Examination of Secondary School Mathematics Curriculum in Terms of 21st Century Skills

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Abstract

The curriculum is the whole system that enables them to develop and renew their school education system. With the transition to the constructivism model in the schools of the world countries, many countries have revised their curricula according to this model. The mathematics curriculum taught in secondary education in Turkey was first revised by the Ministry of National Education in 2005 and then renewed in 2018. The aim of this research is to examine the secondary school mathematics curriculum in 2018 (achievements and activities) within the context of 21st century skills. Achievements and activities determined will be evaluated and examined in terms of learning and renewal skills. In line with this purpose, the research analyzed how much 21st century skills were included in the learning outcomes of the 2018 secondary school mathematics curriculum and its effects in the textbooks In addition, in the research, it was analyzed how much problem solving, critical thinking, creative thinking and communication skills of the P21 framework learning and innovation skills were included in the 2018 secondary school mathematics curriculum achievements and textbooks. The research model was conducted with document analysis, one of the qualitative research methods. In the document analysis, 21st century skills were selected by taking into account the P21 framework for 21st century skills. These skills are grouped in three areas: learning and innovation, information, media and technology, and life and professional skills. At the end of the research, it was determined that, due to the nature of the mathematics course, problem solving skills are included in almost all achievements and activities, while skills other than problem solving skills are not included in the achievements, these skills are included in the coursebook activities.

Keywords: *Secondary school, Mathematics education, Mathematics curriculum, Mathematics textbook, 21st century skills*

E-International Journal of Educational Research

Vol: 14, No: 2, pp. 1-16

Research Article

Received: 2022-11-07
Accepted: 2023-03-06

Suggested Citation

Sarıgöz, O. (2023). Examination of secondary school mathematics curriculum in terms of 21st century skills, *E-International Journal of Educational Research,* 14(2), 1-16. DOI: https://doi.org/10.19160/e-ijer.1200499

INTRODUCTION

Nowadays, developments in different parts of the world can affect everyone and access to information has become much easier with the effect of technology in the rapid development of information and communication technologies. How to interpret the information learned and how to adapt to changing situations has become increasingly important (Akpınar & Ekici, 2022). Korkmaz and Kalaycı's (2019) pointed out, the globalization of information, the development of social, cultural, political, economic, technological, industrial and other fields, changes in quality perceptions, national and international competition and the impact of new professions, personal knowledge, skills and talent requirements has brought a drastic change in education. Today, as always, every individual must receive the necessary education in accordance with the conditions and requirements of the age. With the developing technology, there is a great need for individuals who can use their metacognitive skills professionally (Polat & Dede, 2022), especially those who can think innovatively, critically and creatively.

There are many life skills developed in the field of education in the world. However, the Partnership for 21st Century Skills (P21) framework is one of the most researched and accepted skills frameworks in terms of competences and skills. The P21 Framework for 21st Century Learning is a skills framework created by different companies and associations in the United States. This skill framework defines the competencies and characteristics that students need in their careers and lives (Voogt & Roblin, 2012). In this context, the basic competencies that students should have from kindergarten to the last grade of high school are emphasized. In addition, The P21 Framework for 21st Century Learning is a generally accepted framework that has been cited by different studies (Beers, 2011; Brown, 2018; Gelen, 2017; Lamb et al., 2017; Partnership for 21st Century Skills, 2009).

There are many frameworks in the literature on what 21st century skills are and how they should be. There are four skills that stand out in this framework. These skills are problem solving, critical thinking, creativity and communication skills.

Table 1. *The Partnership for 21st Century Learning (P21, 2009)*

Basic skills	Learning and Innovation Skills	Information, Media and Technology Skills	Life and Professional Skills
Sub skills	Problem solving Critical Thinking Creative Thinking Communication Collaboration	Information Literacy Media Literacy Information and Communication Technologies Literacy	Flexibility and Adaptation Entrepreneurship Self-direction Social Skills Intercultural Skills Productivity and Responsibility Leadership and Responsibility

The 21st century basic skills shown in Table 1 are designed to continue the learning process in life outside of school as well as in school. These skills are thought to be important and effective in the teaching process of mathematics. Some studies have shown that the constantly changing and developing curricula in our country tend to be closer to daily life skills (Alver & Sancak, 2016; Aydın, 2017; Bayburtlu, 2015). The mathematics curriculum, which was updated in 2018 (1st-8th grades), was tried to be updated according to life skills. In particular, the basic skills of the teaching programs have been tried to be based on the skills of the 21st century (MEB, 2018). The updated mathematics course curriculum based on these skills was first implemented in September 2017 Mathematics curriculum was first implemented in the 1st-5th grades, and in the following years in all grades (MEB, 2018).

Education is the process of creating a desired change in an individual's behavior through her/his own life and intentionally (purposefully and planned) (Ertürk, 1997: 12). In addition, education is the interaction of social and cultural phenomena and variables related to individual phenomena (Varış, 1991). Because of this interaction, people's goals, knowledge, behaviors, attitudes, ideals and moral standards change. Additionally, it can said that education is a process that contributes to personality development and is built on it, prepares individuals for adult life and helps to acquire the necessary knowledge, skills, attitudes and behaviors (Tezcan, 1997: 4). It is also emphasized that education is a social process that includes elite and controlled environments and school activities in the formation of individual socialization and personal development (Demirel & Ün, 1987). Toprakçı (2012; 88) added "the ability to live in other societies" to this list with his definition of education as "education is the process

of making the child an effective human being, a qualified individual for the society/nation and world (or universe) in which he lives".

Educational institutions are usually places where teaching and educational activities are organized in order to acquire the desired behaviors according to a predetermined purpose (Yeşilyurt, 2019). Planned, controlled and organized teaching activities in schools as one of the educational institutionsare called teaching (Demirel, 2009). All activities to be carried out in the teaching process are planned in advance and carried out within the framework of this plan (Erden, 2007). While Taşpınar (2012) defines teaching as is an activity of planning, implementation and evaluation according to a pre-prepared plan, Özçelik (2010) defines teaching as the planning, execution and supervision of the teaching process, in short, the operation of the teaching process. Teaching process, according to the curriculum, it is a learning and teaching activity to provide students with positive behaviors and good habits, to develop their abilities, to shape their personalities, to prepare them for life (Kemertaş, 1999). An important part of these teaching and educational activities is mathematics education and teaching (Toprakçı, 2017)..

