

An Analysis of Countries which have Integrated Coding into their Curricula and the Content Analysis of Academic Studies on Coding Training in Turkey

Hüseyin Uzunboylu¹, Elanur Kınık², Sezer Kanbul³

¹ Near East University, Faculty of Education, Department of Educational Sciences Nicosia, North Cyprus, Mersin 10, Turkey

² University of Kyrenia, Faculty of Education, Kyrenia, North Cyprus, Mersin 10, Turkey

³ Near East University, Faculty of Education, Department of Computer Education and Instructional Technology Nicosia, North Cyprus, Mersin 10, Turkey

Abstract – The first aim is to conduct a general analysis of countries which have integrated coding training into their curricula, and the second aim is to conduct a content analysis of studies on coding training in Turkey. It was identified that there are only a few academic studies on coding training in Turkey, and that the majority of them were published in 2016, the intended population was mainly “undergraduate students” and that the majority of these students were Computer Education and Instructional Technology undergraduates. It was determined that the studies mainly focused on the subjects of “programming” and “Scratch”, the terms programming and coding were used as synonyms, most of the studies were carried out using quantitative methods and data was obtained mostly by literature review and scale/survey interval techniques.

Keywords – Coding training, Computational thinking, Content Analysis, Syllabus.

DOI: 10.18421/TEM64-18

<https://dx.doi.org/10.18421/TEM64-18>


Corresponding author: Hüseyin Uzunboylu,
Near East University, Faculty of Education,
Department of Educational Sciences Nicosia, North
Cyprus, Mersin 10, Turkey
Email: huseyin.uzunboylu@neu.edu.tr

Received: 25 August 2017

Revised: 09. October

Accepted: 23 October 2017

Published: 27 November 2017

 © 2017 Hüseyin Uzunboylu, Elanur Kınık, Sezer Kanbul; published by UIKTEN. This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License.

The article is published with Open Access at www.temjournal.com

1. Introduction

The educational use of coding began in the 1960s with the usage of the Logo programming language [16]. A considerable amount of literature states that the skills required of a 21st century individual are creative thinking, problem-solving, critical thinking, communication and cooperation skills [2] [6] [19]. The innovative solutions that technology provides also help the improvement of such skills. Particularly coding training, which has recently been referred to in various fields, has been said to hold the potential to enforce many changes in education at many events [4] [14].

The basis of coding is the skill to programme, and the basis of programming is algorithm. And the basis of all these skills are the problem-solving skills. Problem-solving skills are one of the basic skills which help students succeed in real life [23] [27]. The benefits of coding training, which has recently been acknowledged in studies, are as follows [1] [10] [13]:

- Students can continuously use these tools at school and improve their digital literacy,
- May improve imagination and creativity,
- Enables both outcome and process-oriented thinking,
- May motivate students to go to school and learn as well as encourage research,
- Internalisation of knowledge with long-term memory use,
- Helps students learn problem-solving, spatial thinking and critical thinking skills,
- Helps acquire learning habits to solve complex problems through the integration of small projects and to execute product-oriented large projects,

- Learning habits can be improved by collaborative work, learning skills, learning by doing and learning.

In recent years, coding training has begun to thrive with the visual programming languages Alice, Kodu, code.org and Scratch [20]. Before receiving coding training students first need to receive algorithm training. It is highly recommended that algorithm training is not skipped; because what is important is not which coding or language is used, but to be able to visualise and one by one follow the steps which create the basis of the programme [3]. Coding training is also used to improve students' computational thinking skills [8].

It is impossible to think of a syllabus providing students with the target skills without including coding training. While a curriculum includes all planned activities for all years at a school, a syllabus includes planned activities throughout the years of a particular lesson at a school. A syllabus is an implementation whereas a curriculum is a plan or a schedule. From this perspective, a syllabus is different from a curriculum.

Many private schools provide coding training. However, this training needs to be part of a syllabus and should be rich in content, and should consist of interactive, motivating tasks. For a country to provide a coding education, coding needs to be given the sufficient emphasis in the syllabus and the in-class activities need to be carefully planned. Thus, it is believed that studying countries which have integrated coding into their curricula will set an example for researchers in our country. Furthermore, it is believed that analysing and organising studies on coding training at certain intervals and identifying tendencies in the field would be beneficial to researchers conducting or wanting to conduct studies in this field.

