Chapter 10

Current Trends in Science Education in the Field of Curriculum and Instruction: A Case of Türkiye[1]

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Abstract

The qualifications expected from a training individual differ with the change in science and technology. The contribution of science education in training qualified individuals for the needs of the 21st age is indisputable. For this reason, the content of effective science education has been inquired by various studies over the years. In this context, new educational trends have been spread for effective science education and their effectiveness have been evaluated. One of the fields that contribute to the science education literature is Curriculum and Instruction. In this chapter, the current trends in science education in the field of Curriculum and Instruction are discussed through a systematic review. In addition, the dissertations carried out in this field were examined through descriptive content analysis. For this purpose, the dissertations in the Department of Curriculum and Instruction (DCI) published in the last six years (2018-2023) in the Council of Higher Education Thesis Center database were scanned by using "science" as a keyword. They were analysed in terms of the distribution of them according to their publication year, master/doctoral studies, participants, purpose, and research methodology. Based on the results, a framework for current trends in science education in the field of Curriculum and Instruction has been established, and an up-to-date literature resource has been created for researchers.

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1. Introduction

The qualifications expected from an educated individual to adapt to the changing world are changing day by day. The role of science education is vital in acquiring these qualifications. For this reason, studies for increasing the effect of science education are gaining importance. Current trends in science education in the field of curriculum and instruction are covered in this chapter through a systematic review

1.1. A brief glimpse into science education researches

Since the beginning of the universe, people have tried to understand nature to survive. In the process of making sense of nature, they benefited from science in an unsystematic way. This process has progressed day by day more systematically and scientifically. This has enabled the improvement of science, and the advancing sciences have made people's lives more qualified. Scientific studies carried out every day have created important knowledge for science. The necessity of gaining this knowledge for students in the right way has increased the importance of science education.

Science education has been presented to students within the framework of different learning theories from past to present. Behavioural theory, which deals with the nature of learning and its instructional consequences, has had a long impact on science education as well as in the other educational disciplines. According to behavioural theory, learning develops with the bond established between stimulus and behaviour, and behaviour change occurs with reinforcement (Keleş & Çepni, 2006). According to this theory, teachers are the presenter of knowledge and the students are the receivers of knowledge. In the learning process, this theory focuses on the reactions of the students, not the processes that take place in the mind of the student.

On the other hand, education studies have begun to inquire effectiveness of behavioural theory and the results of the research have revealed the inadequacies of this theory. Scientific developments have also led to the discussion of this theory. The Soviet Union's sent the Sputnik-I satellite into space in 1957, and then the Sputnik-II satellite, which also contains a stray dog, towards the end of the same year. This situation was an important turning point in the world of education as well as astronomy. Many countries have agreed that it is a vital necessity to change science education programs to demonstrate similar scientific developments. For this purpose, program development studies such as Chemstudy, Physical Science Study Committee, Biological Science Curriculum Study, and Nuffield were carried out and they emphasized that science education should be based on

exploring and laboratory applications and that science education should be given in primary school (Sözbilir & Canpolat, 2006). As a result of all these studies and scientific developments, behavioural theory has left its place in cognitive theories since the 1960s.

Learning environments are organized in such a way that students can respond to stimuli based on behavioural theory, while they are organized in a way that encourages students to learn themselves based on cognitive theories (Acar-Şeşen, 2019). Science education research has focused on active learning approaches that provide improvement of students' learning outcomes such as learning, various skills, attitudes, etc. Some of the current approaches commonly used in science education research are the constructivist approach, inquiry-based learning, cooperative learning, context-based learning, problem-based learning, argumentation-based learning, project-based learning, STEM (Science-Technology-Engineering-Mathematics), science teaching in out-of-school, creative drama, socio-scientific issue-based science teaching and history and nature of science.

The development of technology has been another important factor in the advancement of science education. Especially the pandemic period has once again underlined the place and importance of technology in education. On the other hand, science, by its nature, includes many abstract concepts. Visualization tools are of great importance, especially in understanding chemical events at the microscopic level. In addition, the use of educational technologies in measurement and evaluation is becoming widespread. In recent years, technology has been rapidly being integrated into science education and science education research has evaluated the effects of educational technologies in the learning environment. Animation, simulation, robotic coding, artificial intelligence applications, mobile applications, augmented reality, virtual reality, web 2.0 tools, games, 3D designs, and interactive books are some of the technological tools whose effects are measured in science education research.