Secondary school mathematics curriculum

The secondary school mathematics curriculum has undergone many changes within the framework of the constructivist approach in education initiated by the Ministry of National Education in 2005. According to this new approach, unlike the traditional curriculum, the student is taken to the center, and the teacher is put in the position of a guide who leads her/his students to information and allows them to access information. Then, the curriculum of the secondary school mathematics course was updated again in 2018. In the general objectives of the curriculum, the skills that are desired to be found in individuals with the rapid development and change in science and technology are listed as follows; someone who produces knowledge, can use it functionally in life, can solve problems, think critically, are entrepreneurial, determined, have communication skills, can empathize, contribute to society and culture (MEB, 2018). When we look at the skills that individuals are required to acquire in the curriculum, it is seen that these skills coincide with problem solving, critical thinking, creative thinking and communication and cooperation skills, which are the skills of the 21st Century. These skills will equip the student with the skills expected from today's education system.

Problem solving skills

Problem solving skills are considered as an effective and important skill that helps individual in overcoming the troubles. Evans (1997) defines the problem as a complex and troublesome situation. Some researchers consider the problem not as a challenge but as an opportunity. The problem generally consists of two main elements. The first is the need for problem solving, and the second is finding a suitable method for problem solving and making a decision.

William James and John Dewey established their progressive educational philosophies on science and scientific method as a reflection of philosophical movements such as pragmatism to develop problem solving skills. Problem solving research actually encompasses a very broad field. The problem solving phases are designed to evaluate the implementation of the problem solving phase in the classroom as a method and to present practice activities based on research findings. Because improving students' problem-solving skills is one of the most important goals of an educational institution. Individuals need this skill in order to adapt to social life and changes and to develop successfully and independently (Kalaycı, 2001).

In education, knowledge should be actively acquired in interaction and learned in accordance with the interests of the child. Knowledge is a tool for gaining experience, improving and restructuring. In this context, problem solving includes critical thinking and the redevelopment of what has been learned before (Demirel, 2002; Sönmez, 1994; Tozlu, 1997). Individuals can find all the information they need to solve problems by asking questions. Individuals acquire communication and team building skills while learning throughout life (Pierson & Parikh, 2000). Individuals will only understand how they learn, how they should think and what they know when they acquire problem-solving skills, self-learning and learning to learn behaviors (Barrows et al., 1996).

Critical thinking skills

Critical thinking is the process of understanding and questioning the individual's thought system, establishing a sound logic between this system and applying this logic. Definitions of critical thinking

may be similar in educational literature and scientific sources, but the definitions are slightly different from each other. Can establish cause-effect relationships, question the events and phenomena around him, are open to development, value science and scientific thinking, have analytical thinking and problem solving skills It can be said that individuals have critical thinking skills (Bakır vd., 2019).

In some approaches, critical thinking is defined as a skill. Chance (1986) defines critical thinking as a set of skills such as analyzing facts, generating and organizing ideas, defending ideas, making comparisons, making inferences, evaluating arguments, and problem solving. According to Halpern (1996), critical thinking is a way of thinking that combines skills and strategies. This way of thinking is goal-oriented and purposeful. Its implementation requires the acquisition and use of certain skills and strategies. The word critical means that thinking involves evaluation and judgment. This evaluation is not only about the mind, but also about the thought process.

Scientific thinking is a way of thinking that basically involves generating hypotheses and testing their accuracy, and reasoning using existing data. Therefore, it should also include critical thinking.

Creative thinking skills

Considering the purpose of creativity education, basic human rights and their effects on the economic, social and cultural life of the country, educational institutions at all levels should develop programs that will reveal and develop the creative potential of students (Özden, 2009). The purpose of education is not to repeat what other generations have done, but to educate people who can do new things (Sarıgöz, 2014). According to Piaget, the first and most basic purpose of education is to raise individuals who have the ability to invent new things. In other words, it's goal is to raise creative, inventive and discovering individuals, not individuals who cannot go beyond repeating what previous generations have done. The second purpose of education is to train minds that are critical, can search for the truth, and do not immediately accept everything presented (Erdoğdu, 2005; Sungur, 1997).

The objectives of an educational program to prepare for creativity should be to raise creative awareness and attitude towards creativity, to prepare learning experiences that will lead to critical thinking, to understand creative processes and to ensure the teaching of creative thinking skills (Özden, 2009).

Developing creative thinking skills at all educational levels from primary school to university is considered an important goal. The primary school program developed by the Education and Discipline Board aims to develop creative thinking skills (MEB, 2004). Davis and Rimm (1989) mentioned seven goals of creativity education. These goals are to develop creative awareness and attitudes, instruct creativity, provide creative teaching activities, strengthen creative problem-solving skills, strengthen creative personality traits, teach creative thinking skills, and exercise creative abilities (Özden, 2009).

When educational environments are organized in such a way that students feel comfortable, can understand when they have a problem, can notice problems and can make assumptions, students will exhibit more creative attitudes and behaviors.

Communication and collaboration skills

Cooperation, which is one of the most necessary elements of education, is defined as individuals working together for a certain period of time to achieve a task (Johnson & Johnson, 1999). The collaboration process provides significant benefits in terms of personal socialization and academic skill development, experiencing what it feels like to be helped and to help others, and acquiring new ideas (Bay & Çetin, 2012). The knowledge and experiences of individuals acting together for a common purpose in the collaboration process also contribute to the development and strengthening of interpersonal communication.

The rapid developments and changes in the field of education have carried the amount and speed of spreading of information to very high levels. Today's people should not only remember information, but also be able to access it and use it in any field by establishing communications and collaborating. Such expectations and obligations require individuals to have 21st century learning skills.

Purpose of the research

The purpose of this research is to examine the achievements in the 2018 secondary school mathematics course (5th-8th grade) curriculum and the activities in the MEB mathematics textbook in

terms of 21st century skills (P21 framework). In line with this purpose, answers were sought to the following questions:

1- Are 21st century skills included in the achievements of secondary school mathematics (5th-8th grade) curriculums?
2- Are 21st century skills included in the activities in the textbook of the secondary school mathematics course (5th-8th grade) curriculum?

The importance of research

In the literature review conducted, there were no studies related to the examination of the secondary school mathematics course curriculum in terms of 21st century life skills. Only studies on primary school mathematics curriculum (Sarıgöz & Özkara, 2015; Sarıgöz & Bolat, 2018; Bektaş et al., 2019; Ciritci et al., 2019; Çetin et, al., 2019; Keskin-Oğan et al., 2020) and teachers' views on curriculum have been conducted. In this context, this research, which is thought to be useful for the literature, has analyzed what extent 21st century skills are included in the achievements of the secondary school mathematics curriculum and textbook activities. The fact that the achievements of the secondary school mathematics curriculum and the textbook activities as a whole have not been researched in terms of 21st century skills increases the importance of the study. This research will also increase the awareness of mathematics teachers about 21st century skills and contribute to a better understanding and more effective application of these skills. It is thought that the research will be a source of data for teachers, teacher candidates, academicians, textbook authors and all experts involved in the curriculum development process.

