses on computational thinking skills. Considering the number of graduate theses on computational thinking skills in Turkey, it is thought that there is a need for content analysis studies that will investigate trends, gaps, or clutters regarding these with a holistic perspective. Providing a general framework for the theses on computational thinking skills conducted following an analysis of relevant these in Turkey is important in terms of being a guide for researchers to work in related fields. The aim of the research in this context is to examine the thematic and methodological trends of computational thinking skills-related graduate theses in Turkey. While the purpose and problem statements of the theses, their distribution according to disciplines, and the years of publication were examined thematically, research methods, patterns, profiles of sample, data collection tools, and data analysis techniques of graduate theses were examined methodologically. In this way, the research aims to present a general
framework by revealing the similarities and differences of the studies and to guide researchers who will work in this field. In this context, potential answers were sought for the following research questions.

1. What are the general characteristics of computational thinking skills-related graduate thesis made in Turkey thematically?
   a. Which topics have been studied in graduate theses?
   b. How are they distributed according to the branches of science?
   c. What is the distribution according to the years of publication?

2. What are the general characteristics of computational thinking skills-related graduate thesis made in Turkey methodologically?
   a. Which research methods have been used in graduate theses?
   b. Which research model or patterns have been chosen?
   c. What are the sample profiles?
   d. What data collection tools have been used?
   e. What are the techniques of data analysis used in graduate theses?

2. METHOD

This study was designed using the document analysis model, one of the qualitative research methods, based on the process followed. Document analysis is a frequently used research method for systematically analysing written sources planned to be researched (Karasar, 2016). Within the scope of the study, graduate theses on computational thinking skills published until April 2020 were examined thematically and methodologically. The main purpose of the analysis of the related graduate theses is to reveal the trends, gaps or clutter in the field of computational thinking skills. For this purpose, the descriptive content analysis design was used in the study. Descriptive content analysis is a method used to obtain summary information or present a general view about previously published works, depending on a predetermined framework (Büyüköztürk et al., 2008; Çalık & Sözbilir, 2014). The descriptive content analysis consists of steps that include data collection and data analysis. In this context, firstly, data were collected through database scanning in the current study, and then these data were analysed and interpreted according to research questions.

Data Collection

The sample of the study consists of graduate theses on computational thinking skills found in the database of YÖK (Higher Education Council) National Thesis Centre and published until April 2020. For this reason, instead of limiting any date range, all graduate theses published until April 2020 were included in the study. The keywords used in the database search consist of the words used for the concept of computational thinking in line with the relevant literature. Computational thinking was seen to be used in different words in Turkish as "kompütasyone" by (Şahiner & Kert, 2016), “bilgisayarca” by (Korkmaz, Çakır,
& Özden, 2015), “bilişimsel” by (Özkeş, 2016), “bilgisayımsal” by (Çınar & Tüzün, 2017), and “hesaplamalı” by (Özçınar, 2017). In this context, queries were made for each of these keywords in the database of the national thesis centre without date and field restrictions, and related works were reached. In the queries, a total of 63 results were obtained: 43 for computational thinking, 0 for kompütasyonel, 14 for bilgisayarca, 3 for bilişimsel, 0 for bilgisayımsal, and 3 for hesaplamalı. In the preliminary examination, after 13 studies that were unrelated to computational thinking skills, 2 non-accessible and 10 repetitive studies were excluded, a total of 38 graduate theses, including 30 master’s and 8 doctoral theses, were examined within the scope of the research (See Appendix-1). In the examination of the theses, the form prepared by the researcher was used based on similar studies previously conducted. This form consists of two parts, thematic and methodological. The thematic part keeps track of information on the subject studied in the thesis, the discipline in which the thesis was prepared, and the year the thesis was published, while the methodological part keeps track of the method, design, sample, data collection tools used, and the analysis method of the research.

Data Analysis

During the data analysis process, the stages of document review followed by Şimşek and Yaşar (2019) in their studies were followed. In the first stage, the theses were saved in two folders as Master’s degrees and doctorate degrees. Starting from the master’s theses, each one was given a code according to the thesis number order given by the National Thesis Centre. These codes were used in the analysis and presentation of the findings. In the second stage, the data obtained for each research problem were entered in an Excel sheet with the code of the thesis. In the third stage, the tables were prepared by examining the data on the Excel sheet in detail. In the fourth and last stage, the data were presented in the tables with their frequencies within the framework of research questions.