Science education research is carried out for different education degrees in science education, preschool education and elementary school education departments within the education faculties. DCI is one of the departments that contributes to science education research.

1.2. Current Trends in Science Education in the Field of Curriculum and Instruction in Türkiye

The DCI is a post-graduate education department. A wide range of postgraduate dissertations are carried out in this department and dissertations

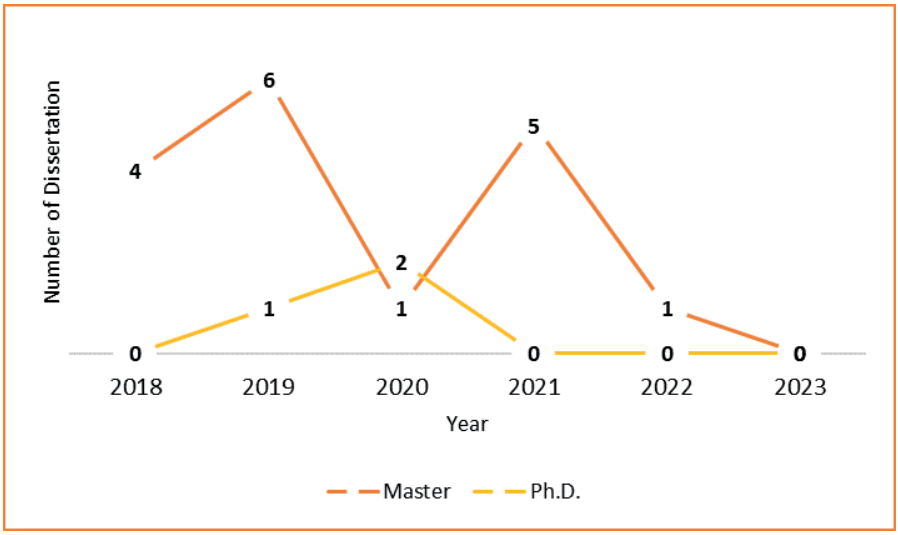
on science education research are the main of them. In this part of the chapter, current trends in science education studies carried out in the curriculum and instruction department are discussed in light of the theses carried out in the last six years (2018-2023).

The dissertations in the DCI published in the last six years (2018-2023) in the Council of Higher Education Thesis Center database were scanned by using "science" as a keyword. The screening was terminated in May 2023. As a result of this scanning, it was determined that a total of 155 dissertations were made in the DCI (Table 1). 34 dissertation completed in the last 6 years and 30 of these dissertations are in master's degrees and four of them are in PhD degrees. Among these dissertations, it has been determined that there are 17 master's and 3 PhD degrees directly related to science education. This situation revealed that a significant portion (75%) of the PhD dissertations completed in the last six years were about science education.

Table 1. Distribution of dissertations carried out in the last 6 years in the DCI

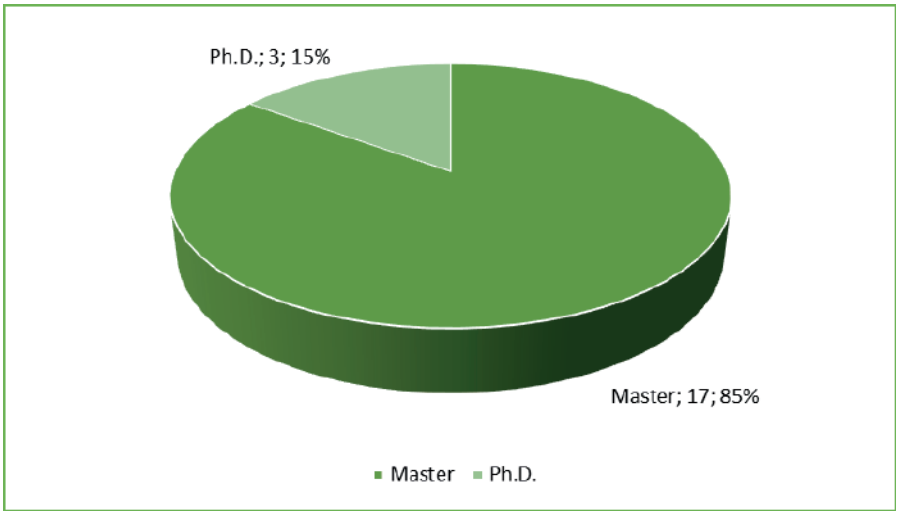
Dissertation	Total (Last 6 years)	Related to science education (f)	Related to science education (%)
Master	30	17	56.7
PhD.	4	3	75
Total	34	20	58.82