METHOD

Model of the research

This research aims to examine the achievements in the secondary school (5th-8th grade) mathematics curriculum and the activities in the textbooks in terms of 21st century skills. The research was carried out with the document analysis method within the framework of the qualitative research approach. The document analysis method is used to reach the data for the purpose of the research and to determine the findings from these data (Çepni, 2010). Documents are important information sources that should be used effectively in qualitative research (Yıldırım & Şimşek, 2018: 190). Document analysis includes the analysis of written materials containing information about the phenomenon or facts for research purposes (Yıldırım & Şimşek, 2018). According to Karasar (2017), document analysis is a research technique in which documents or records related to the determined subject are used as data sources. In addition, document analysis provides generalizations and interpretations by bringing together the data obtained by examining oral, printed, etc. materials containing information about the topics planned to be researched (Yıldırım & Şimşek, 2018).

Data collection tools

Research data consists of 2018 secondary school mathematics curriculum books (5th-8th grade) and skills in P21 frameworks. In this research, 2018 secondary school mathematics (Bektaş et al., 2019; Ciritci et al., 2019; Çetin et, al., 2019; Keskin-Oğan et al., 2020) textbooks (5th-8th grade) were used as documents. In addition, in the research, the achievements in the 2018 secondary school (5th-8th grade) mathematics curriculum and the activities in the textbooks were analyzed separately in terms of 21st century skills.

Analysis of research data

In the research, the achievements and activities in the secondary school (5th-8th grade) mathematics textbooks were compared in terms of the the 21st century P21 skills. For this purpose, while the achievements and activities in the curricula and textbooks were analyzed, the analyzes were carried out according to the structure of the acquisition sentences, activity sentences and predicates of the sentences in the relevant sources. In the research, examples of the achievements in the secondary school mathematics curriculum were also presented. While numbering the achievements, the numbering

system in the mathematics curriculum was used to provide detailed information about the code of the course, grade level, unit number, subject number and achievement number.

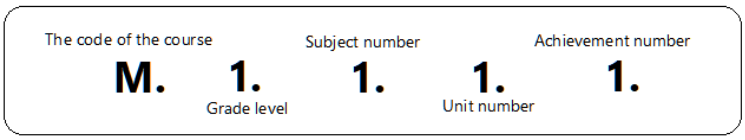

Figure 1. *Curriculum numbering system (MEB, 2018: 14).*

In the research, expert opinion was also sought in order to understand whether the achievements obtained from secondary school mathematics curriculum and textbooks and P21 learning and innovation skills were correctly coded/determined. In order to get expert opinion on the subject, the previously determined achievements and learning and innovation skills were examined by 4 faculty members working on mathematics curriculum, and the similarity ratio between the expert opinions or the reliability of the research was calculated with the formula (consensus / consensus + disagreement) developed by Miles and Huberman (1994). At the end of the calculation, the reliability of the research was determined as .89. According to Miles and Huberman (1994), studies with a reliability coefficient above .70 are reliable. Thus, it was concluded from the calculations and comments that the research data are reliable. The conflicting situations regarding the achievements or learning innovation skills determined in the research were corrected as a result of the opinions of the experts.

According to the grade level, the achievements in the 2018 secondary school mathematics curriculum (5th-8th grade) and textbooks are shown in table 2, and the activities are shown in table 3.

Table 2. *Distribution of 2018 secondary school mathematics curriculum achievements by grade level*

Grade Level	Number of Achievements
5th grade	56
6th grade	59
7th grade	48
8th grade	52
Total	215

According to Table 2, within the scope of the 2018 mathematics curriculum, there are 56 achievements in 5th grades, 59 in 6th grades, 48 in 7th grades and 52 in 8th grades. A total of 215 achievements were examined in the research according to grade levels.

Table 3. Number of activities examined by grade level in 2018 secondary school mathematics textbooks

Grade Level	Number of Activities
5th grade	42
6th grade	38
7th grade	50
8th grade	39
Total	169

The number of activities examined in the MEB textbook is given in Table 3 according to the grade level. According to Table 3, a total of 169 activities were examined in the research, including 42 activities in the 5th grade textbook, 38 activities in the 6th grade textbook, 50 activities in the 7th grade textbook, and 39 activities in the 8th grade textbook.

FINDINGS

In this section, the findings obtained in line with the aims of the research are presented. The findings are presented under separate headings according to the research questions. Therefore, the findings are given under five headings according to achievements and activities.

1. 21st century skills included in the secondary school mathematics curriculum (5th-8th grade)

In the secondary school mathematics curriculum (2018), there are 56 achievements in the 5th grade, 59 achievements in the 6th grade, 48 achievements in the 7th grade and 52 achievements in the 8th grade. Information about including 21st century life skills in these achievements is shown in Table 4.

Although cooperation skills were found in P21 skills, the participants in the study did not mention cooperation skills.

Table 4. *Inclusion of 21st century life skills in the secondary school mathematics curriculum*

Total Achievements by Grade Levels		Problem Solving		Critical Thinking		Creative Thinking		Communication	
		f	%	F	%	f	%	f	%
5th grade	56	56	100	6	10,71	3	5,36	-	-
6th grade	59	59	100	4	6,78	2	3,39	-	-
7th grade	48	48	100	4	8,33	1	2,08	-	-
8th grade	52	52	100	6	11,54	2	3,85	-	-

When Table 4 is examined, problem solving skills are included in all of the achievements in the secondary school mathematics curriculum (5th-8th grade). Critical thinking skill is at the highest rate of 11,54% in 8th Grade achievements and 6.78% in at least 6th Grade achievements. It is seen that creative thinking skills are mostly included in the 5th grade achievements at a rate of 5.36%, and at least in the 7th grade achievements at a rate of 2.08%. Communication skill is not included in any grade level achievements.

Some of the achievements in the secondary school mathematics curriculum related to 21st century skills are as follows.

