

Methods of teaching geometry in the framework of the updated curriculum in mainstream education

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Abstract

This study aimed to determine that the area benefiting from the secondary education curriculum published in the 2020–2021 academic year is the training related to geometry lessons. In this direction, the opinions of 35 secondary school geometry students working in 2 different secondary schools and geometry lessons were consulted. To determine what will be done, a study design from qualitative research was used. Training can be obtained from the delivery of this product. It consists of questions from restructuring and explaining the research. After the findings were reached, they were analysed in detail by the content analysis method used in the described method, and the predicted were categorised. It has been reached that it can be applied for geometric use, due to problems related to educational principles, insufficient mathematics education, use of materials and so on. Teaching the new education can be achieved by having too much content for teaching, teaching well and teaching the new education correctly. In the same way, the scanning of the application contents and the resource counting process have not been completed in order for the new ones to work better. The conclusions to be drawn from the results of this research are described.

Keywords: Secondary education, education, curriculum, geometry, opinion;

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1. Introduction

The world is in a rapidly developing process. In this process of change, information and technology are rapidly advancing in parallel with development and change. As in every field, these reflections show their effect in the field of education, as well as by adding innovations to the curriculum in terms of teaching and education, including new technological tools in education, determining the content of educational technology and increasing the quality of education (Shagholi et al., 2021). With the rapid change and development of societies, it is necessary to provide a sufficient amount of development and change in curricula. In parallel to the rapid progress of information and technology, the needs of individuals to understand and use mathematics in their daily lives are increasing and the skills that mathematics brings to individuals and societies are being investigated and evaluated (Basar, 2021; Gündoğdu et al., 2012). Mathematics is the common thinking tool of people. It forms the basis for man to know himself and the universe. Societies that have acquired the ability to think numerically have always been successful. Mathematics was a branch of science that gave people the habit of reasoning (Baglama et al., 2017; Yalçinkaya, 2018).

Geometry is one of the main branches of mathematics. There is still only one definition of a geometer, which is a subject that has been researched by many researchers (Hardy, 1925; Malkevitch, 1992) if we look at one of the oldest definitions of geometry. Geometry, which started in the Ancient Greek period and forms the whole of mathematics, is only one of the fields of mathematics in today's age. Alongside the teaching of mathematics in schools, as many researchers have observed, geometry receives relatively less attention than other fields of mathematics, as it focuses on arithmetic (in elementary school) and algebra (in high school). However, when we look at the studies in North America, which is another country, it has been shown that geometry attracts the least attention among mathematical sequences (Clements & Sarama, 2011). It has been defined as the branch of mathematics devoted to the study of shapes and space. As yet another definition, geometry is the shaping state of mathematics (Malkevitch, 2009).

The field of geometry is among the content standards of mathematics. It is one of the main skills. Geometry has an important place in the curriculum of mathematics education (Marchis, 2012). Geometry, in terms of shapes, dimensions, direction, position and movements in the child's physical world, is effective in understanding and organising (Copley, 2010; Kılıç & Şahin, 2021). Developing geometry skills at an early age will contribute to the child's future mathematical success (Moss et al., 2015).

The main concept in the definition of teaching is to achieve goals. In the process of gaining the desired behaviour, learning environments should be designed in order to achieve the desired goals and attention should be paid to the arrangements in a way that addresses the individual differences of the students. Considering individual differences, it is expected that educational activities will increase student success (Aktepe, 2005; Ng et al., 2021; Urea, 2021). Curriculums should be designed to guide teachers. In addition, curriculum practices may not always be fully reflected in the classroom environment, and the expected goal of change may not be realised or the effect of change may occur over a longer time than planned (Alramamneh et al., 2022; Sahlberg, 2005). In the current period in the teaching process with research, it is necessary to design the education programmes

