



2018 Fen Bilimleri Öğretim Programı'nın 2013 Programına Göre Yeni Eklenen Fen ve Mühendislik Konuları İle Değişen Kazanımlar Açısından Aydınlatıcı Program Değerlendirme Modeline Göre Değerlendirilmesi

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Öz

Araştırmanın amacı 2018 ve 2013 Fen Bilimleri öğretim programının karşılaştırılması ile 2018 programına yeni eklenen Fen ve Mühendislik kazanımlarının Aydınlatıcı Program Değerlendirme Modeline göre değerlendirmektir. Araştırmada nitel araştırma yöntemlerinden durum çalışması kullanılmıştır. Araştırmanın çalışma grubunu 2021-2022 Eğitim Öğretim yılında Muğla ilinde devlet okullarında görev yapan 12 Fen Bilimleri öğretmeni ile 8 okul müdürü ve Muğla ilinde bulunan devlet okullarında öğrenim gören 12 öğrenci oluşturmaktadır. Araştırmanın verileri araştırmacılar tarafından geliştirilen yarı yapılandırılmış görüşme formları ile toplanmış, elde edilen veriler içerik analizi yöntemi ile analiz edilmiştir. Araştırmanın sonucunda 2018 fen bilimleri öğretim programına 2013 programından farklı olarak fen ve mühendislik konuları eklenmiştir. Ayrıca fen bilimleri öğretim programında yer alan kazanımların sadeleştiği, konuların azaltıldığı ve sınıf düzeyinde konuların yer değiştiği sonucuna ulaşılmıştır. Programa eklenen Fen ve Mühendislik konularının işlenmesi aşamasında konuların ünitelerin sonunda yer alması, haftalık ders saatinin yeterli olmaması, materyallerin temininin sıkıntılı olması, sistemin sınav odaklı olması ve akademik başarı beklentisinden dolayı STEM' e gerekli zamanın ayrılmadığı sonucuna ulaşılmıştır.

Anahtar Kelimeler: Fen Bilimleri, Fen Bilimleri Öğretim Programı, STEM Eğitimi.

Evaluation of the 2018 Science Curriculum in Comparison with 2013 Curriculum in Terms of the Newly Added Science and Engineering Subjects and the Changing Objectives by Using the Illuminative Program Evaluation Model

Abstract

The purpose of the current study is to compare the 2018 and 2013 science curriculums in terms of science and engineering objectives with Illuminative Program Evaluation Model. The study employed the case study design. The study group is comprised of 12 science teachers, 8 principles and 12 students. The data of the study were collected by using a semi-structured interview form developed by the researchers and the obtained data were analyzed using the content analysis method. As a result of the study, it was concluded that the objectives in the science curriculum were simplified, the number of subjects was reduced and the places of some subjects were changed across the grade levels. It was also found that the newly added science and engineering subjects in the curriculum could not be adequately covered due to their placement at the end of units, insufficient weekly class hours, difficulties in obtaining materials, exam-oriented nature of the system and the emphasis on academic achievement.

Key Words: Science, Science curriculum, STEM education.

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INTRODUCTION

The 21st century is the age of science and technology. As everything changes, the conception and purpose of education also change. The main goal of education is no longer to directly transmit ready-made knowledge, but to teach students how to identify which knowledge is needed where and to what extent and how to obtain it. Furthermore, there is a strong emphasis on educating individuals in such a way as to make them sensitive to science and technology, as well as critical and inquisitive thinkers. Some of the main goals of education are to equip individuals with daily life skills to facilitate their lives and to enable them to acquire knowledge and skills related to their professions in their future lives (Trilling and Fadel, 2009). Countries and businesses expect schools to develop students' 21st century skills such as problem solving, critical thinking, communication, collaboration and self-management (National Research Council, 2012). In addition, efforts are made to develop individuals' engineering skills and foster their innovativeness and entrepreneurship. In this sense, science education has a very important place in terms of making individuals sensitive to science and technology, enabling them to have 21st century skills and imparting engineering skills to individuals. In this context, the main goal of the science curriculum is to educate science literate individuals who are equipped with 21st century skills, possess problem-solving skills, engage in research and inquiry, have a lifelong learning mindset, exhibit curiosity towards their surroundings and support these qualities with their knowledge and skills in science (MEB,2005).