> ***"M.5.1.4.2. Solves*** *problems* ***and sets up*** *equations that require addition and subtraction with fractions with equal denominators or multiples of the denominator of the other."* (MEB, 2018). In this achievement, problem solving, critical thinking and creative thinking skills are included.
>
> ***"M.5.1.6.2.*** *Associates a percentile with a fraction and decimal representation that represent the same magnitude, and* ***converts*** *these representations into each other."* (MEB, 2018). Problem solving and critical thinking skills are included in this achievement.
>
> "***M.5.2.1.6***. ***Constructs*** *line segments parallel to a segment,* ***interprets*** *whether the drawn segments are parallel or not.* (MEB, 2018). Problem solving and critical thinking skills are included in this achievement.
>
> "**M.5.3.1.3**. **Solves** problems for interpreting data represented by frequency tables or bar graphs." (MEB, 2018). Problem solving and critical thinking skills are included in this achievement.
>
> ***"M.6.1.6.1. Associates*** *the concept of fraction with the division process."* (MEB, 2018). Problem solving and critical thinking skills are included in this achievement.
>
> ***"M.6.1.7.2.*** *In cases where a whole is divided into two parts, determines the ratio of two parts to each other or each part to the whole, in problem situations, when one of the ratios is given,* ***finds*** *the other."* (MEB, 2018). Problem solving skills are included in this achievement.
>
> ***"M.7.2.2.2. Recognizes*** *an equation with a first-order unknown and* ***sets up*** *an equation with a first-order unknown in accordance with given real-life situations."* (MEB, 2018). Problem solving, critical thinking and creative thinking skills are included in this achievement.
>
> "***M.7.2.3.2. Examines*** *the properties of congruent, reverse, interior reverse and exterior reverse angles formed by two parallel lines and an interceptor, and determines the equivalent or complementary angles of the formed angles,* ***solves*** *related problems."* (MEB, 2018). Problem solving and critical thinking skills are included in this achievement.
>
> "***M.7.2.4.4. Constructs*** *area relations of rhombus and trapezoid and* ***solves*** *related problems."* (MEB, 2018). In this achievement, problem solving, critical thinking and creative thinking skills are included.
>
> ***"M.8.2.1.1.*** *Understands simple algebraic expressions and* ***writes*** *them in different formats."* (MEB, 2018). In this achievement, problem solving, critical thinking and creative thinking skills are all included.
>
> "***M.8.2.2.3. Expresses*** *how one of the two variables that have a linear relationship between them changes depending on the other, with a table and an equation."* (MEB, 2018). In this achievement, problem solving, critical thinking and creative thinking skills are included.
>
> "***M.8.2.3.1. Writes*** *mathematical sentences suitable for daily life situations involving inequality with a first-degree unknown*." (MEB, 2018). In this achievement, problem solving, critical thinking and creative thinking skills are included.

2. 21st century skills included in the activities in the 5th grade mathematics textbook

A total of 42 achievements were examined in the activities in the secondary school 5th grade mathematics MEB textbook. Table 5 shows the inclusion of 21st century life skills in these activities.

Table 5. *Inclusion of 21st century life skills in secondary school mathematics 5th grade textbook activities*

Activities Examined by Grade Levels		Problem Solving		Critical Thinking		Creative Thinking		Communication	
		f	%	F	%	f	%	f	%
5th grade	42	42	100	22	52,38	12	28,57	15	35,71

According to Table 5, problem solving skills were included in all of the activities examined in the 5th grade mathematics textbook. In 5th grade mathematics textbook activities, apart from problem solving skills, critical thinking skills are at the rate of 52.38%, communication skills by 35.71%, and creative thinking skills by 28.57%.

Although not as much as problem solving skills, critical thinking, creative thinking and communication skills are also included in the activities in the 5th grade mathematics textbook. The remarkable situation here is that the communication skill, which is not included in the achievements, is included in the activities in the 5th grade mathematics textbook.

3. 21st century skills included in the activities in the 6th grade mathematics textbook

A total of 38 achievements were examined in the activities of the secondary school 6th grade mathematics textbook of the Ministry of National Education. Table 6 shows the 21st century life skills that are included in these activities.

Table 6. *Inclusion of 21st century life skills in secondary school 6th grade mathematics textbook activities*

Activities Examined by Grade Levels		Problem Solving		Critical Thinking		Creative Thinking		Communication	
		f	%	F	%	f	%	f	%
6th grade	38	38	100	18	46,15	4	10,52	2	5,26

According to Table 6, problem solving skills are included in all of the activities examined in the 6th grade mathematics textbook. In the 6th grade mathematics textbook activities, apart from problem solving skills, critical thinking skills are at a rate of 46.15%, creative thinking skills at a rate of 10.52%, and communication skills at a rate of 5.26%.

When the data obtained from the activities in the 6th grade mathematics textbook are examined, it is seen that the problem solving skills of the 21st century learning and innovation skills are at full value, while the other skills are at a low level and even the creative and communication skills are almost nonexistent.

4. Are 21st century skills included in the activities in the 7th grade mathematics textbook?

A total of 50 achievements were examined in the activities of the secondary school 7th grade mathematics textbook of the Ministry of National Education. Table 7 includes 21st century life skills in these activities.

Table 7. *Inclusion of 21st century life skills in secondary school 7th grade mathematics textbook activities*

Activities Examined by Grade Levels		Problem Solving		Critical Thinking		Creative Thinking		Communication	
		f	%	F	%	f	%	f	%
7th grade	50	49	98	32	64	14	28	2	4

According to Table 7, the problem solving skills of the activities examined in the 7th grade mathematics textbook are included at a rate of 98%. In the 7th grade mathematics textbook activities, apart from problem solving skills, critical thinking skills are 64%, creative thinking skills are 28%, and communication skills are 5.26%.

In the activities in the 7th grade mathematics textbook, problem solving skills were included in every activity, as in the achievements, while other skills remained below expectations, and communication skills remained at a negligible rate, as in other activities and acquisitions.

5. 21st century skills included in the activities in the 8th grade mathematics textbook

A total of 39 achievements were examined in secondary school 8th grade mathematics MEB textbook activities. Table 8 includes 21st century life skills in these activities.

Table 8. *Inclusion of 21st century life skills in secondary school 8th grade mathematics textbook activities*

Activities Examined by Grade Levels		Problem Solving		Critical Thinking		Creative Thinking		Communication	
		f	%	F	%	f	%	f	%
7th grade	39	39	100	16	41,02	12	30,77	11	28,21

According to Table 8, problem solving skills were included in all of the activities examined in the 8th grade mathematics textbook. In the 8th grade mathematics textbook activities, apart from problem solving skills, critical thinking skills are 41.02%, creative thinking skills are 30.77%, and communication skills are 28.21%.

21st century learning and innovation skills in 8th grade mathematics textbook activities are at a slightly better level than the distribution of skills in other grades. While problem solving skills are at the highest and complete level as always, other critical thinking, creative thinking and communication skills are at a level that meets expectations, albeit partially, if not as much as expected.