In order to ensure the reliability of the data analysis, the stage during which the data were entered into Excel and coded was carried out by an expert together with the author. Reliability coefficient = [Agreement / (Agreement + Disagreement)] x100 formula suggested by Miles and Huberman (1994) was used for the percentage of agreement between coders. The reliability coefficient was calculated as 0.84. In codings where an agreement could not be reached, the agreement was achieved by bringing the coders together. In order to ensure the validity of the research, the theses were examined in detail and in-depth by both coders during the data analysis process. The obtained data were presented in tables with their codes.

3. FINDINGS

The findings obtained within the scope of the research are presented in two sections. In the first section, the thematic general features of the graduate theses on computational thinking skills were examined, and in the second section, the methodological general features were examined.
The Thematic General Features Of The Graduate Theses In Turkey Made Related To Computational Thinking Skills

In this section, information about the topics covered in the graduate theses, their distribution according to the branches of science, and the publication years and types of the graduate theses are presented. Information on the topics covered in graduate theses is given in Table 1.

Table 1.
Topics Covered in Graduate Theses

| Topics                                                                 | Master’s          | Doctorate | f |
|------------------------------------------------------------------------|-------------------|-----------|---|
| The analysis of the effects of various variables on the CT skill      |                   |           |   |
| - Project-based learning method                                       | M15, M13*         |           | 2 |
| - Flipped classroom application                                       | M1, M3            |           | 2 |
| - Technology-supported schematic organisers                            | D8*               |           | 1 |
| - Problem-based learning method                                        | M9                |           | 1 |
| - Reflective thinking activities                                       | M11, M27          |           | 2 |
| - Educational games                                                   | M6                |           | 1 |
| - Gamification of the learning process                                | M25               |           | 1 |
| - Computer-aided math activities                                      | D1                |           | 1 |
| - Schematic organisers such as fishbone, brainstorm and flowchart     | D8                |           | 1 |
| - Information Technologies and Software course activities              | M14, M17, M19*    |           | 3 |
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- Programming teaching M3, M5*, M9, D3, D5* M16*, M23* 7
- Programming without a computer M16, M23, M19 3
- Block-based programming M12, M29, M30 D6 4
- Robot-assisted programming M5 1
- The use of an educational robotic set M4, M13, M26, M28 4
- STEM-based activities M10 1

| The analysis of the relationship between various variables and the CT skill | Creative problem-solving skills M18 1 |
| Data visualization application M20 1 |
| Logical-mathematical intelligence apperception M2* 1 |
| Academic success M2, M22 2 |
| Readiness to learn online M7 1 |

| Design and development studies to improve the CT skill | Data visualization application M20 1 |
| Learning environment M8 1 |
| Instructional design M24 D7 2 |
| Program design D4 1 |
| Activity D2, D5 2 |

| Performance-based evaluation of the CT skill using machine learning | M21 1 |

* Studies involving more than one theme.

While determining the themes of the graduate theses, the themes were determined according to the focus points of the studies by examining the purpose of the studies and the problem sentences. In this context, Table 1 reveals that most studies are in the study themes (f: 35) where the effects of various variables on the CT skill are examined. These studies are followed by design and development studies (f: 7) for the development of the
CT skill, and studies (f: 5) that examine the relationship between various variables and the CT skill. However, one may notice that the least amount of work was done in the performance-based evaluation (f: 1) theme of the CT skill using machine learning.

It is seen in studies examining the effects of various variables on the CT skill that the themes of programming teaching (f: 7), the use of the educational robotic set (f: 4) and block-based programming (f: 4) were mostly discussed. In studies examining the relationship between various variables and the CT skill, the theme of academic achievement (f: 2) was the most discussed. In the design and development studies for the development of the CT skill, there were studies where the most activity (f: 2) design was carried out. A distribution of graduate theses according to disciplines is given in Table 2.