It is a subject of curiosity to what extent the science curriculum organized according to the constructivist approach is effective in educating individuals suitable for the 21st century and equipping them with entrepreneurial and engineering skills. Results of international exams or centralized exams held in our country give important clues about this subject. Turkey is above the average (458) in terms of science literacy and it ranks 39th among 73 countries and 30th among 37 OECD countries (PISA 2019 Türkiye Preliminary Report). According to the 2021 LGS (High School Entrance Exam) statistics, the average of the science test was 13.67 in 20 questions. In the 2018 Science Curriculum, there are objectives related to STEM and engineering, but to what extent students internalize these objectives has been the subject of many studies. In the study of Aydın, Guzey and Saka, (2017), it was emphasized that students' STEM awareness is high even if they are not involved in STEM activities. Thus, the presence of objectives related to STEM in a science curriculum can increase students' motivation towards the lesson. Yet, due to the fact that both the results of the international exams and the results of the exams held in Turkey are not clear enough and only quantitative information is given in the presented reports, sufficient information about the functionality of the program cannot be reached. In addition, the 2018 science curriculum has been implemented for 5 years. In this respect, it is very important to determine the effectiveness of the program. This has been a sufficiently long period for evaluating the effectiveness of a curriculum. Any curriculum requires constant change and adaptation because education requires revisions in line with the changing needs of the relevant era. In the 21st century, in which technological developments are very fast, the necessity of evaluating the science curriculum has emerged in order to make the necessary updates and revisions.

Curriculum evaluation is conducted with the aim of improving the current state of the curriculum or addressing any deficiencies that may arise during the implementation of the curriculum (Kandemir, 2016). While assessing whether the expected objectives have been achieved is important, curriculum evaluation also includes examining how the curriculum functions and determining the ways and options available for improving the curriculum (Ornstein and Hunkins, 2009). The current study was carried out on the basis of the Illuminative Program Evaluation Model, since it presents qualitative data about the curriculum to be evaluated and considers the curriculum as a whole.

The science course aims to encourage individuals to engage with science, technology, scientific thinking, research and inquiry and to live in accordance with the current century by adapting to it. In

the updated curriculum of 2018, the main goal of the curriculum is defined as educating individuals who are equipped with 21st century skills, possess problem-solving skills, engage in research and inquiry, have a lifelong learning mindset, exhibit curiosity towards their surroundings and support these qualities with their knowledge and skills in science (MEB, 2005). In order to keep up with the rapidly evolving and globalizing world, any curriculum needs to be current, dynamic, constantly changing and evolving. Efforts to incorporate STEM education into the educational process, which plays a significant role in countries' plans to achieve their economic goals, are going on worldwide. The benefits of STEM education can be listed as follows, as highlighted in the 2018 World Economic Forum: Enhances students' literacy and develops collaborative work skills in science, mathematics and technology, fosters students' creativity, communication skills and curiosity towards change and innovation, enables students to become aware of everyday life problems, fosters their ability to be producers rather than consumers, promotes the development of entrepreneurial skills and helps them acquire critical and analytical thinking skills.

It is thought that with the functional implementation of STEM education, many global problems can be solved and the economies can be stimulated through new innovations resulting from STEM education. In this context, Turkey added new science and engineering subjects at every grade level to the middle school science curriculum updated in 2018. In addition, changes were made in the objectives in the updated curriculum. The current study is important in terms of contributing to the literature by revealing the functionality and deficiencies of the curriculum through an evaluation of the objectives and new science and engineering subjects added to the 2018 curriculum.