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

In the examination conducted on the 2018 secondary school mathematics curriculum attainments and textbook activities, in terms of problem solving, critical thinking, creative thinking and communication skills, which are sub-skills of learning and innovation skills of 21st century skills, different results were obtained in terms of achievement and effectiveness. It has been determined that problem solving skills are included in all of the achievements and activities due to the nature of the mathematics course. However, in the research, while critical thinking, creative thinking and communication skills, which are among the other skills, were not given much place in the achievements, it was concluded that these skills were still included in the coursebook activities, even if they were not sufficient.

In the research, a total of 56 achievements were examined in the 5th grade achievements, critical thinking skills were included in these achievements at a rate of 10.71%, a total of 59 achievements were examined in the 6th grade achievements and 6.78% of these achievements were included in the critical thinking skills, a total of 48 achievements were examined in the 7th grade achievements, critical thinking skills were included at a rate of 8.33%, a total of 52 achievements were examined in the 8th grade achievements, and it was concluded that 11.54% of these achievements included critical thinking skills. In a study conducted by Yeşilpınar-Uyar et al., (2021), it was concluded that the achievements in the secondary school mathematics curriculum (5th-7th grade) were insufficient in terms of critical thinking.

In the research, a total of 42 activities were examined in the 5th grade textbook activities, and 52.38% of these activities included critical thinking skills, a total of 38 activities were examined in the 6th grade textbook activities and critical thinking skills were included in these activities at a rate of 46.15%, a total of 50 activities in the 7th grade textbook activities were examined and critical thinking skills were included in these activities at a rate of 64%. a total of 39 activities were examined in the 8th grade textbook activities and it was concluded that 41.02% of these activities included critical thinking skills. Thus, in the research, it was concluded that critical thinking skills were less included in the learning achievements and more included in the textbook activities. In some studies, it has been concluded that the achievements in the analysis, evaluation and creation steps in the mathematics curriculum are insufficient in number (Çelik et al., 2018; Kablan et al., 2013; İncikabı et al., 2016).

In the research, it was determined that creative thinking skills were included in the 5th grade achievements at a rate of 5.36%, in the 6th grade achievements at a rate of 3.39%, in the 7th grade achievements at a rate of 2.08% and in the 8th grade achievements at a rate of 3.85%. In addition, it was concluded that creative thinking skills were included in the 5th grade textbook activities at a rate of 28.57%, and in the 6th grade textbook activities at a rate of 10.52%, 28% in 7th grade textbook activities and 30.77% in 8th grade textbook activities. By examining the results of the analysis carried out in the

research, it was concluded that creative thinking skills are not at a sufficient level in achievements and textbook activities. According to the findings obtained from the research, the fact that the creative thinking skills are included in such a low level shows that the program is insufficient in terms of 21st century skills.

In the research, communication skills were not included in any of the achievements at all grade levels. It was concluded that communication skills were included in the activities in textbooks by 35.71% in the 5th grade, 5.26% in the 6th grade, 4% in the 7th grade and 28.21% in the 8th grade.

When the findings obtained in the research are examined in terms of achievements, it has been concluded that 21 century skills such as critical thinking, creative thinking and communication skills are inluded less, except for problem solving skills. In addition, in the research, it was concluded that the 21st Century skills, which are included in the general achievements of the secondary school mathematics curriculum, are not sufficiently included in both achievements and activities. In a study conducted by Akbıyık and Seferoğlu (2002), it was concluded that students with a high tendency to critical thinking are more successful in mathematics, science and social fields.

When the secondary school textbooks are examined, it has been determined that 21st century skills are included more in the activities in the textbooks than the achievements. However, the importance given to 21st century skills such as problem solving, creative thinking, critical thinking and communication skills in both learning achievements and textbook activities is not sufficient. Therefore, secondary school mathematics curricula should be rearranged according to 21st century skills.

When the relationship between secondary school mathematics curricula and 21st century learning skills was examined in the literature, it was determined that there were very few studies. Therefore, the lack of research is an important shortcoming in terms of regulating and improving curricula. For this reason, the number of researches to be carried out on this subject should be increased with theses, articles and books to be written.

Both the secondary school mathematics curriculum and the curriculum of all courses in the schools affiliated to the Ministry of National Education should be constantly revised according to the developing world and changing education systems, so that all students should be educated in accordance with the latest changes.

Ortaokul Matematik Dersi Öğretim Programının 21. Yüzyıl Becerileri Yönünden İncelenmesi

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Özet

Öğretim programları, ülkelerin eğitim sistemlerini geliştirmelerini ve yenilemelerini sağlayan bir sistemler bütünüdür. Devlete bağlı okullarda okutulan her dersin kendine özgü bir öğretim programı vardır. Dünya ülkelerinin okullarında yapılandırmacı yaklaşım modeline geçmesiyle beraber birçok ülke öğretim programlarını bu modele göre tekrar revize etti. Türkiye de ortaokullarında okutulan matematik derslerinin öğretim programlarını 2005 yılında Milli Eğitim Bakanlığı tarafından revize ederek yeniledi. Yenilenen derslerin öğretim programında yapılan ilk değişiklik ise öğrencinin pasif durumdan etkin duruma alınmasıydı. Yine bu modele göre öğretmen ise öğrencilere kılavuzluk eden, öğrencilerin bilgiye ulaşmalarını sağlayan, onlara yol gösteren kısacası rehberlik eden bir konuma gelmiştir. Türkiye'de ortaokul matematik dersi öğretim programları 2005 yılından sonra 2018 yılında tekrar revize edilerek güncellenmiştir. Bu çalışmanın amacı, 2018 ortaokul matematik dersi öğretim programını (kazanımlar ve etkinlikler) 21. yüzyıl becerileri kapsamında incelemektir. Bu amaç doğrultusunda araştırmada, 2018 yılı ortaokul matematik dersi programının kazanım ve ders kitaplarındaki etkinlerinde 21. yy becerilerine ne kadar yer verildiği araştırılmıştır. Ayrıca araştırmada, 2018 ortaokul matematik dersi öğretim programı kazanımları ve ders kitaplarında P21 sınıflandırmasından öğrenme ve yenilik becerilerinden; problem çözme, eleştirel düşünme, yaratıcı düşünme ve iletişim becerilerine ne oranda yer verildiği araştırılmıştır. Araştırma modeli nitel araştırma yöntemlerinden doküman analizi ile yapılmıştır. Doküman analizinde 21. yüzyıl becerileri, 21. yüzyıl becerileri için P21 sınıflandırması dikkate alınarak seçilmiştir. Bu beceriler, öğrenme ve yenilik, bilgi, medya ve teknoloji, yaşam ve kariyer becerileri olmak üzere üç alanda gruplandırılmıştır. Yapılan araştırma sonunda, matematik dersinin doğası gereği hemen hemen tüm kazanım ve etkinliklerde problem çözme becerisine yer verildiği, problem çözme becerisi dışındaki becerilere kazanımlarda çok fazla yer verilmezken, ders kitabı etkinliklerinde ise bu becerilere yer verildiği görülmüştür.