2. Purpose

This study has two purposes. The first purpose is to conduct a general analysis of countries which have integrated coding training into their curricula, and the second aim is to conduct a content analysis of studies on coding training in Turkey. To this end, the study aimed to answer the following research questions:

1. Which countries have integrated coding training into their curricula?
2. What is the distribution of studies conducted on coding education in Turkey from 1997-2017 by **year**?
3. What is the distribution of studies conducted on coding education in Turkey from 1997-2017 by **university**?
4. What is the distribution of studies conducted on coding education in Turkey from 1997-2017 by **subject**?
5. What is the distribution of studies conducted on coding education in Turkey from 1997-2017 by **intended population**?
6. What is the distribution of studies conducted on coding education in Turkey from 1997-2017 by **method**?
7. What is the distribution of studies conducted on coding education in Turkey from 1997-2017 by **data collection tools**?

3. Method

The study is a descriptive survey model research. A descriptive research tries to describe and explain what events, objects, entities, institutions, groups and various fields are [26]. In this study, after a general analysis of countries which have integrated coding training into their curricula, articles related to coding training were analysed and explained in terms of various variables. The study consists of articles written in Turkish, retrieved from Turkish databases: Academic Google, Dergi Park, Ulakbim (Turkish National Academic Network and Information Center). While scanning the articles, the following key phrases were searched: algorithm, information-technology thinking, calculational thinking, computer thinking, computational thinking, coding, Scratch and programming. The articles analysed in the study consist of articles dated from 1997 to the end of March 2017, this is the studies limitations.

3.1. Data Collection

In order to analyse the articles, the researchers developed an "Article Information Collection Form". The articles were analysed according to year and university of publication, subject, intended population, method and data collection tools. A total of 39 articles were found.

3.2. Data Analysis

A content analysis of the information obtained from the data collection tools was conducted. The content analysis of the articles included many dimensions like method, subject, sample, data collection tools, content analysis method etc. [15]. To ensure reliability and validity, the articles were analysed on the basis of the researchers' consensus. The data obtained with this principal was collated in an MS Excel document. Next, to answer the research questions the data was collated in tables which were later explained and interpreted.

4. Findings

The findings from the analysis of countries which have integrated coding training into their curricula and the findings from the content analysis of studies on coding training in Turkey were collated in Tables and interpreted. The reason why the findings are not presented in percentages is that the total number of articles was 39.

4.1. Countries which have Integrated Coding Training into their Curricula

Many countries have re-evaluated their curriculum and have revised it or are in the process of revising it so that their curricula includes coding training. European Schoolnet's [11] "Computing Our Future: Computer Programming and Coding" report, states that many countries have integrated coding training into their syllabi or in the process of this addition. Figure 1. presents countries which have integrated coding into their syllabi.

Figure 1. shows that 16 out of 18 countries have integrated coding training into their national or regional curricula (Austria, Bulgaria, Czech Republic, Denmark, Estonia, France, Hungary, Ireland, Israel, Lithuania, Malta, Spain, Poland, Portugal, Slovakia and the United Kingdom.) **Finland** and **Belgium** are planning to integrate coding training into their curricula. **Finland** stated that programming education will be compulsory for primary school students as a part of their core curriculum as of Fall 2016.

Estonia has started giving programming education to students starting from age 7 since October 2012 [7]. In 100% of Estonia state schools in the coming academic year, according to a new implementation, all students starting from the first grade will take a computer science course. Providing students with tablets, as in Estonia, is on the agenda in Turkey with the "Creating more Opportunities and Improving Technology Movement" (FATİH) project. The FATİH Project, which is designed to provide each student in Turkey with a good education, access to high quality learning content and an equal

Rationale for integrating coding in the curriculum (countries which still plan to integrate coding are highlighted)



Figure 1. Countries which have Integrated Coding Training into their Curricula (European Schoolnet, 2015)

opportunity of education, is the largest and most comprehensive educational movement to be implemented in the world in relation to the use of technology in education [12]. The Estonian government, which is increasingly investing in technology, has included computer code writing courses starting from the first year in primary school.

