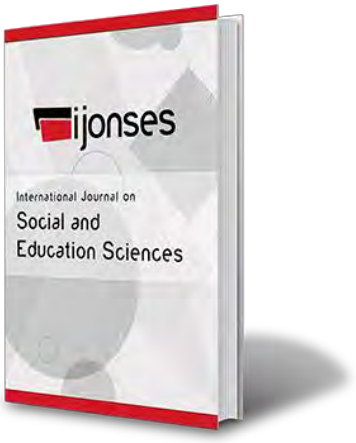

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Abstract

In this research, the level of acquiring analytical thinking skills in the secondary school mathematics curriculum was examined according to the opinions and experiences of the teachers. The research was carried out by the phenomenology pattern, one of the qualitative research designs. The research was performed with the voluntary participation of eight mathematics teachers working in public secondary schools in the central district of Bursa in Türkiye. In the selection of teachers, it was considered that they had experience with the curriculum, had at least five years of professional experience, and received in-service training on the curriculum. The opinions and experiences of the teachers about the curriculum were obtained using a semi-structured interview form. The data were analyzed by content analysis, and themes were created. According to the results, the teachers found the curriculum insufficient for gaining analytical thinking skills. According to the teachers' opinions and experiences, the mathematics textbooks' questions and activities are insufficient for gaining analytical thinking skills. According to teacher experiences, leaving students alone with non-routine questions supports their analytical thinking skills. In addition, the modeling technique helps to embody the analytical thinking process. The teachers stated that the applications in the textbooks were prepared to assume every student would learn at the same pace and similarly. In addition, it has been revealed that students wanted to work by rote, not wanting to tire their minds and getting used to ready-made it difficult for them to acquire high-level thinking skills such as analytical thinking. Some suggestions have been developed according to the results obtained.

Introduction

There is a strong link between the quality of thinking and the individual's quality of life. Qualified and original thoughts enable individuals to make more accurate and effective decisions. In this way, the individual is more successful in daily, business, and academic life. Developing higher-order thinking skills is one of the ways to ensure quality thinking. In this respect, one of the curriculum's primary purposes is to provide students with higher-order thinking skills (MoE, 2008; MoNE, 2018). Analytical thinking is one of the higher-order thinking skills (Kabataş Memiş & Kaçar, 2021). This skill is a fundamental skill required for a meaningful learning process. It supports other high-level thinking skills, such as analytical thinking, reasoning, critical thinking, logical

thinking, divergent thinking, and problem-solving, and enables them to be used effectively (Akpur, 2021; Ocak & Akkaş Baysal, 2021; Ozdemir Baki & Kilicoglu, 2021). In this regard, it has been emphasized in different studies that analytical thinking is a fundamental skill that students should have (Elder & Paul, 2019; Robbins, 2011).

One of the courses in which analytical thinking skills are used effectively is mathematics (Anggoro et al., 2021; Sukmaningthias & Hadi, 2016; Qolfathiriyus, Sujadi & Indriati, 2019). Finding the parts for solving mathematical problems, establishing relationships between the parts, and producing solutions by combining the parts requires analytical thinking. Mathematics curricula are expected to support and develop students' analytical thinking skills. This study aims to examine teachers' opinions about the level of gaining analytical thinking skills in the mathematics curriculum. The results will provide information about the level of gaining high-level thinking skills in the curriculum. It will be understood by which methods and techniques the analytical thinking skill is taught in the classroom.

Mathematics curricula in Türkiye can be examined under two headings, before and after 2004. The curriculum developed before 2004 adopted the traditional education approach. The teacher is in the position of conveying the knowledge. Gaining predetermined target behaviors is one of the most important aims of the curriculum in this period. The curriculum developed in 2004 and the following years brought a new understanding to mathematics teaching. A constructivist approach was adopted, and student-centered practices were added to the program. The "every child can learn mathematics" principle is adopted in the program. Self-control, consideration of individual differences, and development of individual skills were the most important objectives of the program. It aims to support students' cognitive, affective and psychomotor development (MoNE, 2005). In this period, teachers were provided with in-service training to become implementers of the new program. After the 4+4+4 system was put into practice in 2012, the mathematics curriculum was revised. In the program, importance was given to developing mathematics-specific skills and using information and communication technologies. In 2017, 8 basic skills (communication in the mother tongue, mathematical competence, digital competence, etc.) and domain-specific skills (problem-solving, association, etc.) specified in the Turkish Qualifications Framework were added to the program. The curriculum aimed to support high-level thinking skills, ensure permanence in learning, integrate knowledge and skills with abilities, gain human values and transfer what is learned to daily life (MoNE, 2018).

Theoretical Framework

Analytical Thinking

Knowing the standard primary stages of the thinking process and thinking according to these stages can prevent distorted, biased, and prejudiced thinking. Our life and the quality of everything we produce, do or build depend precisely on the quality of our thinking. Thinking of poor quality is more costly in terms of money and quality of life. Although Elder and Paul (2019) stated that there are analysis methods specific to different disciplines, they identified the primary stages of the analytical thinking process common to all disciplines (Figure 1). In this way, researchers aimed to guide individuals to think effectively and analytically.