Anahtar Kelimeler: *Matematik eğitimi, Ortaokul, Matematik öğretim programı, Matematik ders kitabı, 21. yüzyıl becerileri*

E-Uluslararası Eğitim Araştırmaları Dergisi

Cilt: 14, No: 2, ss. 1-16

Araştırma Makalesi

Gönderim: 2022-11-07
Kabul: 2023-03-06

Önerilen Atıf

Sarıgöz, O. (2023). Ortaokul matematik dersi öğretim programının 21. yüzyıl becerileri yönünden incelenmesi, *E-Uluslararası Eğitim Araştırmaları Dergisi, 14*(2), 1-16. DOI: https://doi.org/10.19160/e-ijer.1200499

Genişletilmiş Özet

Problem: Hızla küreselleşen dünyada toplumların ve bireylerinin birbirlerini etkileme oran ve olasılığı da artmıştır. Bu yüzden her zaman olduğu gibi bugün de her bireyin mutlaka çağın şartlarına ve gereksinimlerine uygun olarak gerekli eğitimleri alması gerekmektedir. Toprakçı (2012; 88) yaptığı "eğitim, çocuğun içinde yaşadığı toplum/ulus ve dünya (ya da evren) için etkili bir insan, nitelikli bir birey haline getirilmesi sürecidir" şeklindeki eğitim tanımıyla dünyadaki eğitimin de giderek daha bir etkileştiğini ya da etkileşmesi gerektiğini vurgulamaktadır. Bu eğitimin önemli bir parçası da matematik eğitimidir (Toprakçı, 2017). Bu araştırmanın amacı, 2018 yılı ortaokul matematik dersi (5., 6., 7. ve 8. sınıf) öğretim programındaki kazanımlar ile MEB matematik ders kitabındaki etkinlikleri 21. yüzyıl becerileri (P21 sınıflandırması) açısından incelemektir. Bu amaç doğrultusunda 21. yüzyıl becerilerine, ortaokul matematik dersi (5., 6., 7. ve 8. sınıf) öğretim programlarının kazanımlarında ve ortaokul matematik ders (5., 6., 7. ve 8. sınıf) kitabındaki etkinliklerde yer verilip verilmediği veya ne kadar yer verildiği incelenmiştir. İncelenen beceriler şöyldir:

Problem çözme becerileri, bireyin sorunlarını çözmesinde etkili ve önemli bir konu olarak görülmektedir. Evans (1997) problemi, karmaşık ve sıkıntılı bir durum olarak tanımlamaktadır. Bazı araştırmacılar ise problemi zorluk olarak değil, fırsat olarak değerlendirmektedir. Problem genelde iki ana unsurdan oluşmaktadır. Birincisi problem çözmeye ihtiyaç duyulması, ikincisi problem çözümüne uygun yönteminin bulunup karar verilmesidir.

William James ve John Dewey, problem çözme becerilerini geliştirmek için pragmatizm gibi felsefi akımların bir yansıması olarak ilerici eğitim felsefelerini bilim ve bilimsel yöntem üzerine kurmuşlardır. Problem çözme araştırması aslında çok geniş bir alanı kapsar. Problem çözme aşamaları yöntem olarak problem çözme aşamasının sınıfta uygulanmasını değerlendirmek ve araştırma bulgularına dayalı uygulama etkinlikleri sunmak üzere tasarlanmıştır. Çünkü öğrencilerin problem çözme becerilerini geliştirmek bir eğitim kurumunun en önemli hedeflerinden biridir. Bireylerin toplumsal yaşama ve değişimlere uyum sağlayabilmeleri, başarılı ve bağımsız olarak gelişebilmeleri için bu beceriye ihtiyaçları vardır (Kalaycı, 2001).

Eğitimde bilgi, etkileşim içinde aktif olarak kazanılmalı ve çocuğun ilgi alanlarına göre öğrenilmelidir. Bilgi, deneyim kazanmak, geliştirmek ve yeniden yapılandırmak için bir araçtır. Bu bağlamda problem çözme, eleştirel düşünme ve daha önce öğrenilenlerin yeniden geliştirilmesini içerir (Demirel, 2002; Sönmez, 1994; Tozlu, 1997). Bireyler problemleri çözmek için ihtiyaç duydukları tüm bilgilere sorular sorarak ulaşırlar. Bireyler, yaşam boyu öğrenirken iletişim ve takım oluşturma becerileri kazanırlar (Pierson & Parikh, 2000). Bireyler problem çözme becerisini kazandıklarında, kendi kendine öğrenmeyi ve öğrenmeyi öğrenme davranışlarını kazandıklarında ancak nasıl öğrendiklerini, nasıl düşünmeleri gerektiğini ve ne bildiklerini anlamış olacaklardır (Barrows at al., 1996).

Eleştirel düşünme, bireyin düşünce sistemini anlamak ve sorgulamak, bu sistem arasında sağlam bir mantık kurma ve bu mantığı uygulama sürecidir. Eğitim literatüründe ve bilimsel kaynaklarda eleştirel düşünmenin tanımları benzerlikler gösterebilir ancak tanımlar birbirinden biraz farklıdır. Neden sonuç ilişkisi kurabilen, çevresindeki olay ve olguları sorgulayabilen, gelişime açık, bilime ve bilimsel düşünceye değer veren, analitik düşünme ve problem çözme becerisine sahip bireylerin eleştirel düşünme becerisine sahip oldukları söylenebilir (Bakır vd., 2019).

Bazı yaklaşımlarda eleştirel düşünme bir beceri olarak tanımlanır. Chance (1986) eleştirel düşünmeyi gerçekleri analiz etme, fikirler üretme ve organize etme, fikirleri savunma, karşılaştırmalar yapma, çıkarımlarda bulunma, argümanları değerlendirme ve problem çözme gibi bir dizi beceri olarak tanımlar. Halpern (1996)'ye göre eleştirel düşünme, beceri ve stratejileri birleştiren bir düşünme biçimidir. Bu düşünce tarzı, hedef odaklı ve amaçlıdır. Uygulanması, belirli beceri ve stratejilerin edinilmesini ve kullanılmasını gerektirir. Kritik kelimesi, düşünmenin değerlendirme ve yargılamayı içerdiği anlamına gelir. Bu değerlendirme sadece zihinle ilgili değil, aynı zamanda düşünce süreciyle de ilgilidir.