Table 2

Distribution of graduate theses according to disciplines

| Disciplines                                | Master’s        | Doctorate   | f   |
|--------------------------------------------|-----------------|-------------|-----|
| • Computer engineering                     | M21             |             | 1   |
| • Computer and instructional technology education | M1, M3, M4, M5, M6, M9, M11, M13, M14, M15, M16, M17, M20, M22, M23, M24, M25, M27, M28, M29, M30 | D1, D2, D3, D8 | 25  |
| • Educational Sciences                      | M7, M18         | D4, D6, D7  | 5   |
| • Education technologies                   | M12, M19        |             | 2   |
| • Informatics                              | M26             | D5          | 2   |
| • Science education                        | M1, M10         |             | 2   |
| • Internet and information technology management | M8             |             | 1   |
| Total                                      |                 |             | 38  |

As can be seen in Table 2, graduate theses on computational thinking skill are mostly made in the field of Computer and Instructional Technology (f: 25) followed by Educational Sciences (f: 5), Educational Technologies (f: 2), Informatics (f: 2), Science (f:
A distribution of graduate theses according to the years of publication is given in Table 3.

Table 3

| Years | Master’s | Doctorate | f |
|-------|----------|-----------|---|
| 2016  |          | D8        | 1 |
| 2017  | M1, M2, M30 |          | 3 |
| 2018  | M3, M4, M5, M6, M7 | D1, D2, D3 | 8 |
| 2019  | M8, M9, M10, M11, M12, M13, M14, M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M27, M28, M29 | D4, D5, D7 | 25 |
| 2020  |          | D6        | 1 |
| Total |          |           | 38|

Considering the distribution of the graduate theses on computational thinking skills in Table 3, it is seen that the first study was published in 2016 and most studies were published in 2019 (f: 25). However, the data used in this study are limited to graduate theses published until April 2020. Therefore, there may be an increase in the number of graduate theses published in 2020 in the future. Considering this exceptional situation, it is seen that there has been an increase in the number of graduate theses on computational thinking skills over the years (2016-2019).

The methodological general features of the graduate theses in Turkey made related to computational thinking skills

In this section, information about research methods, research models, sample profiles, data collection tools, and data analysis techniques used in graduate theses is presented. Information on research methods used in graduate theses is given in Table 4.
Table 4

Research Methods Used in Graduate Theses

| Method             | Master's       | Doctorate | f  |
|--------------------|----------------|-----------|----|
| • The quantitative | M1, M2, M5, M6, M7, M9, M10, M12, M13, Y14, Y15, Y16, Y17, Y18, Y19, Y21, Y22, Y23, Y26, Y28 |             | 20 |
| • Qualitative      | Y8, Y11, Y24, Y27, Y29 | D2, D8    | 7  |
| • Mixed            | Y3, Y4, Y20, Y25, Y30 | D1, D3, D4, D5, D6, D7 | 11 |
| Total              |                |           | 38 |

Table 4 reveals that although the quantitative research method (f: 20) is mainly used in graduate theses, there is no doctoral thesis published using only the quantitative method. It is seen that the mixed research method (f: 6) is used in most of the doctoral dissertations. However, the qualitative research method was used least in graduate theses. Research designs/models used in graduate tests are given in Table 5.

Table 5

Research Patterns/Models Used in Graduate Theses

| Design/Model                  | Master's       | Doctorate | f  |
|-------------------------------|----------------|-----------|----|
| • Descriptive sequential pattern | M3             |           | 1  |
| • Case study                  | M11, M24, M25, M27, M29 | D8        | 6  |
| • Descriptive survey          | M2, M7, M22    |           | 3  |
| • Relational survey           | M18            |           | 1  |
| • Experimental                | M10, M12, M28  |           | 3  |
| • Development research        |                 | D2        | 1  |
| • Embedded experimental design | M4             | D7        | 2  |
| • Exploratory sequential design |               | D6        | 1  |
As seen in Table 5, the most used research design in graduate theses is the quasi-experimental design (f: 15) followed by case study (f: 6), descriptive survey (f: 3) and experimental research model (f: 3). The least used research model/design is descriptive sequential design (f: 1), relational survey (f: 1), development research (f: 1), exploratory sequential design (f: 1), design and development research (f: 1). In addition, the design was not specified in a study. The sample profile of graduate theses is given in Table 6.