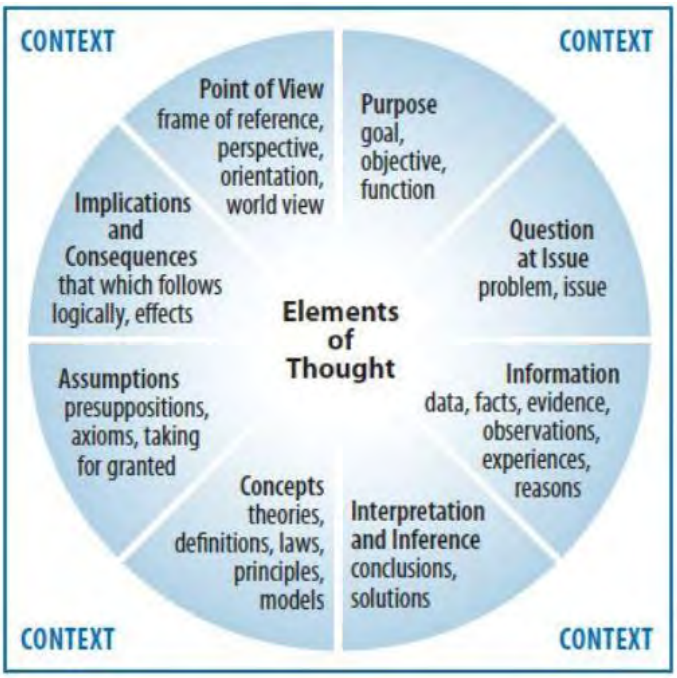

Figure 1. The Elements of Thought (Elder & Paul, 2019)

Thinking about the purpose, defining the question, collecting information, checking inferences, checking assumptions, explaining concepts, being aware of personal perspective, and thinking about results increase the quality of the analytical thinking process (Elder & Paul, 2019). Thinking about the purpose allows the individual to question their own goals and to understand what the task is for, for what purpose, and what objective. Defining the question and making it more understandable can guide the individual to think better. Gathering information provides information and evidence for solving the problem. This way, the individual can understand what information they need and what data types are relevant to the problem. Checking inferences allow interpretations and conclusions to be questioned based on available information. Controlling the implications allows the individual to consider alternative implications. Assumptions cover information that is accepted as accurate without question. Knowing what assumptions the results reached by the individual are based on can enable them to think more accurately. Explaining concepts and being aware of their effects on the thinking process is also necessary for correct thinking. Personal perspective affects what an individual looks at and sees. Knowing how the individual's point of view affects the thinking process can enable him to think healthily. Finally, the individual needs to reflect on the results achieved. The individual is expected to question what the choices, thoughts, and actions will bring and what they imply.

Analytical thinking is defined as examining any object, situation, or event from different aspects, separating it into its components, determining the relationships between components, classifying, seeing cause-effect relationships, and understanding the reasons for established relationships (Bloom, 1956). Analytical thinking skills are used in problem-solving situations (Chaffee, 2014). In order to produce practical solutions to the problems faced by individuals in daily life, they need to think analytically. Namely, it is possible to identify the factors that cause the problem and to see the relationships between them from an analytical point of view. Analytical thinking is also an essential part of academic life. Thinking analytically in mathematics, physics,

chemistry, social studies, grammar, and other disciplines is imperative. Analytical thinking is required to understand and analyze mathematical problems, chemical equations, physical experiments, and social events to realize their essential components and to develop a perspective.

Anderson and Krathwohl (2001) examined analytical thinking in the context of three basic skills: distinguishing, organizing, and dissecting. Discrimination is distinguishing what is essential in a given material or information obtained. Organizing is about understanding the relationships between parts and the whole. Understanding how the parts work and function as a whole makes organizing easier. Analysis by dissecting requires identifying a point of view that is not explicitly stated in a given material. Individuals who use the three fundamental skills effectively can evaluate the information to solve a problem, choose the most effective solution, and see the relationships between the whole and the parts (Anderson et al., 2001).

Core, metacognitive and cognitive systems are the three essential elements of Marzano's (1993) taxonomy that explain how information is processed. The cognitive system plays a crucial role in the processing of information. The cognitive system must work effectively to complete cognitive tasks successfully. In this process, analytical operations such as inference, comparison, and classification are performed, and the cognitive system is responsible for this process (Marzano & Kendall, 2006). Marzano (1993) explained analytical thinking by referring to the cognitive processes within the scope of the analysis step specified in Bloom's (1956) taxonomy. An analytical thinker can identify pieces of information and identify the relationships between these pieces. These individuals can quickly identify the main idea of a text or information and the supporting ideas. Analytical thinking is an essential skill for all students to master thinking. Analytical thinking skills are needed to learn the courses' high-level subjects quickly. Students with this skill can analyze poems, mathematical formulas, biological systems, textbook chapters, concepts and ideas, essays, novels, and articles (Elder & Paul, 2019).

Mathematics and Analytical Thinking

Analytical thinking is a skill that students use when encountering an uncertain situation or problem (Robbins, 2011). Problems faced by students may be related to social or academic life. One of the primary purposes of mathematics lessons, which is an essential part of academic life, is to develop students' higher-order thinking skills (MoNE, 2018). Students use some higher-order thinking skills, such as analytical thinking, to generate solutions to mathematical problems (Anggoro et al., 2021).

According to Bloom's (1956) taxonomy, analytical thinking is among the higher levels. According to taxonomy, analytical thinking is superior to remembering, understanding and applying. In this context, students need to remember, comprehend and apply mathematical knowledge and skills to solve mathematical problems. After this stage, students need analytical thinking to produce correct and valid solutions to the problem. By thinking analytically, they can identify the necessary information for solving a mathematical problem, grasp the relationships between information, and say which information is more critical.

Anderson and Krathwohl (2001) stated that the three essential elements of analytical thinking are distinguishing,

organizing, and dissecting. In solving a mathematical problem, the student's understanding of what information is vital among the given information requires the ability to distinguish. Students' understanding of the use of the information given in the problem and the order of operations requires organizing skills. Finally, the ability of students to produce new information that will lead to a solution based on the information given in the problem requires the ability to examine by disassembling.