The Illuminative Program Evaluation Model claims that by evaluating the curriculum with a holistic perspective, it provides significant information not only about the curriculum objectives but also about its functionality throughout the process. It allows for the identification of the strengths and weaknesses of both the theoretical and practical aspects of the curriculum. It is illuminative for the stakeholders of the curriculum regarding all its aspects (Özüdoğru and Adıgüzel, 2015).

One of the main purposes of the Illuminative Program Evaluation Model is to guide teachers and also includes the idea that the same curriculum can produce different results in schools depending on different social and physical conditions (Çalışkan, 2014). Since the illuminative model is a holistic model, it offers the opportunity to examine the curriculum in terms of preliminary conditions, implementation process and outcomes.

In the Illuminative Program Evaluation Model, qualitative interviews are conducted with the stakeholders including teachers, students and school principals and then by combining them, the features of the curriculum are tried to be clarified. The illuminative evaluation is carried out at three stages (Ornstein and Hunkins, 2009):

1- Observation: At this stage, the researcher tries to gather information by making observations and making preliminary interviews with teachers and students. Key issues are identified through observations and interviews.

2- Inquiry: At the second stage, various cases, events and ideas are selected. The researcher narrows down his/her focus to concentrate on inquiry. At this stage, comfortable and consistent communication contributes to the selectiveness of the inquiry.

3- Explanation: At this stage, the curriculum is organized by searching for general principles to explain the findings in an explanatory context with cause-effect relationships.

Before the curriculum is updated, the current curriculum is evaluated and then planning and design are performed. Pre-service teachers and teachers are expected to have skills about curriculum development, curriculum implementation and evaluation processes (Ayas and Çepni, 2016). From another point of view, no matter how carefully the curriculum is prepared, if the teacher internalizes

Length of Service	15	30	15	20	15	1	2	2	1	17	19	19
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No.	STUDENTS											
	1	2	3	4	5	6	7	8	9	10	11	12
Grade Level	6	6	6	6	7	7	7	7	8	8	8	8

SCHOOL PRINCIPALS												
No.	1	2	3	4	5	6	7	8				
Length of service	12	29	9	10	6	11	20	7				

Data Collection Tools

In the study, the teacher, student and school principal interview forms consisting of semi-structured interview questions developed by the researchers were used to collect data. The interview forms were submitted to the review of curriculum development and evaluation experts and necessary adjustments were made in accordance with their feedbacks and the principles of preparing interview forms were taken into consideration in the development process of the forms.

Teacher Interview Form

The teacher interview form consists of 6 items. The items include questions about what has changed in the 2018 curriculum compared to the 2013 science curriculum, the contributions of the newly added science and engineering subjects and newly added objectives to the development of projects, to the organization of events such as competitions and science fairs and to science education and to the studies conducted in the field of STEM. After the teacher interview form was prepared, it was submitted to the review of four experts specialized in the field of curriculum. In line with the feedbacks of the experts, necessary corrections were made and the form was finalized.

Student Interview Form

The student interview form consists of 7 items. The items include questions about how the newly added science and engineering subjects are covered in the classroom, if techniques such as experiments, projects and drama are used, the effect of these techniques on creativity and inquiry skills, the effect of methods which make students active on their learning, the materials they use in the lesson and their knowledge and opinions about STEM. After the student interview form was prepared, it was submitted to the review of four experts specialized in the field of curriculum. In line with the feedbacks of the experts, necessary corrections were made and the form was finalized.

School Principal Interview Form

The school principal interview form consists of 3 items. The items include questions about the functioning of the newly added science and engineering subjects in the 2018 science curriculum and their contribution to school activities, to the development of projects at school, to events such as competitions and science fairs and to the studies conducted in the field of STEM. After the school principal interview form was prepared, it was submitted to the review of four experts specialized in the field of curriculum. In line with the feedbacks of the experts, necessary corrections were made and the form was finalized.