The Ministry of Education in **England** started Basic Computer Programming courses in their schools as of November. At the age of 5, students start to learn how to create a basic programme, store and organise data, and at the age of 11, they learn how to use a series of programming languages [21]. In 2014, England made programming education compulsory starting from primary school level.

In some states in the **USA** similar decisions have been taken in regard to coding training. In recent years, in America coding training has gained significance at K-12 schools. At the Los Altos school region in California, various programming lessons are given every week. In 2013, in Lasd professional development courses, computational thinking and computer programming were launched for new teachers at primary schools [24].

The **South Korean** Ministry of Science and Future Planning has announced that software courses will be compulsory starting from primary school level and that primary school students will start to receive a progressive software training in 2017 and in 2018 high schools will start a similar education programme [18].

Turkey is among the countries which have realised the significance of coding training and are under the process of its integration. With the publishing of the national syllabi on the 28th of May 2013, Information Technology and Software courses were introduced as a 2-hour compulsory course for 5th and 6th grades while they were offered to 7th and 8th grades as elective courses [5].

4.2. The Distribution of Coding Education Studies in Turkey by Year

The distribution of the studies analysed by year is presented in Figure 2. When Figure 2. is analysed, it can be seen that not many studies were conducted in this area up until 2013, and studies regarding coding became more frequent particularly in recent years (2014-2016).

Moreover, there is a 10-year gap between the years 1997-2007 and 2007-2017. It is observed that there were 4 studies published in the first 10 year period, whereas there were 35 in the last 10 year period.

4.3. The Distribution of Studies on Coding Education in Turkey by University

The distribution of studies analysed on coding education in Turkey by university is presented in Figure 3.

The distribution of studies analysed on coding education in Turkey by university is presented in Figure 3. by Fırat University (5) and Kırıkkale University (6).