according to the individual characteristics to make the Z generation more active in the teaching process of the younger generation. In the teaching process, it should be possible to plan the teaching in accordance with the generation period of the students and, in this direction, it should be included in the classroom in accordance with the technological developments. It is thought that the new generation, called the Z generation, has different expectations from life compared to previous generations due to the fact that they were born and grew up in the technological age (Bello et al., 2020; Evans et al., 2021; Oblinger & Oblinger, 2005; Prensky, 2001). Although the main target of the curriculum is seen as the students, it is actually prepared mostly for the teachers, as the expected impact on the students will not be achieved if the teachers who are the implementers of this programme are not well informed (Brumpton et al., 2022). For this reason, in the full examination of the changes in the curriculum, it is expected that not only the teachers but also the teachers who will have a say in the preparation of the curriculum in order to reveal exactly what is wanted to be said in the curriculum will be the teachers (Aktan, 2019).

As stated in the geometry curriculum, the existence of many types of geometry is known today, and programme developers are re-discussing the geometry topics and concepts that should be included in the curriculum. Geometry curricula are reconstructed by considering these discussions.

1.1. Purpose of the research

The opinions of the mathematics teachers working in secondary education about the geometry course are very important. Geometry is one of the most important branches of mathematics. The methods and techniques used in the teaching of geometry will also be very effective in the teaching of other mathematics. The opinions of the teachers about the teaching of geometry are very important in the changing curriculum. Within the scope of this general purpose, answers were sought for the following sub-objectives:

1. What are the problems experienced in geometry teaching?
2. What is the reason for the curriculum change?
3. What are the positive aspects of the changing education curriculum?
4. What are your suggestions regarding the new curriculum?

2. Method

In the research, the education for the renewed curriculum is designed to be brought together. In this study, a case study from qualitative research was not conducted. Case study, which is one of the qualitative research, is explained with in-depth expressions, research, examination and interpretation of one or more events (McMillan & Schumacher, 2006). In this context, the most important goal of the researcher in case studies is to make a definition while dealing with one or more situations (Christensen et al., 2014). For this reason, the case study design was determined as the appropriate design in the examination of this study. The current situation is revealed by examining other studies conducted with content analysis. For this reason, the data obtained in this study were supported by content analysis (Uzunboylu et al., 2021).

2.1. Study group of the research

In order to reach the research findings, the opinions of the mathematics teachers who teach geometry in secondary education were obtained. Maximum variation sampling, one of the purposive sampling types, was chosen as the sample type in the selection of the study group for the research. The purpose of choosing this method is to ensure that the diversity of individuals who may be a party to the problem is reflected at the highest level in a small sample group (Uzunboylu et al., 2022; Yağar & Dökme, 2018). The study group consists of 35 geometry teachers working in secondary education institutions on a voluntary basis.

The personal information of the participants participating in the research is given in Table 1.

Table 1. Demographic information

Variable	Group	F
Gender	Female	10
	Male	25

2.2. Data collection and data analysis

Necessary permissions were obtained from the ministry and the school method for this study. In order to reach the data of the research, the questions were prepared by the researchers by taking expert opinions. A qualitative method was used for the research data and semi-structured open-ended interview questions were prepared. As a result of the feedback obtained from the expert opinions, the research questions were finalised. Opinions were received from three experts. The experts consulted for their opinions are one education programmer and two mathematics teachers. A pilot study was conducted before the study was implemented in order to measure the clarity of the questions. As a result of the interviews, the form was given its final shape and four questions were included as research questions. At the end of the interview, the findings obtained from the teachers were confirmed by the teachers participating in the research. The reliability of the research results was attempted to be ensured in this manner. After the research findings were themed, they were explained in detail with the content analysis method.

3. Findings

3.1. Findings related to the problems experienced in geometry teaching

Table 2. Problems in geometry teaching

Theme	f
Based on education policy	15
Math geometry combination	14
Inadequate use of materials	10
Lack of cooperation	2

The opinions of the teachers regarding the difficulties experienced in the teaching of the geometry course were consulted. Most teachers stated that education could not be fully provided due to education policy. Likewise, the majority of teachers stated that they had problems arising from the combination of geometry and mathematics courses. There were 10 teachers who stated that they had problems in teaching due to the lack of materials used in the course. Two teachers stated that there is a problem due to the lack of cooperation with other teachers and teachers in another school.