Table 6

**Sample Profile of Graduate Theses**

| Sample Profile | Master's | Doctorate | f |
|----------------|----------|-----------|---|
| Preschool      |          | D8        | 1 |
| Elementary School | M2*, M8  |           | 2 |
| Secondary School | M1, M2, M4, M5, M9, M10, M11, M12, M13, M14, M16, M18, M19, M22, M23, M25, M26, M27, M28, M30 | D1, D2, D3, D5, D6, D7 | 26 |
| High School    | M2, M15, M17*, M20* |           | 4 |
| University     | M6, M7   | D4        | 3 |
| Teacher        | M17, M20, M24, M29 |           | 4 |
| Academician    | M21      | D2        | 1 |
| Total          |          |           | 41 |

*Studies with more than one participant profile.*
Table 6 demonstrates that in graduate theses, studies are mainly conducted with secondary school (f: 26) sample profile. This is followed by high school (f: 4), teacher (f: 4) and university (f: 3) participant profiles. The least studied sample profile consists of preschool (f: 1) and academician (f: 1) profiles. In addition, since data sets were used as the sample profile in the Y21 coded study conducted in the field of Computer Engineering, they were not included in the table. Data collection tools that were used in graduate theses are given in Table 7.

**Table 7**

*Data Collection Tools Used in Graduate Theses*

| Data Collection Tool | Master’s          | Doctorate | f  |
|----------------------|-------------------|-----------|----|
| • Questionnaire      | M29               | D2*       | 2  |
| • Scale              | M1, M2, M3*, M4*, M5, M6, M7, M9, M10, M12, M13, M14, M15, M16, M17, M18, M19, M22, M23, M25*, M26, M28, M30* | D1*, D3*, D5*, D6*, D7* | 28 |
| • Rubric             | M20*              | D2, D4, D7 | 4  |
| • Inventory          | M30               |           | 1  |
| • Graded scoring key |                   | D6        | 1  |
| • Evaluation form    |                   | D8        | 1  |
| • Observation        | M24*, M27*        | D3, D6, D7 | 5  |
| • Daily              | M11*, M27         | D4        | 3  |
| • Clinical interview |                   | D2        | 1  |
| • Engagement         | M11, M27         | D1        | 3  |
| • Interview          | M3, M4, M8, M20, M24, M25, M29, M30 | D2, D4, D5, D6, D7, D8 | 14 |

Total 63

* Studies using more than one data collection tool.

As seen in Table 7, the most used data collection tools in graduate theses are scale (f: 28), interview (f: 14), observation (f: 5) and rubric (f: 4), respectively. The least used data collection tools are inventory (f: 1), graded scoring key (f: 1), evaluation form (f: 1), and clinical interview (f: 1). Also, since the data collection tool used in the study coded Y21 was
not specified, it was not included in the table. Data analysis techniques used in graduate theses are given in Table 8.

Table 8

Data Analysis Techniques Used in Graduate Theses

| Data analysis technique | Master’s | Doctorate | f   |
|-------------------------|----------|-----------|-----|
| Descriptive             |          |           |     |
| • Frequency, percentage, mean, standard deviation, etc. | M2, M4, M18, M20, M23, M25, M28, M29, M30 | D2*, D3*, D4*, D6*, D7*, D8* | 15 |
| Predictive              |          |           |     |
| • T-Test               | M1, M3, M7*, M9, M10, M14, M16, M17, M18, M25, M28, M30 | D5*, D7 | 14 |
| • Ancova               | M7*, M9, M16, M18, M19 | D3, D6 | 2 |
| • Anova                | M7*, M9, M16, M18, M19 | D3, D7 | 7 |
| • Mancova              | M13, M16, M18 | D1*, D5 | 4 |
| • Manova               | M5 | | 1 |
| • Mann- Withney H U    | M16, M23 | | 2 |
| • Kruskal-Wallis H     | M16, M23 | | 2 |
| • Wilcoxon             | M6, M12, M13, M15, M23, M26 | D1, D5 | 8 |
| • Correlation          | M7, M18, M22 | D8 | 4 |
| Qualitative            |          |           |     |
| • Content analysis     | M3, M8, M11, M20, M24, M27, M29, M30 | D1, D2, D4, D5, D6, D7, D8 | 15 |
| Total                  |           |           | 73 |

* Studies using more than one analysis technique.