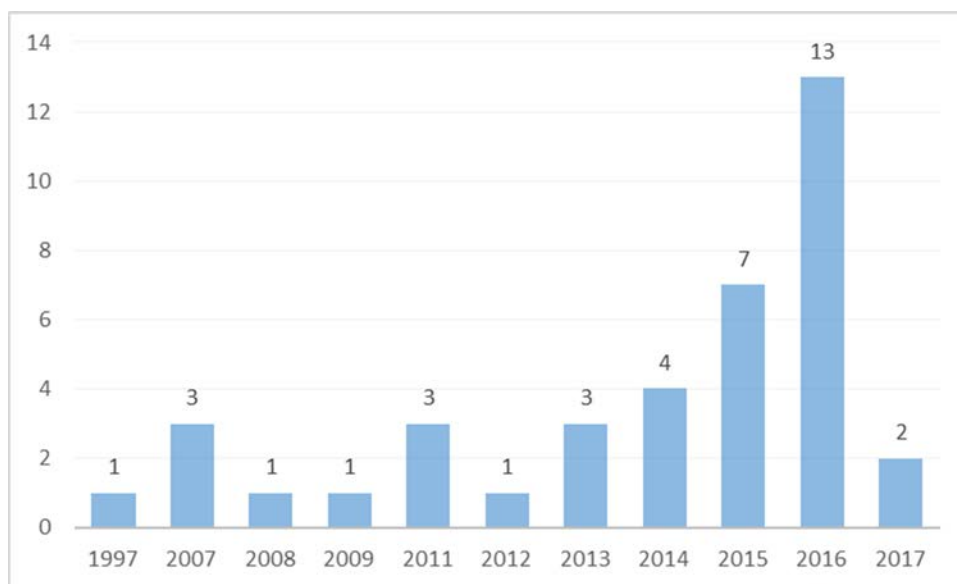


Figure 2. The Distribution of Studies by Publication Dates

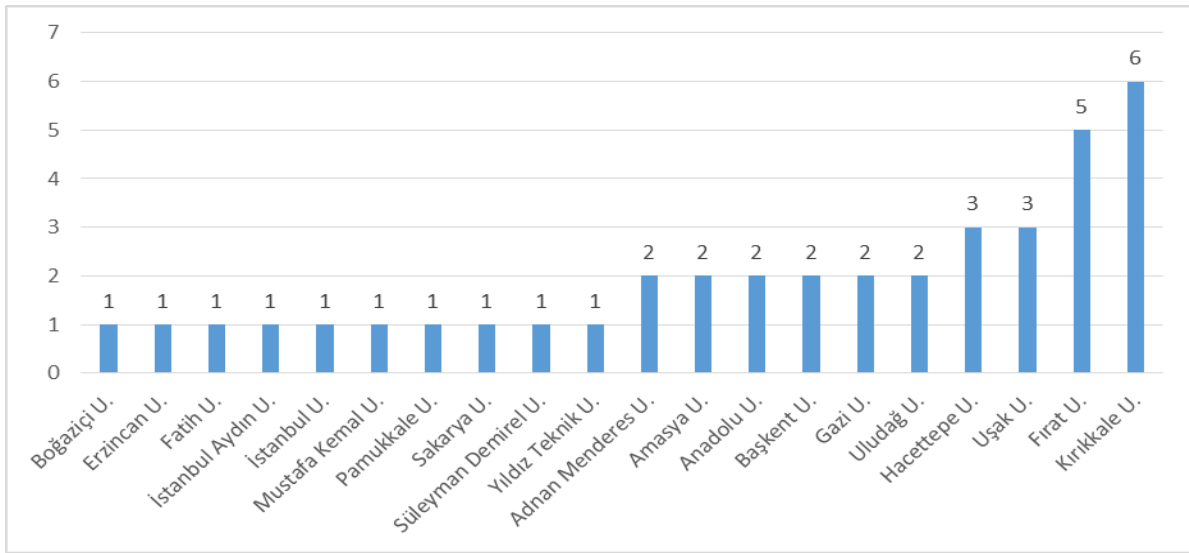


Figure 3. Distribution of Studies by University Publication

4.4. The Distribution of Studies on Coding Education in Turkey by University

The distribution of studies analysed on coding education in Turkey by subject is presented in Figure 4. When Figure 4. is analysed, it can be seen that subjects of the studies on coding education were; algorithm, computational thinking, coding, robot programming, Scratch training and programming. It can be seen that most of the studies were conducted on the programming theme and that programming and coding were used equally.

4.5. The Distribution of Studies on Coding Education in Turkey by Intended Population

The distribution of studies analysed on coding education in Turkey by intended population is presented in Figure 5. When Figure 5. is analysed, it can be seen that most of the studies on coding education were conducted on undergraduate level students. Furthermore, it is interesting that 20 out of 23 of the studies conducted on undergraduate students were conducted on Computer Education and Instructional Technology undergraduates.