Some of the opinions of the teachers are as follows:

‘Even though geometry seems to be intertwined with mathematics, teaching geometry should be handled separately. Cognitive skills learned in geometry are also used in mathematics lessons. Many issues are interrelated. A student who is unsuccessful in mathematics is prejudiced in geometry and does not gain the ability to learn’.

‘Educational policies are very important in every teaching. Due to the changing policy, the teaching contents are constantly changing. Mathematics and geometry fields sometimes merge and sometimes separate. That’s why it gets mixed up. It complicates and complicates teaching’.

‘Collaboration is important when teaching. It is very important for the teachers who teach the same course to exchange information in cooperation in transferring the subjects to the students. When cooperation is lacking, there are also problems in teaching’.

3.2. Findings on the reason for the curriculum change

Table 3. The reason for the curriculum change

Theme	<i>f</i>
Topics more	12
By rote	11
Far from practice, too much theoretical content	10

Teachers were asked for their views on the reason for the changed curriculum. There were 12 teachers who assumed that the subjects in the old curriculum have changed because there were too many. Likewise, there were 11 teachers who stated that the curriculum topics had changed due to the fact that there is too much rote-based information. There were 10 teachers who stated that the new curriculum was made due to the fact that there was too much theoretical knowledge far from applied teaching.

Some of the opinions of the teachers are as follows:

‘When we looked at the subjects of the old curriculum, there were too many subjects. Since their content was too much, their narration had to be done very quickly. We had to train subjects that were far from the purpose of teaching. For this reason, a new curriculum was introduced’.

'The old curriculum subjects had a rote-based system. For this reason and because the theoretical knowledge is too much, I think it has changed'.

'We have to comply with the curriculum in institutions affiliated to a centre. Too many curriculum subjects make teaching difficult. For this reason, when I looked at the old curriculum, the subjects were extremely intense. The information was based on memorisation. That's why it was changed'.

3.3. Findings on the positive aspects of the changing education curriculum

Table 4. Positive aspects of the changing education curriculum

Theme	<i>f</i>
Subject distributions are appropriate	12
Applications increased	12
Content and achievement compatible	10

Teachers were asked about the positive aspects of the changing curriculum content. They stated that, unlike the old curriculum, the subject distributions in the new curriculum were arranged in accordance with the classes. Theoretical content has been reduced and the applications have been increased. On the other hand, 10 teachers stated that the compatibility of the content and achievements in the new curriculum is among the positive aspects of the new curriculum.

Some of the opinions of the teachers are as follows:

'Among the most positive aspects of the new curriculum, the content and achievements are generally compatible. The distribution of theoretical information was also appropriate'.

'Because the subjects were so intense, we did not have the opportunity to do activities with the students to train the curriculum subjects. In the new curriculum, this situation has improved compared to the old one and the subjects have been reduced'.

'Subject distributions were a mix of geometry and mathematics. In this case, it showed that the gains and the contents did not match. In the new curriculum, this situation seems to have disappeared. In other words, I can say that the distribution of the subjects and the achievements are compatible'.

3.4. Findings regarding the solution proposals that need to be regulated regarding the new curriculum

Table 5. Solution proposals that need to be regulated regarding the new curriculum

Theme	<i>f</i>
Resources should be increased	15
The content of the teacher's book should be	15

edited	
Application examples should be increased	8

The teachers who took the geometry course were asked for their opinions on the topics they wanted to change or add to the new curriculum. To this finding, most of the teachers stated that the resources should be increased and the content of the teacher explanation handbook should be regulated. Eight teachers stated that the sample applications in the contents of the book should be increased.