Yaratıcılık eğitiminin amacı temel insan haklarını ve bunların ülkenin ekonomik, sosyal ve kültürel yaşamına etkilerini dikkate alarak, her düzeydeki eğitim kurumlarının öğrencilerin yaratıcı potansiyellerini ortaya çıkaracak ve geliştirecek programlar geliştirmesi gereklidir (Özden, 2009). Eğitimin amacı, diğer nesillerin yaptıklarını tekrarlamak değil, yeni şeyler yapabilen insanlar yetiştirmektir. Piaget'e göre yaratıcı

ve keşfedici insanlar kendilerine sunulan her şeyi kabul etmeyen insanları kontrol ederler (Sungur, 1997). Yaratıcılığa hazırlanmak için bir eğitim programının hedefleri yaratıcılığa yönelik yaratıcı farkındalık ve tutum kazandırmak, eleştirel düşünmeye yol açacak öğrenme deneyimleri hazırlamak, yaratıcı süreçleri anlamak ve yaratıcı düşünme becerilerinin öğretimini sağlamak olmalıdır (Özden, 2009).

İlkokuldan üniversiteye kadar tüm eğitim kademelerinde yaratıcı düşünme becerilerinin geliştirilmesi önemli bir hedef olarak görülmektedir. Eğitim ve Disiplin Kurulu tarafından geliştirilen ilköğretim programında yaratıcı düşünme becerilerinin geliştirilmesi amaçlanmaktadır (MEB, 2004). Davis ve Rimm (1989) yaratıcılık eğitiminin yedi hedefinden bahsetmiş olup bu hedefler; Yaratıcı farkındalık ve tutumlar geliştirin, yaratıcılığı bilgilendirin, yaratıcı öğretim etkinlikleri sağlayın, yaratıcı problem çözme becerilerini güçlendirin, yaratıcı kişilik özelliklerini güçlendirin, aratıcı düşünme becerilerini öğretin ve yaratıcı yetenekleri geliştirmeye yönelik alıştırmalar yapın (Özden, 2009).

Eğitimin en gerekli unsurlarından biri olan işbirliği, bireylerin bir görevi başarmak için belirli bir süre boyunca birlikte çalışması olarak tanımlanmaktadır (Johnson & Johnson, 1999). Bu da *iletişim ve işbirliği becerisini* gerektirmektedir. İşbirliği süreci, kişisel sosyalleşme ve akademik beceri gelişimi, yardım edilmenin ve başkalarına yardım etmenin nasıl bir his olduğunu deneyimleme ve yeni fikirler edinme açısından önemli faydalar sağlamaktadır (Bay & Çetin, 2012). İşbirliği sürecinde ortak bir amaç için birlikte hareket eden bireylerin bilgi ve tecrübeleri de kişilerarası iletişimin gelişmesine ve güçlenmesine katkı sağlamaktadır.

Eğitim alanında yaşanan hızlı gelişimler ve değişimler, bilginin miktarını ve hızını çok yüksek boyutlara taşımıştır. Günümüz insanları bilgiyi sadece hatırlamakla kalmayıp, aynı zamanda iletişimler kurarak ve işbirliği yaparak ona erişmeli ve her alanda kullanabilmelidir. İşte bu tür beklentiler ve zorunluluklar bireylerin mutlaka 21. yy öğrenme becerilerine sahip olmasını gerektirmektedir.

Yapılan literatür taramasında ortaokul matematik dersi öğretim programının 21. Yüzyıl yaşam becerileri yönünden incelenmesiyle ilgili herhangi bir çalışmaya rastlanmamıştır. Literatürde sadece ilkokul matematik dersi öğretim programı ve öğretim programlarına ilişkin öğretmen görüşleriyle ilgili çalışmalar yapılmıştır. Bu bağlamda literatüre faydalı olacağı düşünülen bu çalışmada, ortaokul matematik dersi öğretim programının kazanımlarında ve ders kitabı etkinliklerinde 21. yüzyıl becerilerine ne ölçüde yer verildiği araştırılmıştır. Ortaokul matematik dersi öğretim programının kazanımlarının ve ders kitabı etkinliklerinin bir bütün olarak 21. yüzyıl becerileri yönünden daha önce araştırılmamış olması çalışmanın önemini artırmaktadır. Bu araştırma aynı zamanda matematik dersi öğretmenlerinin 21. yüzyıl becerilerine yönelik farkındalığını artırarak bu becerilerin daha iyi anlaşılmasına ve daha etkili uygulanmasına katkı sağlayacaktır. Araştırmanın öğretmenlere, öğretmen adaylarına, akademisyenlere, ders kitabı yazarlarına ve öğretim program geliştirme sürecinde görev alan tüm uzmanlara veri kaynağı olacağı düşünülmektedir.

Yöntem: Bu araştırma, ortaokul matematik dersi öğretim programında yer alan kazanımları ve ders kitaplarındaki etkinlikleri 21. yüzyıl becerileri açısından incelemeyi amaçlamaktadır. Araştırma, nitel araştırma yaklaşımı çerçevesinde doküman incelemesi metoduyla yürütülmüştür. Dokümanlar, nitel araştırmalarda etkili bir şekilde kullanılması gereken önemli bilgi kaynaklarıdır (Yıldırım & Şimşek, 2018: 190). Doküman incelemesi, araştırma amacına yönelik olgu veya olgular hakkında bilgi içeren yazılı materyallerin analizini kapsar (Yıldırım & Şimşek, 2018). Karasar (2017)'e göre doküman analizi belirlenen konu ile ilgili elde edilen belgelerin veya kayıtların veri kaynağı olarak kullanıldığı araştırma tekniğidir.

Araştırma verilerini, 2018 ortaokul matematik dersi öğretim programı kitapları (5.,6.,7, ve 8. sınıf) ile P21 çerçevelerindeki beceriler oluşturmaktadır. Araştırmada ortaokul matematik ders kitaplarda bulunan kazanımlar ve etkinlikler 21. yüzyıl P21 becerileri ile karşılaştırılmıştır. Bu nedenle 2018 ortaokul matematik dersi öğretim programındaki (5.,6.,7. ve 8. sınıf) kitaplarında bulunan kazanımlar ve etkinlikler kodlanarak belirlenmiştir.