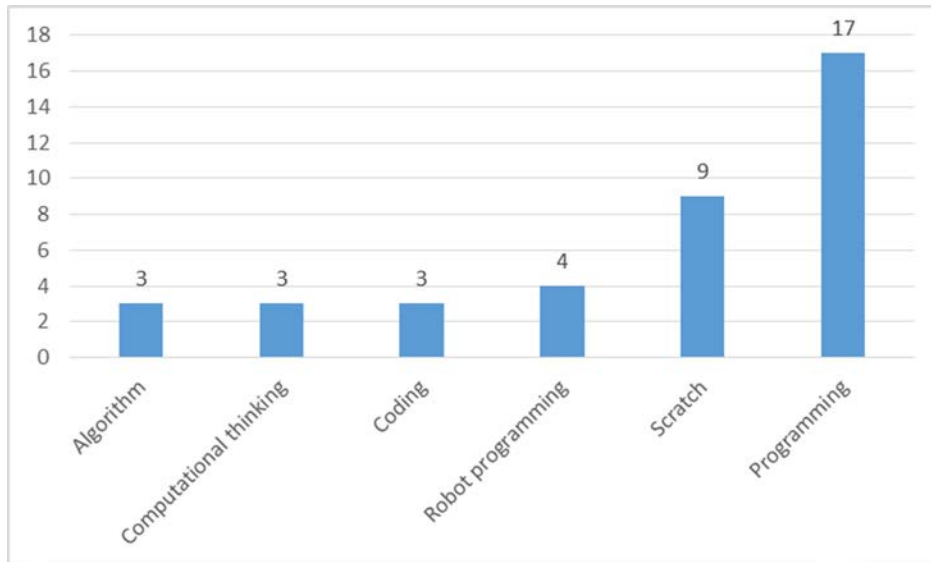


Figure 4. Distribution of Studies by Subject

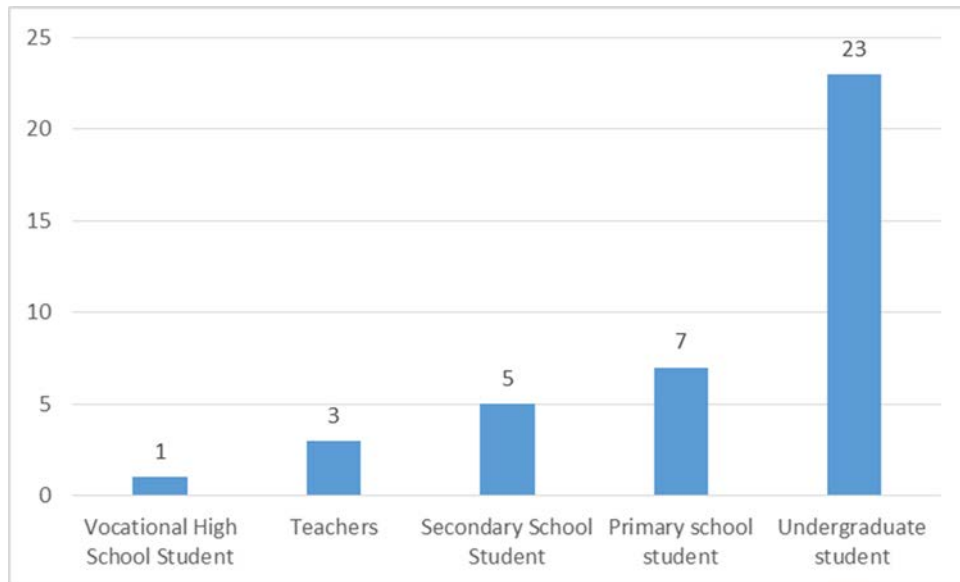


Figure 5. Distribution of Studies by Intended Population

4.6. The Distribution of Studies on Coding Education in Turkey by Method

The distribution of studies analysed on coding education in Turkey by method is presented in Figure 6. When Figure 6. is analysed, it can be seen that 17 of the studies on coding education used quantitative methods, 10 used descriptive survey methods (based on literature review), 8 used qualitative methods and 4 used a mixed method.

Moreover, these findings suggest that studies conducted on coding training were mainly quantitative studies.

4.7. The Distribution of Studies on Coding Education in Turkey by Data Collection Tools

The distribution of studies analysed on coding education in Turkey by data collection tools is presented in Figure 7. When Figure 7. is analysed, it can be seen that most of the descriptive studies were conducted by reviewing documents and the least were carried out by literature review.

In Figure 7., it should be noted that in coding training there were no experimental studies which mainly include more practice.