The distribution of dissertations on science education completed in the DCI in the last six years is shown in Graph-1. Based on this graph, it is seen that the PhD dissertations were completed in 2019 and 2020, and the PhD dissertation has not been completed since 2020. In 2023, there is no completed dissertation on science education yet. The maximum number of dissertations is 2019 with 7 theses, 6 of which are masters.



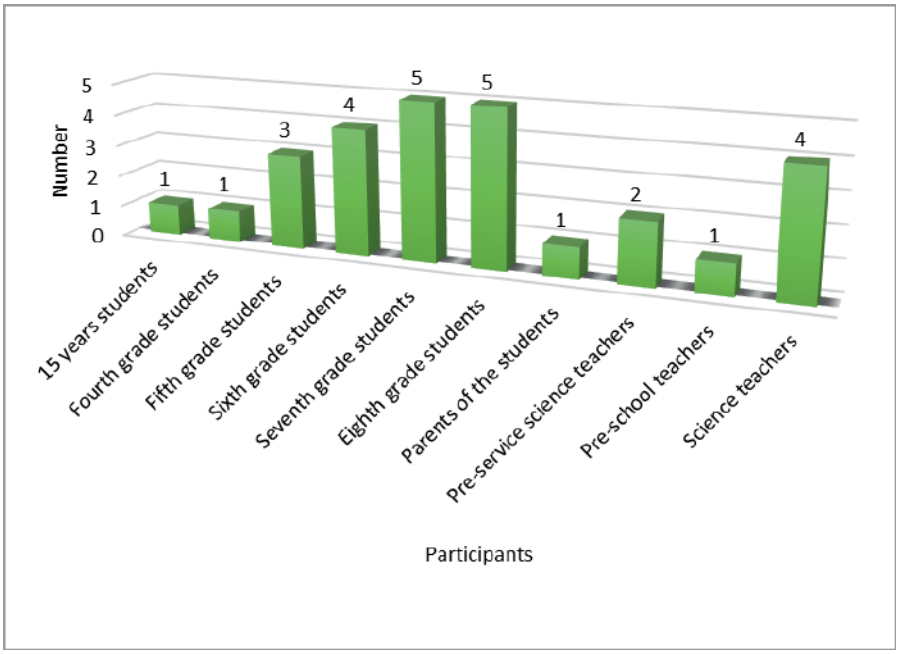
Graph 1. Distribution of dissertations carried out in the last 6 years in the DCI by publication year

In the last six years, a total of 20 dissertations on science education have been completed at the Department of Curriculum and Instruction. The distribution of type of these dissertations is presented in Graph 2. A significant portion (85%) of dissertations are master's theses. While 17 of 20 dissertations are master's dissertations, 3 are doctoral dissertations.



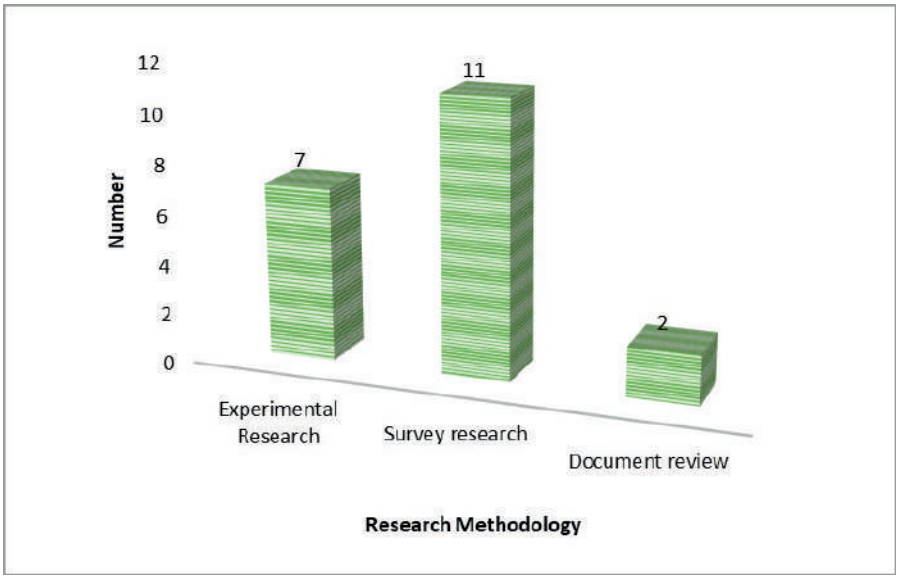
Graph 2. Distribution of dissertations carried out in the last 6 years in the DCI by their types