Araştırmada kazanımlar ve etkinlikler analiz edilirken ders kitaplarında veya öğretim programlarında geçen kazanım cümleleri, etkinlik cümleleri ve cümlelerin yüklemlerinin yapısına göre analizler gerçekleştirilmiştir.

Sonuçlar: 2018 ortaokul matematik dersi öğretim programı kazanımları ve ders kitabı etkinliklerinin 21. Yüzyıl becerilerinin ana becerilerinden öğrenme ve yenilik becerilerinin alt becerileri olan problem

çözme, eleştirel düşünme, yaratıcı düşünme ve iletişim becerileri bakımından yapılan incelemede, kazanım ve etkinlik yönünden farklı sonuçlara ulaşılmıştır. Kazanımların ve etkinliklerin tamamında matematik dersinin doğası gereği problem çözme becerisine yer verildiği görülmüştür. Ancak diğer becerilerden eleştirel düşünme, yaratıcı düşünme ve iletişim becerilerine kazanımlarda fazla yer verilmemişken ders kitabı etkinliklerinde bu becerilere yeterli düzeyde olmasa da yine yer verildiği sonucuna ulaşılmıştır.

Araştırmada, 5. Sınıf kazanımlarında toplam 56 kazanım incelenmiş bu kazanımlarda eleştirel düşünme becerisine % 10,71 oranında yer verilmiş, 6. Sınıf kazanımlarında toplam 59 kazanım incelenmiş bu kazanımların %6,78 oranında eleştirel düşünme becerisine yer verilmiş, 7. Sınıf kazanımlarında toplam 48 kazanım incelenmiş, eleştirel düşünme becerisine %8,33 oranında yer verilmiş, 8. Sınıf kazanımlarında toplam 52 kazanım incelenmiş bu kazanımların %11,54 eleştirel düşünme becerisine yer verildiği sonucuna ulaşılmıştır.

Araştırmada, 5. Sınıf ders kitabı etkinliklerinde toplam 42 etkinlik incelenmiş bu etkinliklerde eleştirel düşünme becerisine %52,38 oranında yer verilmiş, 6. Sınıf ders kitabı etkinliklerinde toplam 38 etkinlik incelenmiş bu etkinliklerde eleştirel düşünme becerisine %46,15 oranında yer verilmiş, 7. Sınıf ders kitabı etkinliklerinde toplam 50 etkinlik incelenmiş bu etkinliklerde eleştirel düşünme becerisine % 64 oranında yer verilmiş ve 8. Sınıf ders kitabı etkinliklerinde toplam 39 etkinlik incelemiş ve bu etkinliklerde % 41,02 oranında eleştirel düşünme becerilerine yer verildiği sonucuna ulaşılmıştır. Bu durumda araştırmada, kazanımlarda eleştirel düşünme becerilerine çok az yer verilirken, ders kitabı etkinliklerinde daha fazla yer verildiği sonucuna ulaşılmıştır.

Araştırmada, yaratıcı düşünme becerilerine 5. Sınıf kazanımlarında %5,36 oranında, 6. Sınıf kazanımlarında %3,39 oranında, 7. Sınıf kazanımlarında %2,08 oranında ve 8. Sınıf kazanımlarında %3,85 oranında yer verildiği sonucuna ulaşılmıştır. Yine araştırmada yaratıcı düşünme becerilerine 5. Sınıf ders kitabı etkinliklerinde %28,57 oranında, 6. Sınıf ders kitabı etkinliklerinde %10,52 oranında, 7. Sınıf ders kitabı etkinliklerinde %28 oranında ve 8. Sınıf ders kitabı etkinliklerinde %30,77 oranında yer verildiği sonucuna ulaşılmıştır. Araştırmada yapılan analiz sonuçlarından yaratıcı düşünme becerilerinin kazanımlarda ve ders kitabı etkinliklerinde yeterli düzeyde olmadığı sonucuna ulaşılmıştır. Araştırmadan elde edilen bulgulara göre yaratıcı düşünme becerisinin bu denli az olması programın 21. Yüzyıl becerileri açısından yetersiz olduğunu göstermektedir.

Araştırmada, tüm sınıf düzeyindeki kazanımların hiçbirinde iletişim becerilerine yer verilmemiştir. Ders kitaplarındaki etkinliklerinde ise 5. Sınıfta %35,71 oranında, 6. Sınıfta %5,26 oranında, 7. Sınıfta %4 oranında ve 8. Sınıfta %28,21 oranında iletişim becerilerine yer verildiği sonucuna ulaşılmıştır.

Araştırmada elde edilen bulgular kazanımlar bakımından incelendiğinde problem çözme becerisi hariç, eleştirel düşünme, yaratıcı düşünme ve iletişim becerileri olarak 21. Yüzyıl becerilerine çok az yer verildiği ayrıca araştırmada ortaokul matematik dersi öğretim programının genel amaçlarında yer alan 21. Yüzyıl becerilerine hem kazanımlarda hem de etkinliklerde yeterli düzeyde yer verilmediği sonucuna ulaşılmıştır.

***Öneriler*:** Ortaokul ders kitapları incelendiğinde kazanımlara göre ders kitaplarındaki etkinliklerde 21. Yüzyıl becerilerine daha fazla yer verildiği belirlenmiştir. Ancak yine de hem kazanımlardaki hem de ders kitabı etkinliklerindeki 21 yüzyıl becerileri olan problem çözme, yaratıcı düşünme, eleştirel düşünme ve iletişim becerilerine verilen önem yeterli değildir. Bu nedenle ortaokul matematik öğretim programları 21 yüzyıl becerilerine göre yeniden düzenlenmelidir.

Literatürde ortaokul matematik öğretim programlarının 21. Yüzyıl öğrenme becerileriyle ilişkisi araştırıldığında yapılan araştırmaların çok az olduğu belirlenmiştir. Dolayısıyla yapılan araştırmaların azlığı öğretim programlarının düzenlenmesi ve geliştirilmesi açısından önemli bir eksikliktir. Bu nedenle bu konuda yapılacak olan araştırmaların sayısı tezlerle, makalelerle ve yazılacak kitaplarla arttırılmalıdır.

Gerek ortaokul matematik öğretim programları gerekse de Milli Eğitim Bakanlığına bağlı okullardaki tüm derslerin öğretim programları gelişen dünya ve değişen eğitim sistemlerine göre devamlı revize edilmeli böylelikle yetiştirilmek istenen tüm öğrenciler çağa uygun olarak ve son değişikliklere göre yetiştirilmelidir.

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