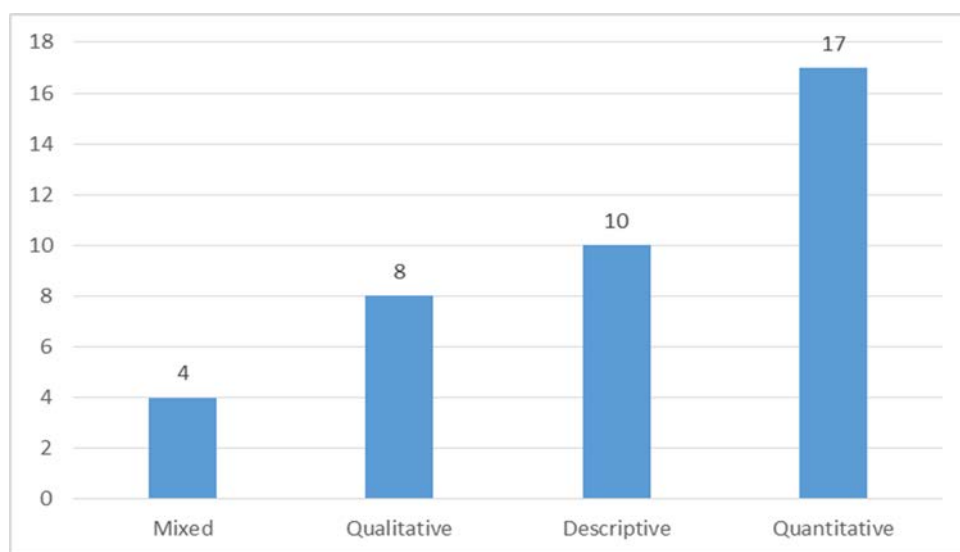


Figure 6. Distribution of Studies by Method

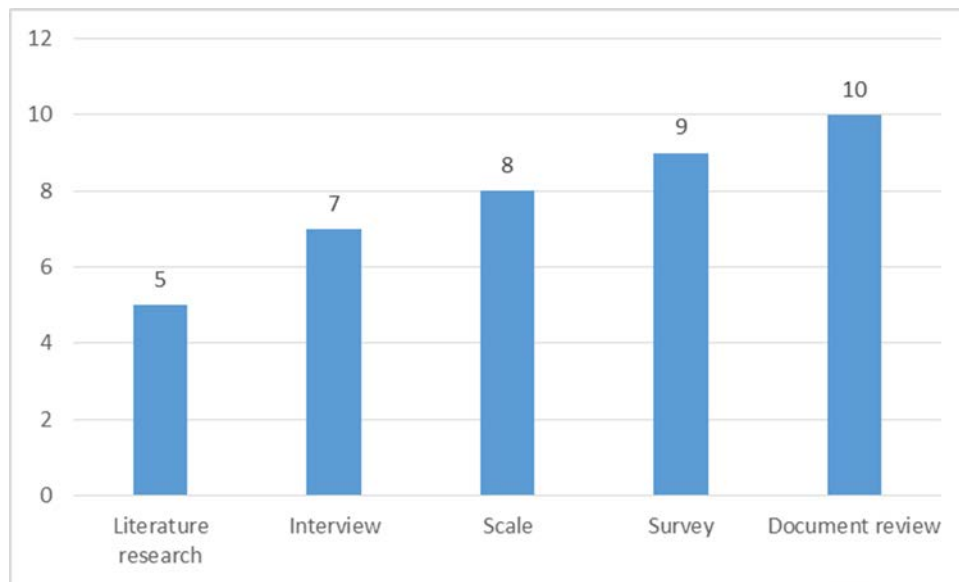


Figure 7. Distribution of Studies by Data Collection Tool

5. Findings Discussion and Conclusion

In this section, the findings from a general analysis of countries which have integrated coding training into their curricula and the content analysis of studies on coding training in Turkey are presented and discussed. It is believed that this study's findings from the analysis of countries which have integrated coding training into their curricula and the content analysis of studies on coding training in Turkey, will provide an insight to other researchers.

Many countries have re-evaluated their curriculum and have revised it or are in the process of revising it so that their curricula includes coding training. 16 out of 18 countries analysed have integrated coding training into their national or regional curricula (Austria, Bulgaria, Czech Republic, Denmark, Estonia, France, Hungary, Ireland, Israel, Lithuania, Malta, Spain, Poland, Portugal, Slovakia and the United Kingdom.) It was determined that **Finland**, **Belgium**, the **USA** and **South Korea** are planning to integrate coding training into their curricula. **Turkey** is also among the countries which have realised the significance of coding training and are under the process of its integration.

Similarly Demirer & Sak [9], in their study on programming education around the world and in Turkey observed that programming education has been launched as of primary school education both around the world and in our country, and that individuals who start writing codes at an early age will be able to design their own projects and applications in the future; and thus, the programmers

of the future will be born and these programmers will impact the development of their countries.