In mathematics, analytical thinking is required to combine cognitive processes, plan solutions, produce solutions and reach a conclusion to produce correct answers (Anggoro et al., 2021). Accordingly, it can be said that analytical thinking is an essential skill for teaching mathematics. Studies have shown that using the problem-solving approach in mathematics supports analytical thinking. Sukmaningthias and Hadi (2016) stated that solving mathematical problems improves analytical thinking skills and using mathematical representations. According to these researchers, when a student is faced with a mathematical problem, he starts thinking analytically, albeit superficially. Students develop their analytical thinking skills over time, and accordingly, students use mathematical representations more effectively. There are individual differences in analytical thinking in mathematics. Individuals can have different analytical thinking features, including pre-analytical, partial-analytical, semi-analytical, and analytical. It has been observed that gifted students have high-level features such as pre-analytic and semi-analytic when solving mathematical problems (Qolfathirius, Sujadi & Indriati, 2019). These students effectively used their analytical thinking skills to understand mathematical problems, plan steps and check the answer. Theoretical explanations and research show that analytical thinking skills are essential in mathematics teaching.

Purpose of the Research

When the studies on analytical thinking in Türkiye are examined, secondary school (Kocabaş, 2021; Olça, 2015), high school (Kocaman, 2021), and university students (Arıol, 2009; Retired, 2021; Runyun, 2018) are more involved in the study groups of these studies. These studies discussed analytical thinking skills with mathematical problem-solving, conceptual understanding, critical thinking, context-based thinking, and life skills. There is a limited number of studies conducted with teachers. Yüksel (2011) conducted a study aiming to examine physical education teachers' critical and analytical thinking skills. The results revealed that teachers tend to think critically and analytically. Quantitative and mixed designs were preferred in studies on analytical thinking in Türkiye, and no study was found based on only qualitative research designs.

Numerous studies have been conducted in Türkiye aiming to evaluate mathematics teaching programs. In the research, the curriculum was examined according to the Bloom taxonomy (Aktan, 2020), the TIMSS evaluation framework (Delil, Özcan, & Işlak, 2020; İncikabı et al., 2016), the SOLO taxonomy (Erbaş, 2021), and the teachers' opinions (Çiftçi & Tatar, 2015; Yalçınkaya, 2018). These studies emphasized that the quality of the mathematics curriculum was not at the desired level. The current study aimed to examine the level of gaining analytical thinking skills in the secondary school mathematics curriculum according to the opinions and experiences of the teachers. In this way, information will be collected about the level of providing and supporting high-level thinking skills in the curriculum. Which teaching methods are preferred to gain analytical thinking

skills will be understood. It will be possible to determine the compatibility of the applications in the curriculum with the student's readiness level. The results can shed light on the studies to increase the quality of the mathematics curriculum.

The main problem of the current research is to reveal the opinions and experiences of the mathematics teachers working at the secondary school level regarding the level of acquiring analytical thinking skills in the curriculum. The questions to be answered in line with this fundamental problem are presented below:

1. What are the teachers' views on the level of providing analytical thinking skills in the secondary school mathematics course's official curriculum?
2. What are the teacher's views on the program's practices, methods, and techniques to gain analytical thinking skills?
3. What are the teachers' views on the problems and activities in the textbooks to gain analytical thinking skills?
4. What are the teachers' opinions about the level of gaining analytical thinking skills of the students who achieved the acquisitions in the curriculum?
5. What are the teachers' opinions about the appropriateness of the applications (question, problem, activity) that require analytical thinking skills in the curriculum to the student's readiness levels?

Method

Research Model

This research, which examines the opinions and experiences of teachers about the level of gaining analytical thinking skills in the secondary school mathematics curriculum, was designed as qualitative research. This research, in which the views and experiences of mathematics teachers were examined and described in line with the sub-problems prepared by the purpose of the research, was carried out under the phenomenology pattern, one of the qualitative research designs. This pattern aims to focus on facts that we are aware of but do not have an in-depth and detailed understanding of (Yıldırım & Şimşek, 2016). In this study, the reasons for choosing the phenomenology design are i) to obtain in-depth and detailed information by examining the opinions and experiences of the teachers regarding the level of gaining analytical thinking skills in the mathematics curriculum and ii) to reveal in detail how the secondary school teachers who implement the mathematics curriculum experience the program.

Study Group

This research was carried out with the voluntary participation of eight (8) mathematics teachers working in public secondary schools in the central district of Bursa province in the 2022-2023 academic year. In phenomenological research, data sources are individuals or groups that experience the phenomenon that the research focuses on and can express or reflect this phenomenon (Yıldırım & Şimşek, 2016). For this reason, it is recommended to use non-random sampling (Creswell, 2013) so that the researcher can choose the study group from which he can obtain the best information about the phenomenon (Creswell, 2013). In this context, the criterion sampling method was

used because the participants in the study should have experience with the researched phenomenon. In selecting the participants, the criteria were taken into account: i) teachers have experience with the 2018 official mathematics curriculum, ii) have at least five years of professional experience, and iii) have received in-service training on the current curriculum. Interviews were conducted with eight secondary school mathematics teachers who met these criteria and agreed to participate in the research voluntarily. Creswell (2013) stated that a heterogeneous group ranging from 3-4 individuals to 10-15 individuals is sufficient for phenomenological research. The demographic characteristics of the study group of the research are shown in Table 1.

Table 1. Demographic Characteristics of the Teachers

		f	%
Gender	Female	5	62.5
	Male	3	37.5
Age	35	2	25.0
	36	2	25.0
	37	2	25.0
	38	1	12.5
	41	1	12.5
Educational level	Graduate	3	37.5
	Postgraduate	5	62.5
Professional experience (year)	7	3	37.5
	10	2	25.0
	11	1	12.5
	14	3	12.5
Have you received in-service training on the curriculum?	No	0	0.0
	Yes	8	100.0

When Table 1 is examined, it is understood that 62.5% of the teachers are female and 37.5% are male. The ages of the teachers range from 35 to 41. 62.5% of the teachers have postgraduate education. The professional experience of teachers ranges from 7 to 14 years. All of the teachers stated that they received in-service training on the curriculum.