The distribution of the participants in the dissertations is shown in Graph 3. It is seen that 7th and 8th-grade students are the most selected participants in the theses on science education in the Department of Curriculum and Instruction. 6th-grade students and science teachers follow them.



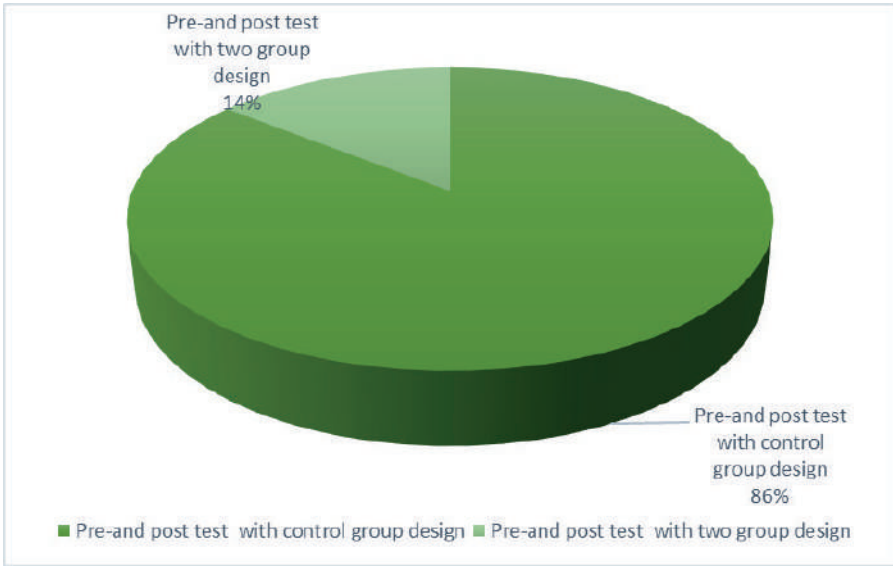
Graph 3. Distribution of dissertations carried out in the last 6 years in the DCI by their participants

The research methodology preferred in dissertations is presented in Graph 4. The graph showed that survey research methodology is mostly used in dissertations. Totally seven dissertations preferred experimental design and two of the seven dissertations are PhD degrees.



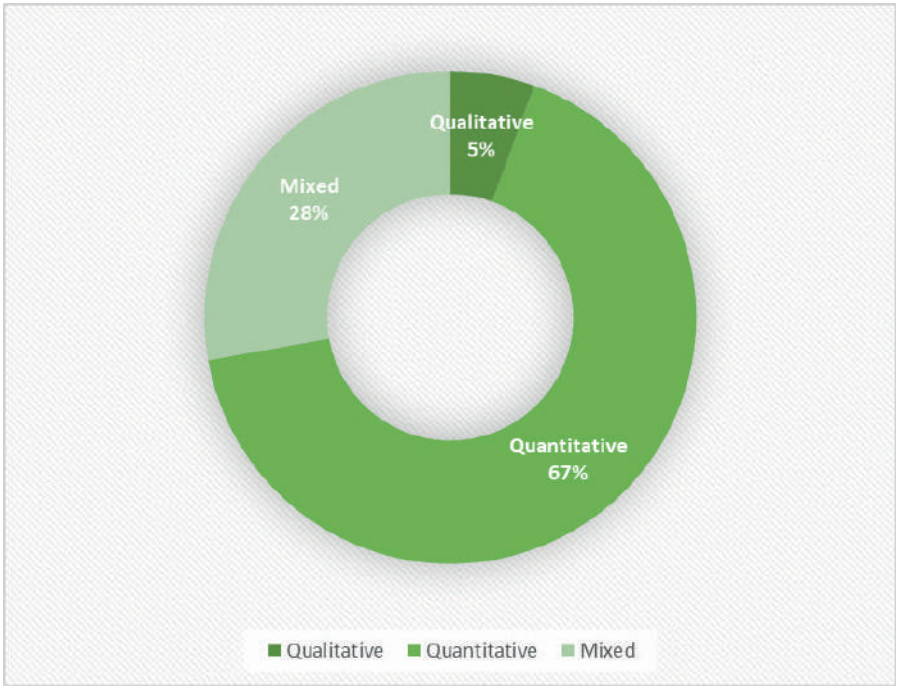
Graph 4. Distribution of dissertations carried out in the last 6 years in the DCI by their research methodologies