Table 8 demonstrates that the most used data analysis techniques in graduate theses are predictive (f: 43), descriptive (f: 15, and content analysis (f: 15), respectively. The t-test (f: 14) was the most used technique among predictive analysis techniques, while the least used ones were Mancova (f: 1), Manova (f: 1), Ancova (f: 2), and Kruskal-Wallis H (f: 2) tests.
4. CONCLUSION, DISCUSSIONS AND RECOMMENDATIONS

This study has been designed to examine graduate theses made in Turkey regarding computational thinking graduate thesis. In this context, 38 graduate theses registered in the database of YÖK National Thesis Centre were analysed. According to the results of the analysis, some studies mostly examine the effects of programming teaching, the use of educational robotic set, and block-based visual programming on computational thinking skills in graduate theses. This result is in line with the result of the research conducted by Kalelioğlu (2018), revealing that there is increased importance given to programming teaching and that the research on the effects of programming teaching on computational thinking skill is a crucial subject matter for researchers. As a matter of fact, the literature review shows that it is possible to reach a great number of studies on the effects of programming teaching on computational thinking (Atmatzidou & Demetriadis, 2018; Djambong & Freiman, 2016; Nouri, Zhang, Mannila, & Noren, 2019; Pérez-Marín, Hijón-Neira, Bacelo and Pizarro, 2020; Portelance and Bers, 2015).

Another result is that the number of theses for the development of computational thinking skills that focus on activity, learning environment or program design is quite low although it is known that activity, learning environment or program design play crucial roles in the process of developing computational thinking skills (Wing, 2008). Therefore, the low number of design studies aimed at developing computational thinking skills indicates a gap in the field, which means that this gap may have been ignored by the researchers working on a thesis on computational thinking skill.

Considering the distribution of theses on computational thinking skills, one may notice that the majority of them are made in the field of Computer Education and Instructional Technology. This may be because the concept of computational thinking skill is expressed in its simplest form as “problem-solving by using technology” (Gretter & Yadav, 2016) and mainly computer science and programming contents are used in studies on computational thinking skills (Bers, Flannery, Kazakoff, & Sullivan, 2014; Caldwell & Smith, 2016). It is observed that very few studies have been conducted in the fields of Educational Sciences, Educational Technologies, Informatics, Science Education, Internet and Information Technology Management and Computer Engineering. It is thought that more research on these disciplines of science is likely to make important contributions to the development of computational thinking skills.

The number of graduate theses on computational thinking skills is quite limited. What is clear is that graduate theses have started to emerge since 2016, while most of the theses were published in 2019. Computational thinking skill is a relatively new field of study, thus considering that a graduate thesis can be published following a study of two years, the first studies actually started before 2016. However, the data used in this study are limited to graduate theses published until April 2020. Therefore, there may be an increase in the number of graduate theses published in the future. Considering this exception, it is possible to maintain that there has been an increase in the number of graduate theses on computational thinking skill over the years (2016-2019). This result coincides with the
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results of the research conducted by Haseski, Ilıc and Tugtekin, (2018), Tang, Chou, and Tsai (2020). Similarly, when the studies conducted by Tang et al. (2020) on computational thinking skill between 2006 and 2018 were examined, it was concluded that there was a great increase in the number of studies on computational thinking between 2013 and 2018.

When the graduate theses were analysed methodologically, it was concluded that the majority of the studies were designed using the quantitative research method and quasi-experimental design. This situation is thought to be related to the subject, purpose, and data collection tools used in theses. In this context, it can be said that the quantitative research method may have been preferred more since most of the graduate theses aim to determine the effects of different variables on computational thinking skills. It is thought that the quantitative method and quasi-experimental design may have been preferred more, as the use of scale as a data collection tool in graduate theses is mostly preferred. In other words, it can be said that the research method may change according to the purpose of the research. In addition, it is thought that the preference of the quantitative research methods in graduate theses may be due to the fact that the theses selected for the research are mainly master theses. Shorter data collection and application processes in the quantitative research methods compared to qualitative research may have played an effective role. This result of the research is supported by the results of the research conducted by Kalelioğlu, Gulbahar and Kukul (2016). Kalelioğlu et al. (2016) examined 125 studies on computational thinking skills. As a result of the analysis of the articles according to their types and research methods, it was determined that the quantitative research methods (f: 33) were used more than other methods (f: 31).

When the theses on computational thinking skills were examined in terms of sample profiles, it was seen that the secondary school level was preferred most in graduate theses. This is followed by high school and university levels, respectively. This result of the research parallels the results of research conducted by De Araujo, Andrade and Guerrero (2016); İlıc and Haseski (2019); Tang, Chou, and Tsai (2020). In graduate theses, the fact that computational thinking skill was mostly examined with the student dimension may have been effective in preferring to study with secondary school students in graduate theses. However, it is observed that few studies have been conducted with academicians and preschool sample groups. However, the acquisition of computational thinking skill, which is described as a 21st-century skill, is considered to be an important issue that should be emphasized in all age groups and education levels (Wing, 2008).