Data Collection Tool

In phenomenological research, participant's experiences of the phenomenon are analyzed through interviews, observations, documents, etc. (van Manen, 2017). In this context, the data collection tool of the research is the semi-structured interview form, which was created to examine the secondary school mathematics curriculum focused on teachers' opinions and experiences. In creating the draft interview form, four stages stated by Castillo-Montoya (2016) were followed. In this direction, in the first stage, care was taken to ensure that the interview questions were compatible with the purpose and problems of the research. For this, first of all, the literature was searched, and the studies examining the curriculum according to the views and experiences of the teachers were

concerned. In the second stage, draft interview questions based on questioning the opinions and experiences of teachers who implement the mathematics curriculum in the context of analytical thinking were structured. In the third stage, the questions in the draft interview form were submitted to expert opinions to receive feedback on their structure, length, way of expression, comprehensiveness, clarity, and intelligibility. After the changes were made according to expert opinions, some changes were made in the interview form. In the fourth and final stage, a Turkish language and literature teacher examined the draft interview form in terms of language and expression. Before the actual application, two mathematics teachers with the study group's characteristics carried out a pilot application. The opinions of the two teachers who were piloted about the clarity of the questions and whether any questions needed to be added, removed, or changed were received. After the pilot application, the interview form was given its final form. The questions in the semi-structured interview form are as follows:

1- What are your thoughts on the level of acquiring analytical thinking skills in the official secondary school mathematics curriculum?

2- Which applications, methods, and techniques do you include in the program to improve your students' analytical thinking skills? How do you apply these methods?

3- Can the problems and activities in the textbooks sufficiently develop your students' analytical thinking skills?

4- What are your views on the level of gaining analytical thinking skills of students who reach the acquisitions in the mathematics curriculum?

5- What are your views on the suitability of the applications (questions, problems, activities, etc.) that require analytical thinking skills in the mathematics curriculum and textbooks to the student's readiness levels?

Data Collection and Analysis

Before the data collection, pre-interviews were made with eight teachers in the study group. In this meeting, information was given about the purpose of the study. The questions that the teachers wondered about in the research were answered. In the next step, a semi-structured interview form was sent to the teachers via Google Forms. The answers given to the semi-structured interview form were analyzed by content analysis. Data were analyzed, and themes were created independently by the researcher and an expert (in the department of curriculum and instruction). The formula (number of consensus/total agreement + number of disagreements) proposed by Miles and Huberman (2018) was used to determine the percentage of agreement among coders. The percentage of agreement between coders was calculated as 85%. The lack of agreement between the coders was reviewed, and a consensus was fully achieved. In the coding of teachers, the first letter indicates the teacher (T), the second letter indicates the gender (M or F), and the following number indicates the order of the teachers. For example, the first female teacher was coded as TF1.

Validity and Reliability

In general terms, validity means that the inferences the researcher makes based on the collected data are appropriate, meaningful, and valuable. Reliability, on the other hand, refers to the consistency of these inferences

in terms of time, environment, and conditions (Fraenkel, Wallen & Hyun, 2012). However, in qualitative research, the concepts of credibility (internal validity), transferability (external validity), consistency (internal reliability), and confirmability (external reliability) are used instead of validity and reliability (Creswell, 2013; Yıldırım & Şimşek, 2016). Strategies such as long-term interaction, diversification, expert opinion, and participant confirmation are recommended in the field in order to ensure credibility that reflects the accuracy of the findings obtained from the research and meets the concept of internal validity (Creswell, 2013; Fraenkel, Wallen & Hyun, 2012; Miles & Huberman, 1994; Yıldırım & Şimşek, 2016). In this context, the researcher examined many documents related to the focus of the research and interacted with the data sources by communicating with the participants through preliminary interviews. However, expert opinion was sought for the interview form, a data collection tool.

Transferability, which meets the concept of external validity, expresses the extent to which the findings obtained from the research can be applied in different contexts and situations; in other words, to what extent they can be generalized (Fraenkel, Wallen, & Hyun, 2012). In order to increase the transferability of this research, he explained the research design, study group, data collection tools, and data analysis process in detail in the method section and included direct quotations in the findings section. In addition, the criterion sampling method, one of the purposive sampling methods, was used to determine the study group of this qualitative research, which was carried out in the phenomenology pattern. The formula (Reliability = Consensus / (Agreement + Disagreement) x 100) recommended by Miles and Huberman (1994) was used to calculate the reliability of the data obtained from the research.

Results

Teachers' Opinions on the Level of Gaining Analytical Thinking Skills in the Secondary School Mathematics Curriculum

For the first sub-goal of the study, the mathematics teachers were asked, "What are the teachers' views on the level of providing analytical thinking skills in the secondary school mathematics course's official curriculum?" The themes formed according to the teachers' opinions are shown in Table 2.