Experimental designs used in experimental research are presented in Graph 5. While pre-and post-test with a control group design was used in six (86%) of the experimental studies, pre-and post-test with two group designs were used in one.



Graph 5. Distribution of dissertations carried out in the last 6 years in the DCI by their experimental designs

Data analysis methods used in dissertations are presented in Graph 6. While the qualitative analysis method was used in only one dissertation, the majority of the dissertations (N=12, 67%) preferred the quantitative analysis method.



Graph 6. Distribution of dissertations carried out in the last 6 years in the DCI by their data analysis methods

The topics of the dissertations on science education in the DCI are presented in Figure 1. Since most of the dissertations use survey research methods and they focused on determining the level of various characteristics of the participants and the relationships between them. Some of these characteristics are the frequency of using scientific concepts, views on science and nature activities, and reflective thinking tendencies. In experimental studies, the effect of the coach-assisted quantum learning approach, STEM, inquiry-based learning, project-based learning, STEAM, and the learning environment structured according to learning styles on various variables was investigated.

Figure 1. Topics of the dissertations

2. Conclusion

In this chapter, the current trends in science education in the field of Curriculum and Instruction are identified through a systematic review. In this context, the dissertations in the DCI published in the last six years (2018-2023) in the Council of Higher Education Thesis Center database were analysed in a detailed manner in terms of the distribution of them according to their publication year, master/doctoral studies, participants, purpose, and research methodology.

Descriptive content analysis results showed that most of the dissertations are master's in the last six years. The number of doctoral dissertations is few. These data were expected because conducting the doctoral dissertation

requires experience and the number of people doing a doctorate is low in the Department of Curriculum and Instruction, as in all programs in Türkiye. However, a significant part of these dissertations is about science education, and this is promising for science education research.

The most selected participants in the dissertations on science education in the DCI are secondary school students and science teachers. Teachers are enrolled in graduate education at the Department of Curriculum and Instruction, and the easiest participants for a teacher to reach are their students or colleagues. It is thought that this is one of the effective factors in the preference of these participants.

When the research methodology preferred in the dissertations on science education in the DCI in the last six years (2018-2023) is examined, it is seen that the survey research methodology is mostly used in the dissertations. Experimental research cannot be always carried out uncomplicatedly (Fraenkel, Wallen & Hyun, 2012) and they required more experience in conducting research than other methodologies. In addition, 2 of the 7 theses in which experimental studies were carried out are doctoral dissertations. These results also verified these interpretations.

Current trends for data analysis methods used in dissertations point to quantitative analysis methods. There are deficiencies in the dissertations, especially in the use of qualitative analysis methods. When the dissertations' subjects are considered, it is seen that current approaches are rarely used especially in experimental studies. While current approaches such as STEM and inquiry-based learning were used, many current approaches used in science education were not included in the dissertations. With the development of technology in recent years, the integration of technology into science education has increased. However, there is no technology-assisted dissertation in the dissertations on science education in the Department of Curriculum and Instruction.

Studies on science education are important in increasing the impact of science education and in creating effective science education policies. For this reason, every field that contributes to the science education literature is valuable. As seen in this chapter, science education theses in the DCI provide valuable contributions to the science education literature. However, to increase its contribution to science education, it is recommended that this department receives support from science educators.

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