Validity and Reliability of the Study

In order to control the validity of qualitative data, credibility and transferability are checked. For reliability, dependability and confirmability are checked. Credibility is about the examination of the fact that the findings reflect the truth, are compatible with the truth and are suitable for the purpose of the study (Merriam, 2013). In order to ensure credibility in this study, more than one measurement tool were used and the study was conducted over a long period of time. While developing the data collection tools, 4 expert opinions were taken; 2 from the field of science and 2 from the field of education. The applicability of the findings to other situations can be defined as transferability (Patton, 2002). In this study, the application process of the study, the sample and the environment in which it was applied were taken into account in order to ensure transferability. Reliability is that the same research gives the same results when applied at different times or in different situations (Merriam, 2013). A dependability examination can be used to ensure dependability in qualitative research (Yıldırım and Şimşek, 2011). In order to ensure dependability in this study, teachers, students and school principals were included in the implementation process.

Data Analysis

In the analysis of the collected data, content analysis, one of the qualitative data analysis methods, was used. In the analysis of the data obtained in the study, the stages determined by Yıldırım and Şimşek (2008) were followed. The recorded interviews were transcribed and themes and codes were generated based on the data. The frequency of code repetition was determined. In the process of data analysis, the researcher triangulation method was employed. The categorization of extracted codes into respective themes was determined by researchers. A consensus meeting was held for codes that were discussed under different themes and after reaching an agreement, the accuracy of both themes codes was verified by an assessment and evaluation expert.

Process

Ethical approval of Muğla Sıtkı Koçman University Social Humanities Ethics Committee (02/12/2022- 150) was obtained for this study. In addition the informed consent form was signed by the students and their families.

FINDINGS

In this study, which was carried out to evaluate the science and engineering subjects added to and changing objectives in the 2018 science curriculum by using the Illuminative Program Evaluation Model, interviews were conducted with science teachers, students and school principals using a semi-structured interview form.

1- Findings Regarding the First Sub- Problem

The data collected in this section are presented in tables. Findings from the interviews conducted with the science teachers are given in Table 2.

Table 2. Themes, Codes and Frequencies of the Data Obtained From the Interviews with the Science Teachers

THEME	CODE	FREQUENCY
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Changes in the Curriculum	Science and engineering subjects	12
	Problem solving and questioning skills	6
	Project design, product creation	4
	Reduction in the number of subjects	7
	Entrepreneurial skill	5
Changes in the Objectives	Reduction in the number of objectives Up-to-date and simple objectives	5
		4
	Student-centred objectives	7
Changes in the Content	Content simplification	7
	Separating from mathematics	3
	First units including subjects about space	3
	Unbalanced distribution of the subjects across the grade levels	5
	Inadequate content of textbooks	3
Effect of Science and Engineering Subjects on the Teaching of the Lesson	Crowded classrooms	7
	Inadequate weekly class hours	8
	Exam-oriented system	8
	Lack of training in teachers	6
	Supply and use of materials	6
Contributions to Project Development, Science Fairs and Competitions	Contributes to science education if necessary conditions are provided and the subjects are covered	8
Contribution to the Field of STEM	Contributes to the field of STEM if necessary conditions are provided and the subjects are covered	9
Differences in Evaluation	Student and process-oriented	11
	Giving importance to individual differences	4

As seen in Table 2, as a result of the content analysis of the data obtained from the interviews with the teachers, seven themes related to the research subject were reached. These themes were determined as changes in the curriculum, changes in the objectives, changes in the content, the effect of science and engineering subjects on the teaching of the lesson, contributions to project development, science fairs and competitions, contribution to the field of STEM, differences in evaluation. This section continues with the findings and interpretations obtained through the analysis of teacher opinions. Explanation of the themes and codes is supported with direct quotations. The obtained themes and codes are presented in a table.

These sub-themes are explained below.