Table 2. Teachers' Opinions on the Level of Gaining Analytical Thinking Skills in the Secondary School Mathematics Curriculum

Theme	Participants	f	%
The effective aspect of the curriculum	TF2, TF3	2	22.2
The weakness of the curriculum	TF1, TM4, TM5, TF3, TF6, TM8	6	66.7
Advice	TF1	1	11.1

According to the coding, the "Effective aspect of the curriculum" theme has two frequencies, the "Weakness of the curriculum" theme has six frequencies, and the "Advice" theme has one frequency. It has been observed that the view that the program is not sufficient to gain analytical thinking skills has come to the fore. Some of the teachers' views on the theme of the missing aspect of the program are as follows:

"I think that the Official Curriculum is mostly aimed at gaining mathematical skills and subject skills. Even though the subjects in the program are tried to be associated with daily life, a way is followed as if the rules of the subject are made available to the students, but this remains only for learning the rules of the subject. I think it is limited for a role that develops analytical thinking." TF1

"The subjects and concepts in the program are not sufficient, and a program was designed to measure basic knowledge and skills. Practical studies are limited and limit the student's perspective." TF3

"There is no direct expression of analytical thinking skills in the program. There are more references to abstract thinking, mathematical thinking, and algebraic thinking. However, when I look at it on the basis of gains, there are more limitations and recommendations on how to follow a procedure according to the principle of succession. In the context of analytical thinking, opinions are expressed about what is more important and to be emphasized according to the discrimination component. I do not think that the achievements in the program have direct recommendations for gaining analytical thinking skills." TM5

"Although the current program aims to develop students in many ways, it does not give detailed information on how to do this. For example, I have not seen any gains aimed at directly gaining analytical thinking skills. Maybe they expect us as teachers to gain this skill and to explain it indirectly." TM8

According to the views of the teachers listed above, it is understood that the secondary school mathematics curriculum does not have targets for directly gaining analytical thinking skills. It was stated that the subjects and concepts in the program were insufficient in gaining analytical thinking skills and remained at the level of essential knowledge and skills. Although the program aims to develop students' higher-order thinking skills, it does not provide a clear roadmap on how to do this.

Teachers' Opinions on the Applications in the Program to Gain Analytical Thinking Skills

For the second sub-goal of the study, the mathematics teachers were asked, "What are the teacher's views on the program's practices, methods, and techniques to gain analytical thinking skills?" The themes formed according to the teachers' opinions are shown in Table 3.

Table 3. Teachers' Opinions on the Applications in the Program to Gain Analytical Thinking Skills

Theme	Participants	f	%
Associating with daily life	TF1	1	5.6
Developing the habit of reading books	TF1	1	5.6
Using the question-and-answer technique	TF2, TF3, TM4	3	16.6
Gamification	TF2	1	5.6
Solving new types of questions (non-routine problems)	TF3, TF6, TM4, TM5, TF7, TF6, TM8	7	38.8
Modeling	TF2, TM5, TF6, TF7, TM8	5	27.8

According to the coding, the "associating with daily life" theme has one frequency, the "Getting a habit of reading a book" theme has one frequency, the "Using a question-answer technique" theme has three frequencies, the "gamification" theme has one frequency, the "Solving new types of questions" has seven frequencies, and the "Modeling" has five frequencies. It is understood that teachers prefer methods of solving non-routine problems,

modeling, and gamification to gain analytical thinking skills. Some of the teachers' views on the theme of "solving new types of questions" are as follows:

> "Designing skill-based, logic and reasoning criteria such as PISA and TIMSS for the changing exam system LGS (High School Entrance System) exam is effective in gaining thinking skills. In the textbooks that can be designed to be used, the reasoning and hardware-based scenarios that will be derived from the models for LGS can be evaluated with questions and situation drawings." TM4
>
> "I try to create different problem scenarios from time to time by changing the conditions in the given problem. In order to reach a generalization by comparing the differences in such a new situation with the previous one. While solving a problem, I give feedback on how many steps the problem has been solved so that they are aware of the stages of the solution applied and can apply it. So I'm actually trying to improve this skill by using non-routine problems." TM5
>
> "I refer students to different resources to develop higher-order thinking skills such as analytical thinking. Especially for the LGS exam, we need to develop our eighth-grade students beyond what the program specifies. I think that students with analytical thinking skills will solve new-generation questions better. In this regard, I direct my students to different question books to enable them to solve new generation questions." TM8

According to the teachers' explanations, leaving students alone with non-routine questions supports their analytical thinking skills. The fact that the questions asked within the scope of the high school entrance exam also examine their high-level thinking skills shows that teachers encourage their students to solve non-routine problems that they describe as the new generation. Another method that teachers use to gain analytical thinking skills is modeling. The opinions of teachers about this method are as follows:

> "I use the layered teaching technique and make lists of the questions that need to be modeled more practically through the model. I think mathematical modeling questions in terms of analysis satisfy this. The issue of what is important or should be used in the given problem is important in solving these problems." TF6
>
> "Individually, I make students understand the question step by step by modeling it so that they can simply interpret the question and interpret it in a way they understand." TF7
>
> "I want them to model and visualize the information needed to solve the problem; this allows them to examine the problem better and see what is needed for the solution." TM8

According to the teachers' experience, modeling provides the concretization of analytical thinking. Since middle school students are in a substantial development period, modeling is an effective technique for gaining analytical thinking skills. In this respect, it can be said that a large proportion of teachers prefer to use this technique.

Teachers' Views on Problems and Activities in Textbooks to Gain Analytical Thinking Skills

For the third sub-goal of the study, the mathematics teachers were asked, "What are the teachers' views on the problems and activities in the textbooks to gain analytical thinking skills?" The themes formed according to the teachers' opinions are shown in Table 4.