Scale, interview, and observation data collection tools were mainly used in graduate theses. Similarly, in the studies conducted by De Araujo, Andrade and Guerrero (2016), and Weinberg (2013), it has been determined that data collection tools such as tests, questionnaires, and interviews are mostly used for computational thinking skills. In the analysis of the collected data, it was seen that mostly predictive, descriptive, and content analysis techniques were used respectively. While the t-test was used mostly in predictive analysis, content analysis was used in qualitative analysis. It is thought that the use of
quasi-experimental design as one of the quantitative research designs may have been effective in using t-test mostly in graduate theses.

As a result of the research, studies examining the effect of different variables on computational thinking skill are more frequently observed in graduate theses on computational thinking skills. On the other hand, it is seen that the number of graduate theses, in which learning environment, instructional design, program design or activity designs are made for the development of computational thinking skills, is quite low. In this context, conducting researches in which activities, practices or learning environment designs are made to support computational thinking skills can make significant contributions to the field. It is seen that the quantitative research method is mostly preferred in graduate theses. In this context, it is recommended that research be conducted using qualitative or mixed research methods. In graduate theses, it is seen that there are very few studies conducted with pre-school sample groups. In this context, it is thought that pre-school sample groups will contribute significantly to the literature for graduate theses about computational thinking skills.

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Appendixs
Graduate theses and codes analyzed within the scope of this study