Some of the opinions of the teachers are as follows:

‘There are some subjects that need to be regulated in the new curriculum. While preparing these curricula, I think that we, the teachers, who practice, should be consulted. There is a teacher’s handbook, that is, a supplementary book. I think the content of the supplementary book should be changed. The variety of teaching techniques can be increased. More detailed information can be given about which samples and measuring tools we will use for practice’.

‘The number of resources and test booklets we will use in the course can be increased. It should not consist of a single book and notes’.

‘The number of sample tests that students will do in the main book content should be increased. At the end of each subject, there should be tests that students can try themselves. In other words, the examples in the content of the book should be increased’.

‘The new curriculum content is much better than the old one, but there are parts that need editing. Solving these problems will increase the quality of education. Teacher aid books should be reorganised. Contents must be compatible with classes. The number of practice questions in the books should be increased’.

4. Conclusion, discussion and suggestions

As a result of the results obtained from this research, it is to determine the level of the changing curriculum process and contents in practice. Within the scope of this general purpose, teachers’ content on the subject is important in increasing the quality of education. Considering the results obtained from the teachers regarding the difficulties experienced in the teaching of the geometry course, most of the teachers stated that the education could not be given fully due to the education policy. This situation reveals the opinion that changing system contents and exams make it difficult for students to learn. Likewise, the vast majority of teachers stated that they had problems arising from combining geometry and mathematics courses. Although geometry is a branch of mathematics, it can be concluded that it should be taught as a separate course. Another result is that there are problems due to the inadequacy of the materials used in the course. It can be concluded that the technical structures and materials of the schools are lacking. It was also concluded that there was a need for cooperation between teachers. In a study that cognitively examined the mathematical learning of the concept of propositional equivalence in the Logic and Set Theory courses of the secondary school and undergraduate mathematics departments of a state

university in Bulacan, it was concluded that cognitive visual tools and applications had a great effect on learning. The content of the training programmes should be appropriate and the curricula should be in this direction (Ignacio & Sison, 2022).

When the results obtained from the opinions of the teachers regarding the justification of the changed curriculum were examined, it was concluded that the new curriculum was also switched because the subjects in the old curriculum were too many. It has been concluded that the new curriculum has been developed in accordance with the readiness of the new generation of students. Another result of this purpose is that the content in the old curriculum was changed to the new curriculum on the grounds that the content in the old curriculum was too much in terms of theory. Many educational studies today aim to help students learn mathematics (and its related fields) by understanding it in order to create a system. The content of the education programmes should be prepared in accordance with the students. Effective education is provided if the content and achievements are compatible in education programmes (Cawley et al., 2009; Franke & Kazemi, 2001; Van Der Sandt, 2007).

After the findings regarding the old curriculum and the new curriculum contents, the positive aspects of the new curriculum were asked. When the results of this finding were examined, it was concluded that the new curriculum was better. While it was difficult to explain the subject in the old curriculum with a lot of theoretical content, it is seen that this problem has disappeared in the new curriculum. It can be said that the content and theoretical subject distributions of the new curriculum are appropriate. In a study, the geometry learning of primary schoolteacher candidates was examined by both qualitative and quantitative methods. It has been concluded that the number of tests in geometry teaching is significant in increasing geometry content knowledge. This result supports the results obtained from this study. It shows that the more applications and tests are applied to teaching geometry to students, the more successful they are (Tutak & Adams, 2015).

It was asked if there were any areas in the new curriculum that teachers teaching in schools would like to add or change. When the results of this finding were examined, it was concluded that the content of the teacher's handbook could be prepared better. Likewise, another result was that the number of books, notes and handbooks should be increased. Another result is that the number of tests at the end of the topics included in the textbook content should be increased. In another study, it was determined how education should be for teaching geometry in Zimbabwe. A study was conducted in which qualitative and quantitative methods were used together. It has been revealed that teachers are more likely to teach by using the approaches they have experienced during their education. Effective geometry learning is directly proportional to how much experience and practice (Sunzuma & Maharaj, 2019).

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