Table 4. Teachers' Views on Problems and Activities in Textbooks to Gain Analytical Thinking Skills

Theme	Participants	f	%
Problems and activities are enough	TF1, TF2	2	22.2
Problems and activities are insufficient	TF1, TF3, TM4, TM5, TF6, TF7, TM8	7	77.8

According to the coding, the " Problems and activities are enough " theme has two frequencies, and the " Problems and activities are insufficient " theme has seven frequencies. The opinion that the problems and activities in the textbooks are insufficient for gaining analytical thinking has come to the fore. The opinions of the teachers on the subject are as follows:

> "After the introduction, students are faced with more exam-oriented and more mathematical, that is, technical questions. The student, who thinks he understands the subject in the introduction and thinks it is simple, falters regarding the more technical parts. Unfortunately, this is the result of a system that stems from the reality of the exam. For example, students who can make mental operations with integers with the air temperature think that they do not understand the subject when they encounter parentheses and exponential numbers in the questions. Considering all these, I can say that developing students' analytical thinking skills is not supported." TF1
>
> "I think that the activities in the textbooks are not at the level to develop metacognitive skills; I see that they are mostly at the level of remembering, comprehending, and applying and cannot pass to the analysis part. I think students should be supported with other resources that include logical reasoning and skill-based questions." TM4
>
> "The problems and activities in the textbooks are not enough to develop your students' analytical thinking skills. For example, the exercises are simple. Some of the questions and activities explain the order in which the given information should be used, and the operations should be done in order, but it is not enough for the student to use it. There is no redundant information regarding discrimination or skills, such as identifying the important variable. There is no high-level thinking approach in the sample exercises, and questions presented." TM5

According to the teachers' opinions, it is understood that the questions and activities in the mathematics textbooks are not suitable for gaining analytical thinking skills. It was stated that the problems and activities in the textbooks were mostly at the level of remembering, comprehension and application. It is emerging that problems and activities with understanding and explanations supporting high-level thinking skills, such as analytical thinking, should be added to textbooks.

The Opinions of the Teachers on the Level of Acquisition of the Analytical Thinking Skills of the Students Who Achieve the Curriculum Lesson Acquisitions

For the fourth sub-goal of the study, the mathematics teachers were asked, "What are the teachers' opinions about the level of gaining analytical thinking skills of the students who achieved the acquisitions in the curriculum?" The themes formed according to the teachers' opinions are shown in Table 5.

Table 5. The Opinions of the Teachers on the Level of Acquisition of the Analytical Thinking Skills of the Students Who Achieve the Curriculum Lesson Acquisitions

Theme	Participants	f	%
The acquisitions are enough	TF1, TF2,	2	25.0
The acquisitions are insufficient	TF3, TM4, TM5, TF6, TF7, TM8	6	75.0

According to the coding, the "The acquisitions are enough" theme has two frequencies, and the "The acquisitions are insufficient" theme has seven. The view that the gains in the curriculum are insufficient for gaining analytical thinking skills is more dominant. Some of the teachers' opinions stating that the achievements are insufficient are as follows:

> "The achievements guide us with the explanations below about what is more important. I care more about the explanations than the achievements themselves. In classrooms, when we teach according to achievements, we focus on the ability to process in a short time rather than thinking skills. This actually causes not only analytical thinking but also other thoughts not to be adequately developed in the classroom environment." TF3
>
> "I think that the achievements targeted in the curriculum generally remain at the level of comprehension and application. In order to develop analytical thinking skills of the students, they should encounter different types of questions apart from the routine problems and activities in the program." TM4
>
> "The student who achieves the goals can reach the level of knowledge and comprehension, cannot pass the application and analysis phase, students who develop themselves with different questions other than what the achievements require are more successful." TF7
>
> "I think that most of the achievements in the program are at the application level. Thanks to these achievements, students become more proficient in solving problems that we express more routinely. Higher level acquisitions, activities, and question types are needed to acquire analytical thinking skills fully." TM8

According to the teachers' views, the gains in the program are primarily at the knowledge, comprehension, and application level. In this respect, it was stated that the students who achieved these gains could not think analytically. In addition, the achievements and explanations do not provide enough guidance for teachers on how to gain higher-order thinking skills. Teachers recommended using non-routine problems and activities together with the achievements in the curriculum to support students' higher-order thinking skills.

The Opinions of the Teachers on the Compliance of the Applications Requiring Analytical Thinking Skills in the Curriculum to the Readiness Levels of the Students

For the fifth sub-goal of the study, the mathematics teachers were asked, "What are the teachers' opinions about the appropriateness of the applications (question, problem, activity) that require analytical thinking skills in the curriculum to the student's readiness levels?" The themes formed according to the teachers' opinions are shown in Table 6.

Table 6. The Opinions of the Teachers on the Compliance of the Applications Requiring Analytical Thinking Skills in the Curriculum to the Readiness Levels of the Students

Theme	Participants	f	%
Readiness is taken into account	TF1, TF2	2	16.7
Program-based issues	ÖK 1, TF2, TM5, TM8	4	33.3
Textbook-based problems	TF1, TF6, TM8	3	25.0
Student-based issues	TF3, TM4, TF7	3	25.0

According to the coding made, the "Readiness is taken into account" theme has two frequencies, the "Program-based issues" theme has four frequencies, the "Textbook-based problems" theme has three frequencies, and the "Student-based issues" theme has three frequencies. Some of the teachers' opinions stating that the curriculum and textbooks do not take into account the readiness for analytical thinking are as follows:

> "In the questions at the end of the topic, the student encounters question styles with no examples in the narration. What is worse is that the questions in the general official exams are not at all similar to these, and the new generation questions are precisely the questions for analytical thinking. In other words, there is no problem in the operation of the program and the connection of the subject in daily life, rules are given, and these rules are reinforced with examples. However, the question styles that will develop analytical thinking on the subject are not in the book, and there is no time to solve them from different sources due to the density of the curriculum." TF1
>
> "There is actually a lot to say about this situation. First of all, not every region in our country is advantageous, there are disadvantaged regions, but our program is a general program, not a local one. So I actually think this problem should be fixed first." TF2
>
> "I do not think that the textbooks and the program give too much space to activities aimed at directly gaining students' analytical thinking skills. It seems that it is aimed at gaining more basic skills. For this reason, I think that the necessary prerequisites for the student for analytical thinking are not specified in the program and are not taken into account. For example, activities and questions that improve students' thinking step by step, that is, going from simple to complex, are not included in the program. It is assumed that students will learn at the same pace and in a similar way." TM8

According to the teachers' opinions, it is understood that the applications in the textbooks are prepared by assuming that every student will learn at the same pace and in a similar way. A large proportion of the applications are aimed at gaining essential skills. Curriculums and textbooks do not meet the needs of students who want to develop their analytical thinking skills. There are no question types in the textbooks that will support the high-level thinking of the students and enable them to think analytically by using the knowledge and skills they have learned.