| Kod  | Master’s |
|------|----------|
| M1   | Çakur, E. (2017). *Ters yüz smf uygulamalarının fen bilimleri 7.smf öğretmeninin akademik başarı, zihinsel risk alma ve bilgisayarca düşünce becerileri üzerine etkisi* (Yayınlanmamış yüksek lisans tezi). Ondokuz Mayis Üniversitesi, Eğitim Bilimleri Enstitüsü, Samsun. |
| M2   | Oluk, A. (2017). *Öğrencilerin bilgisayarca düşünce becerilerinin mantıksal matematiksel zeka ve matematik akademik başarıları açısından incelemesi* (Yayınlanmamış yüksek lisans tezi). Amasya Üniversitesi, Fen Bilimleri Enstitüsü, Amasya. |
| M3   | Erdem, E. (2018). *Blog tabanlı ortamlarda programlama öğretmeni sürecinde farklı öğretim stratejilerinin çeşitli değişkenler açısından incelemesi* (Yayınlanmamış yüksek lisans tezi). Başkent Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara. |
| M4   | Yolcu, V. (2018). *Programlama eğitiminde robotik kullanımının akademik başarı, bilgi-öğrenme düşünce becerisi ve öğrenme transferine etkisi* (Yayınlanmamış yüksek lisans tezi). Süleyman Demirel Üniversitesi, Eğitim Bilimleri Enstitüsü, İsparta. |
| M5   | Şimşek, E. (2018). *Programlama öğretmeninin robotik ve scratch uygulamalarının öğrencilerin bilgi-öğrenme düşünce becerileri ve akademik başarılarına etkisi* (Yayınlanmamış yüksek lisans tezi). Ondokuz Mayıs Üniversitesi, Eğitim Bilimleri Enstitüsü, Samsun. |
| M6   | Akkaya, A. (2018). *Eğitsel oyunların öğrencilerin nesne tabanlı programlama temel kavramsal bilgisi ve bilgi-öğrenme düşünce becerilerine etkisi* (Yayınlanmamış yüksek lisans tezi). Boğaziçi Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul. |
| M7   | Çatana-Kuleli, S. (2018). *Öğretmen adaylarının çevrimiçi öğretmeyi hazırlık alanlarındaki düzeyleri ve bilgi-öğrenme düşünce becerilerinin değerlendirilmesi* (Yayınlanmamış yüksek lisans tezi). Düzce Üniversitesi, Sosyal Bilimler Enstitüsü, Düzce. |
| M8   | Özyol, B. (2019). *Bilgi-öğrenme düşünce becerisinin kazandırılmasını yönelik bir ortam tasarımı ve geliştirilmesi* (Yayınlanmamış yüksek lisans tezi). Afyon Kocatepe Üniversitesi, Fen Bilimleri Enstitüsü, Afyon Kocatepe. |
| M9   | Turan, B. (2019). *Ortaokul öğretmenin gelişirdiği oyun ve robot projelerinde probleme dayalı öğrenmenin problem çözme ve bilgi-öğrenme düşünce becerilerine etkisi* (Yayınlanmamış yüksek lisans tezi). Van Yüzüncü Yıl Üniversitesi, Eğitim Bilimleri Enstitüsü, Van. |
| M10  | Çimentepe, E. (2019). *Stem etkinliklerinin akademik başarı, bilimsel süreç becerileri ve bilgisayarca düşünce becerilerine etkisi* (Yayınlanmamış yüksek lisans tezi). Niğde Ömer Halisdemir Üniversitesi, Eğitim Bilimleri Enstitüsü, Niğde. |
| M11  | Uğur, N. (2019). *Bilgisayarsız ortamda bilgisayar bilimi öğretiminde yansıtılmak için etkinliklerin bilgi-öğrenme düşünce becerilerini geliştirmeye etkisi* (Yayınlanmamış yüksek lisans tezi). Trabzon Üniversitesi, Lisansüstü Eğitim Enstitüsü, Trabzon. |
| M12  | Uysal, Y. (2019). *Blok tabanlı görsel programlanmanın matematiksel problem çözme ve hesaplamaları düşünce üzerine etkileri* (Yayınlanmamış yüksek lisans tezi). Boğaziçi Üniversitesi, sosyal Bilimler Enstitüsü, İstanbul. |
| M13  | Karaahmetoğlu, K. (2019). *Proje tabanlı arduino eğitsel robot uygulamalarının öğrencilerin bilgisayarca düşünce becerileri ve temel stem beceri düzeyleri algılarına etkisi* (Yayınlanmamış yüksek lisans tezi). Amasya Üniversitesi, Fen Bilimleri Enstitüsü, Amasya. |
| M14  | Çetinkaya, H. N. (2019). *Bilşim teknolojileri ve yazılım dersindeki etkinliklerin bilgi-öğrenme düşünce ve bazi değişkenler açısından incelemesi* (Yayınlanmamış yüksek lisans tezi). İnönü Üniversitesi, Eğitim Bilimleri Enstitüsü, Malatya. |
| M15  | Ergin, H. (2019). *Programlama dersinde proje kullanımının öğrencilerin bilgi-öğrenme düşünce becerilerine ve programlama öz yeterlilik inancına etkisi* (Yayınlanmamış yüksek lisans tezi). Ege Üniversitesi, Fen Bilimleri Enstitüsü, İzmir. |
| M16  | Çelik-Kırçaği, A. (2019). *K12 Düzeyinde algoritma öğretiminde kullanılan bilgisayarlı ve bilgisayarsız araçların çeşitli değişkenler üzerindeki etkilerini* (Yayınlanmamış yüksek lisans tezi). Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü, İstanbul. |