An analysis of the distribution of the studies on coding education written in Turkish conducted in Turkey by year reveals that there was an increase in number of studies on coding training between 2014-2016 and that between 1997-2007 there were 4 studies published in the first 10 year period, whereas there were 35 in the last 10 year period. It can be said that a total of 38 studies in the last 10 years is a low number for Turkey.

Similarly, within the scope of Turkey [22] reached only 20 articles in their a content analysis in English using the Web of Science as their digital database, which they limited to the field of education and educational researchers and using the "teaching programming, coding, learning coding" keywords.

When the distribution of studies analysed on coding education in Turkey by university is examined, it is determined that most studies conducted on coding education were from Fırat University (5) and Kırıkkale University (6). It can be said that it is insufficient for one university to conduct one study regarding coding, as many universities have done.

When the distribution of studies analysed on coding education in Turkey by subject is examined, it can be seen that subjects of the studies on coding education were; algorithm, computational thinking, coding, robot programming, Scratch training and mostly programming.

When the distribution of studies analysed on coding education in Turkey by intended population is examined, it can be seen that most of the studies were conducted at the undergraduate level and that 20 out of 23 of the studies conducted on undergraduate students were conducted on Computer Education and Instructional Technology undergraduates. Turkey's Ministry of Science, Industry and Technology announcement that the informatics teachers giving the coding courses, which will be added to the curriculum, will be Computer Education and Instructional Technology graduates, supports this conclusion [25]. Furthermore, at the annual Computer Education and Instructional Technology congressional panels Computer Education and Instructional Technology students design projects for coding training, hold workshops (Arduino Programming, Infographic Workshop, Lesson through Drama Workshop, Unity and Game Programming, Scratch Workshop, Robotic Programming Workshop, 3D Creativity Workshop) and compete with students from other universities [17].

When the distribution of studies analysed on coding education in Turkey by method is examined, it can be seen that 17 of the studies on coding education used quantitative methods, 10 used descriptive survey methods (based on literature review), 8 used qualitative methods and 4 used a mixed method. Furthermore, when the distribution of studies analysed on coding education in Turkey by data collection tools is examined, it can be seen that most of the descriptive studies were conducted by reviewing documents and the least were carried out by literature review. It can be said that there need to be more experimental studies regarding coding education.