Teachers also stated that there are different obstacles apart from the curriculum and textbooks. Some teachers' views on student-based problems in the teaching of analytical thinking skills are as follows:

> "The problem is with the students; they want to work by rote; they want everything ready. It is difficult to analyze. I think the general problem of this age is that nobody wants to deal with anything; they want

> to have everything easily and quickly. This way of thinking is reflected in the school as well. They solve the question when you explain it, but they do not want to think about that explanation part." TF3
>
> "Students have a hard time solving logical reasoning and skill-based questions. I think that the metacognitive skills of the students are not developed enough because these types of questions are encountered from an early age. Even though the students' ability to remember, comprehend and apply these kinds of questions in the last year, that is, in the exam year, they have difficulty in reasoning because their analytical thinking skills have not progressed sufficiently." TM4
>
> "Students are not active in solving questions because their prior knowledge is insufficient. The weak foundation takes the form of an impossible problem, which progresses with the child's lack of knowledge at each level. The tests in the book are very inadequate and do not match the required skill level." TF7

According to the teachers' opinions, students' willingness to study by rote, not wanting to tire their minds, and getting used to the ready is a critical obstacle for them to acquire high-level thinking skills such as analytical thinking. The fact that students have not acquired the essential skills that enable high-level thinking before secondary school makes it difficult to think analytically in the secondary school process. This is especially true in solving non-routine problems. Students' deficiencies in basic mathematical knowledge and skills also prevent the acquisition of analytical thinking skills.

Discussion

This research aims to examine teachers' opinions and experiences about the level of gaining analytical thinking skills in the secondary school mathematics curriculum. The research was carried out with the voluntary participation of eight mathematics teachers working in public secondary schools in the central district of Bursa. The criterion sampling method was used because the participants in the study should have experiences with the researched phenomenon. In the selection of the participants, it was taken into account that they had experience with the curriculum, had at least five years of professional experience, and had received in-service training on the curriculum. The opinions and experiences of the teachers about the curriculum were obtained by using a semi-structured interview form. The data were analyzed by content analysis, and themes were created.

When the teachers' opinions about the level of gaining analytical thinking skills in the mathematics curriculum were evaluated, it was determined that the teachers emphasized that the curriculum was insufficient. According to the teachers' views, there are no targets for directly gaining analytical thinking skills in the secondary school mathematics curriculum. It has been stated that the subjects and concepts in the program are insufficient for gaining analytical thinking skills. There is a dominant opinion among teachers that the subjects remain at the level of gaining fundamental knowledge and skills. Although the program aims to develop students' higher-order thinking skills, it does not provide a clear roadmap on how to do this. When the secondary school mathematics curriculum is examined, it is understood that the program aims to gain high-level thinking skills (MoNE, 2018). However, there are different approaches to teaching thinking skills. These approaches can be general, infusion, embedded, and mixed (Ennis, 1989). In the general approach, skills are taught separately and expressly from the content of the current subject. The infusion approach aims to integrate the skills to be taught into the subject

teaching. In the embedded approach, on the other hand, the principles and practices related to the skills are not taught explicitly; they are gained indirectly. In the mixed approach, on the other hand, the general, infusion, or embedded approach is preferred depending on the situation in teaching skills. It can be said that the embedded approach is preferred in the secondary school mathematics curriculum. The program aimed to indirectly provide students with high-level thinking skills, such as analytical thinking, in line with the views and experiences of teachers. On the other hand, the program has no explanation on how to teach analytical thinking skills, even if indirectly. Teachers need to receive in-service training to gain high-level thinking skills. Different studies have also revealed that teachers need in-service training to understand the curriculum better (Çiftçi & Tatar, 2015; Karcı, 2012).

This study evaluated teachers' views on the program's applications to gain analytical thinking skills. It was determined that the teachers included the applications that were included in the program and those that were not. According to teachers' opinions, leaving students alone with non-routine questions supports their analytical thinking skills. The questions asked within the scope of the high school entrance exam and specified as the new generation questions require high-level thinking skills. Many teachers encourage students to solve non-routine problems, which they describe as the new generation. In the literature, it has been recommended to use non-routine problems to develop higher-order thinking skills in mathematics (Arifin, Putri & Hartono, 2021; Fortes & Andrade, 2019; Khaerudin, Praja & Sulaeman, 2021; Maharani et al., 2019). In this respect, it can be said that the teacher's method is appropriate. Another method that teachers use to gain analytical thinking skills is modeling. Modeling helps embody the analytical thinking process. In addition, since conceptual development has just begun in the secondary school period (Senemoğlu, 2003), using the modeling technique can help develop analytical thinking skills. In this respect, it can be said that a large proportion of teachers prefer to use this technique.