| M17  | Huruoğlu, N. (2019). *Kısa süreli bir eğitimin öğrencilerin bilgi-öğrenme düşünce ve öğretmenlerin bilgi-öğrenme düşünce, programlama ve girişimcilik önyeterlik algıları üzerindeki etkisi* (Yayınlanmamış yüksek lisans tezi). Örta Doğu Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Ankara. |
| M18  | Paf, M. (2019). *Ortaokul öğrencilerinin bilgi-öğrenme düşünce becerileri ile yaratıcı problem çözme becerileri arasındaki ilişkisi* (Yayınlanmamış yüksek lisans tezi). Aydın Adnan Menderes Üniversitesi, Sosyal Bilimler Enstitüsü, Aydın. |
| M19  | Delal, H. (2019). *Ortaokul öğrencilerinin bilgi-öğrenme düşünce becerilerinin bilgisayar bilimi (h5) etkinlikleri ile geliştirilmesi* (Yayınlanmamış yüksek lisans tezi). Boğaziçi Üniversitesi, Sosyal Bilimler Enstitüsü, İstanbul. |
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| M20 | Tutulmaz, M. (2019). **Bilgi-ışnemli düşünme becerisinin geliştirilmesine yönelik veri görselleştirmenin tasarlanması, uygunlanması ve değerlendirme** (Yayınlanmamış yüksek lisans tezi). Hacettepe Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara. |
| M21 | Karakaş, E. (2019). **Bilgi işlemel düşüncenin makina öğrenmesi kullanarak performansa dayalı değerlendirilmesi** (Yayınlanmamış yüksek lisans tezi). İstanbul Okan Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul. |
| M22 | Kuleli, S. (2019). **8. Sınıf öğrencilerinin bilgi işlemel düşünme becerilerine yönelik özyeterlilik algılarının incelenmesi** (Yayınlanmamış yüksek lisans tezi). Ege Üniversitesi, Eğitim Bilimleri Enstitüsü, İzmir. |
| M23 | Özel, O. (2019). **Programlama yöntemlerinin ortakolu öğrencilerin bilgi işlemel düşünme becerisine yönelik öz yeterlilik algısına ve programlama başarısına etkisi** (Yayınlanmamış yüksek lisans tezi). Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü, İstanbul. |
| M24 | Dağlı, Z. (2019). **Bilgisim teknolojileri öğretmenlerinin bilgisayar dersi “problem çözme ve algoritmalar” ünitesinde öğrencilerin bilgi işlemel düşünme becerilerini geliştirmek için tasarladıkları öğretim tasarım sürecinin incelemesi** (Yayınlanmamış yüksek lisans tezi). Mersin Üniversitesi, Eğitim Bilimleri Enstitüsü, Mersin. |
| M25 | Serim, E. (2019). **Oyunlaştırma yöntemiyle tasarlanan kodlama öğretimi ile öğrencilerin hafızalılama düşüncenin geliştirilmesi ve kodlamaya ilişkin öz-yeterlilik algılarının incelenmesi** (Yayınlanmamış yüksek lisans tezi). Balıkesir Üniversitesi, Fen Bilimleri Enstitüsü, Balıkesir. |
| M26 | Bal, N. (2019). **Temel robotik eğitiminde ortaokul öğrencilerinin 21. yüzyıl becerilerine ve bilgi işlemel düşünme becerilerine etkisi** (Yayınlanmamış yüksek lisans tezi). Hatay Mustafa Akyıldız Üniversitesi, Fen Bilimleri Enstitüsü, Hatay. |
| M27 | Kocabıyık, N. (2019). **Bilgisayar ortamında bilgisayar bilimi öğretiminde yansıtılan etkinliklerin bilgi işlemel düşünme becerilerini geliştirmek** (Yayınlanmamış yüksek lisans tezi). Trabzon Üniversitesi, Lisansüstü Eğitim Enstitüsü, Trabzon. |
| M28 | Uşengül, L. (2019). **Lego wedo 2.0 eğitiminde öğrencilerin fen bilimlerine yönelik akademik başarı ve tutumları ile bilgi işlemel düşünme becerilerine etkisi** (Yayınlanmamış yüksek lisans tezi). Fırat Üniversitesi, Eğitim Bilimleri Enstitüsü, Elazığ. |
| M29 | Şenol, Ş. (2019). **İlkokulda kodlama öğretim: sınıf öğretmenleri örneği** (Yayınlanmamış yüksek lisans tezi). Süleyman Demirel Üniversitesi, Eğitim Bilimleri Enstitüsü, Isparta. |
| M30 | Altun, H. (2017). **Teknolojik pedagojik alan bilgisi (tpac) çerçevesi ile oluşturulmuş programlama öğretiminin öğrenme etkileri üzerine etkileri** (Yayınlanmamış yüksek lisans tezi). Necmettin Erbakan Üniversitesi, Eğitim Bilimleri Enstitüsü, Konya. |
| D1 | Taş, N. (2018). **Farklılaştırılmış bilgisayar destekli matematik etkinliklerinin üstün yeteneklilerin bilgi işlemel düşünme özyeterlilikleri ve matematiğe yönelik tutumlarına etkisi** (Yayınlanmamış Doktora tezi). Atatürk Üniversitesi, Eğitim Bilimleri Enstitüsü, Erzurum. |
| D2 | Berikan, B. (2018). **Bilgi işlemel düşünme becerisine yönelik tasarlanan “veri setlerileye problem çözme” öğrenme deneyiminin biçimlendirici değerlendirme** (Yayınlanmamış Doktora tezi). Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara. |
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