References

- [1]. Akpınar, Y., & Altun, A. (2014). The need for programming education in knowledge-based society schools. *Primary Education Online Magazine*, 13(1), 1-4.
- [2]. Ananiadou, K., & M. Claro (2009), 21st Century Skills and Competences for New Millennium Learners in OECD Countries. *OECD Education Working Papers*, No. 41, OECD Publishing. DOI: 10.1787/218525261154
- [3]. Babori, A., Fihri Fassi, H., Hariri, A., & Bideq, M. (2016). An e-Learning environment for algorithmic: toward an active construction of skills. *World Journal on Educational Technology: Current Issues* 8(2), 82-90.
- [4]. Bers, M. U., Flannery, L., Kazakoff, E. R., & Sullivan, A. (2014). Computational thinking and tinkering: Exploration of an early childhood robotics curriculum. *Computers & Education*, 72, 145-157.
- [5]. BTE Association. (2013). What has happened, What is happening, What is going to happen? Retrieved from: http://www.bte.org.tr/belge/ne_oldu_ne_oluyor_ne_olacak_BTE_dernege.pdf. (accessed 26 March 2017).
- [6]. Ceker, E., & Ozdamli, F. (2016). Features and characteristics of problem based learning. *Cypriot Journal of Educational Sciences*, 11(4), 195-202. DOI: 10.18844/cjes.v11i4.1296
- [7]. Computing in Estonia, (2012). *Computer language has entered the 1st grade in Estonia*. The Hürriyet Newspaper. Retrieved from: <http://www.hurriyet.com.tr/planet/21405007.asp> , (accessed 27 March 2017).
- [8]. Curzon, P. (2013). Computational thinking: Searching to speak. *Queen Mary, University of London*.
- [9]. Demirer, V., & Sak, N. (2016). Programming Education and New Approaches Around The World And In Turkey. *Journal of Theory and Practice in Education*, 12(3), 521-546.
- [10]. EARGED, (2011). MEB 21st Century Student Profile. Retrieved from: http://www.meb.gov.tr/earged/earged/21.%20yy_og_pro.pdf , (accessed 23 August 2017).
- [11]. European Schoolnet (2015). "Computing Our Future: Computer Programming And Coding" Report. http://www.eun.org/c/document_library/get_file?uuid=3596b121-941c-4296-a760-0f4e4795d6fa&groupId=43887 , (accessed 08 June 2017).
- [12]. FATİH Project in Education (2017). *About FATİH Project in Education* <http://fatihprojesi.meb.gov.tr/proje-hakkinda/> , (accessed 24. June 2017).
- [13]. Framework For 21st Century Learning, 2017. <http://www.p21.org/our-work/p21-framework> , (accessed 20 August 2017).
- [14]. Giordano, D., & Maiorana, F. (2015, March). Teaching algorithms: Visual language vs flowchart vs textual language. In *Global Engineering Education Conference (EDUCON), 2015 IEEE* (pp. 499-504). IEEE.
- [15]. Göktaş, Y., Küçük, S., Aydemir, M., Telli, E., Arpacık, Ö., Yıldırım, G., & Reisoğlu, İ. (2012). Educational technology research trends in Turkey: a content analysis of the 2000-2009 decade. *Educational Sciences: Theory & Practice*, 12(1), 191-196.
- [16]. Kalelioglu, F., & Gülbahar, Y. (2014). The effects of teaching programming via Scratch on problem solving skills: a discussion from learners' perspective. *Informatics in Education*, 13(1), 33-50.
- [17]. National Computer Education and Instructional Technology Student Convention Project Competition (2017). <http://www.botekurultayi.org/> , (accessed 20 August 2017).

- [18]. Özçakmak, Ş. (2014). Bilgisayar kullanımı çocukta bağımlılık yapar mı? <http://www.haberturk.com/polemik/haber/973204-bilgisayar-kullanimi-cocukta-bagimlilik-yapar-mi>. (accessed 13 March 2017).
- [19]. Pinto, A., & Escudeiro, P. (2014, June). The use of Scratch for the development of 21st century learning skills in ICT. In *Information Systems and Technologies (CISTI), 2014 9th Iberian Conference on* (pp. 1-4). IEEE.
- [20]. Resnick, M., Rusk, N., Silverman, B., & Eastmond, E. (2010). The Scratch programming language and environment. *ACM Transactions on Computing Education (TOCE)*, 10(4), 16.
- [21]. Salter, J. (2013). Coding for kids: schoolchildren learn computer programming. *The Telegraph*, 27, 2014..
- [22]. Sayın, Z. & Seferoğlu, S. S. (2016). Academic Informatics 2016, 3-5 February 2016, Adnan Menderes University, Aydın. *Academic Informatics 2016*, 3-5 February 2016, Adnan Menderes University, Aydın.
- [23]. Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. John Wiley & Sons.
- [24]. Vaidyanathan, S. (2013). We need coding in schools, but where are the teachers? <https://www.edsurge.com/news/2013-12-09-opinion-we-need-coding-in-schools-but-where-are-the-teachers> (accessed 20 May 2016).
- [25]. Which Faculty is going to Offer Coding Courses? <http://www.mebpersonel.com/egitim/kodlama-dersini-hangi-brans-verecek-h174915.html> (accessed 24 June 2016).
- [26]. Yıldırım, H., & Şimşek, Y. (2013). *Qualitative Research Methods in the Social Sciences*. Seçkin Publishing, Istanbul.
- [27]. Yucel, Ö., Karahoca, D., & Karahoca, A. (2016). The effects of problem-based learning on cognitive flexibility, self-regulation skills and students' achievements. *Global Journal of Information Technology: Emerging Technologies*, 6(1). DOI: [10.18844/gjit.v6i1.394](https://doi.org/10.18844/gjit.v6i1.394)