Teachers' views on the problems and activities in the textbooks were also evaluated to gain analytical thinking skills. According to the teachers' opinions and experiences, the mathematics textbooks' questions and activities are unsuitable for gaining analytical thinking skills. The teachers stated that the problems and activities in the textbooks were mostly at the level of remembering, comprehension and application. It has been stated that problems and activities that support high-level thinking skills, such as analytical thinking, should be added to the textbooks. In the literature, in studies examining official mathematics textbooks, problem-posing activities were not evenly distributed according to learning areas. All problem-posing types were not included (Çimen & Yıldız, 2017), high-level questions were not included according to the PISA mathematics proficiency scale (Şaban, 2019), Bloom According to the taxonomy, most of the questions measure low-level cognitive skills (Üredi & Ulum, 2020). They are fragile in gaining mathematical competence and skills (Akkaya, 2016). Mathematics textbooks should be developed with practices and activities to develop high-level thinking skills.

Within the scope of the research, the teachers' opinions about the level of gaining the analytical thinking skills of the students who achieved the achievements in the program were also examined. According to the teachers' views, the achievements in the program do not go beyond the level of practice. In this regard, it was stated that the analytical thinking skills of the students who achieved these achievements were not sufficiently developed. In addition, the explanations of the achievements do not guide the teachers on how to gain high-level thinking skills.

Teachers recommended that non-routine problems and activities be used together with the achievements in the curriculum to support students' higher-order thinking skills. Teachers' opinions are consistent with the results of studies in the literature. Aktan (2020) stated that the achievements in the mathematics curriculum focus on low-level steps such as application, understanding, and remembering. Erbaş (2021) determined that few of the achievements in the mathematics curriculum and the questions in the textbooks are found in the extended abstract level, which is the highest level according to the SOLO taxonomy. Çelik, Kul, and Çalık Uzun (2018) stated that according to the revised Bloom's taxonomy, a large proportion of the achievements in the mathematics curriculum are found in the cognitive process dimension in the understanding and application steps, and the knowledge dimension in the conceptual and procedural knowledge steps. Yorulmaz, Çekirdekçi, and Önal (2021) stated that the number of acquisitions for high-level thinking skills, such as creative thinking, is insufficient in the mathematics curriculum. The research and results of this study indicate that the achievements in the current mathematics curriculum are insufficient for gaining high-level thinking skills.

The teachers' opinions about the suitability of the applications that require analytical thinking skills in the curriculum to the student's readiness levels were also evaluated. The teachers stated that the applications in the textbooks were prepared to assume that every student would learn at the same pace and similarly. A large proportion of the applications are aimed at gaining essential skills. Curriculums and textbooks do not meet the needs of students who want to develop their analytical thinking skills. However, the teachers also mentioned the student-based factors that hinder teaching analytical thinking skills. Teachers stated that students' wanting to work by rote, not wanting to tire their minds, and getting used to the ready-made makes it difficult for them to acquire high-level thinking skills such as analytical thinking. In addition, the fact that students did not acquire the essential skills that enable high-level thinking before secondary school makes it difficult for them to think analytically in the secondary school process. This is especially true when solving non-routine problems. In addition, students' deficiencies in basic mathematical knowledge and skills make it difficult to think at a higher level. Teacher views and experiences are consistent with the results of studies in the literature. Arslan and Özpınar (2009) stated that students' prior knowledge is not considered sufficiently in the mathematics curriculum, and there is a disconnection between the units. Tekalmaz (2019) stated that teachers have criticisms that students' readiness levels are not taken into account sufficiently in the mathematics curriculum. Demir and Akar Vural (2017) stated that teachers struggle with some problems conveying the mathematical competence and skills that the curriculum aims to provide students. These problems are; The exam system is listed as having insufficient time to complete the program, and the student's readiness level is inappropriate. The research and the results obtained in this study revealed that the readiness problems arising from the curriculum, textbook, and students make it challenging to acquire analytical thinking skills in mathematics teaching.

Conclusions

When the teachers' opinions about the level of gaining analytical thinking skills in the mathematics curriculum are evaluated in general, it is understood that the teachers mainly emphasize that the program is insufficient. According to the teachers' opinions and experiences, the mathematics textbooks' questions and activities are unsuitable for gaining analytical thinking skills. The gains in the program do not go beyond the application level.

In this regard, it was stated by the teachers that the analytical thinking skills of the students who achieved these achievements were not sufficiently developed. In addition, the explanations of the achievements do not guide the teachers on how to gain high-level thinking skills.

It has been determined that teachers include applications that are included or not in the program in order to improve their analytical thinking skills. When the opinions obtained are evaluated, leaving students alone with non-routine questions supports their analytical thinking skills. In addition, the modeling technique helps to embody the analytical thinking process. The teachers stated that the applications in the textbooks were prepared to assume that every student would learn at the same pace and similarly. In addition, it was stated that student's willingness to work by rote, not wanting to tire their minds, and getting used to the ready-made makes it difficult for them to acquire high-level skills such as analytical thinking. In addition, the fact that students did not acquire the basic skills necessary for higher-order thinking before secondary school makes it difficult for them to think analytically during secondary school.

Recommendations

Acquisitions aiming to teach high-level thinking skills, such as analytical thinking skills, directly or indirectly can be added to the curriculum. It is advisable to increase the number of non-routine questions in textbooks. More attention can be paid to ordering activities and questions in the textbooks from simple to complex. Teaching students' different methods and techniques for solving non-routine questions can directly support the development of analytical thinking skills. Teachers can receive in-service training on developing non-routine problems. In addition, teachers should encourage students to solve non-routine problems.

This research has some limitations. The ages of the teachers, whose opinions were taken about the level of gaining analytical thinking skills in the mathematics curriculum, ranged from 35 to 41. In order to evaluate the curriculum, studies with the participation of more experienced teachers can be conducted. This study examined the level of acquiring analytical thinking skills in the curriculum. With different studies, the level of acquiring high-level thinking skills, such as critical and creative thinking, in the curriculum can be examined. In addition, the level of questioning and the higher-order thinking skills of the questions teachers use in their exams can be investigated.

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