1. Changes in the Curriculum

Within the theme of changes in the curriculum, the codes of science and engineering subjects, problem solving and questioning skills, project-product creation, reduction in the number of subjects

and entrepreneurial skills were reached. Some quotations from teacher opinions on the theme of changes in the curriculum are given below:

In terms of objectives, in the 2018 curriculum, unlike the previous curriculum, the main emphasis is placed on entrepreneurial skills, universal ethical values, national and cultural values, science, engineering and entrepreneurship practices, as well as critical thinking and decision-making skills. (ST-3)

When the 2005 curriculum is compared to the 2013 curriculum in terms of objectives, the number of objectives was reduced by 65% in the 2013 curriculum. The decrease in the number of objectives continued in the 2018 curriculum. Additionally, some objectives related to certain concepts were eliminated, and there were changes in the grade level at which some concepts were introduced. (ST-3)

When the student role is examined from the perspective of the learning-teaching process, in the 2018 curriculum, the main emphasis is placed on students creating models and products, designing projects, presenting products, expressing themselves verbally, visually and in writing and approaching problems with an interdisciplinary perspective. In this process, teachers are expected to assign tasks that enable students to develop products, come up with inventions and engage in higher-order thinking. They are also expected to facilitate the integration of science, technology, mathematics and engineering disciplines, fostering a holistic approach. It is seen that there is an emphasis on fostering innovative thinking within the domain of engineering and design skills as a new skill area. Within the scope of science, engineering and entrepreneurship practices, students are expected to identify a real-life problem related to the concept they learn at school, generate alternative solutions for a problem, select the best solution, develop a product for solving a problem and later showcase their developed products in a science fair-like atmosphere within the school environment. It was emphasized that they could carry out this process in cooperation with their peers in the school environment. (ST-3)

It is seen that the subject of "World and Universe", which was in the last place in the 2013 curriculum, is given in the first place in the 2018 curriculum. (ST-3)

The frequent changes occurring in the curriculum lead to science teachers being introduced to a new curriculum before fully adapting to a previous one. In-service training provided for the implementation of the new curriculum may be inadequate. More objectives related to the subjects of first aid, destructive natural events and the measures to be taken should be addressed at suitable grade levels through practice-oriented instructional activities. Subjects such as earthquakes which were addressed in the 8th grade in the former curriculum have been simplified and introduced at the 5th grade level. As a country located in an earthquake-prone zone, I believe we should be more organized, prepared and sensitive towards taking measures against earthquakes. The subjects of meiosis and mitosis, which were previously taught at the 8th grade level, are now introduced at the 7th grade level. This leads to a disconnection in the new curriculum when the subject of inheritance is taught in the 8th grade, causing a lack of continuity. There is a need for repetition of the subject of meiosis and mitosis cell divisions, which are included in the 7th grade objectives, in order for students to remember them. The subject of "World and Universe", which was in the last place in the 2013 curriculum, is given in the first place in the 2018 curriculum, which is a positive development. (ST-3)

In the new curriculum, greater emphasis is placed on science and engineering applications. It is aimed to improve engineering and entrepreneurial skills. This revision will ensure that the development of the individual is multifaceted and is a good step in preparing for life. It will be good in terms of transferring the learned knowledge into life. (ST-8)

When the opinions of the teachers were examined, within the theme of changes in the curriculum, all the teachers who participated in the study stated that science and engineering subjects

were added. In addition to science and engineering subjects, it was stated that changes were made to improve problem solving and questioning skills and entrepreneurial skills. In addition, a few of the teachers stated that the number of subjects was reduced or the grade level and ordering of some units were changed. Moreover, they stated that the curriculum emphasizes that students should be engaged in activities such as creating projects, designing products and models. Senior teachers as well as novice teachers who participated in the study positively welcome these changes and believe that they will yield long-term benefits.

2. Changes in the Objectives

Within the theme of changes in the objectives, the codes of reduction in the number of objectives, up-to-date and simple objectives and student-centred objectives were reached.

Some quotations from teacher opinions in the theme of changes in the objectives are given below:

According to Bloom's taxonomy, the objectives in the former curriculum were teacher-centred, while the newly developed objectives in the new curriculum are suitable for student-centred learning. The objectives have been simplified. (ST-9)

The objectives have been prepared in a way that will help students to deal with problems they may encounter in life. (ST-4)

If we examine it in terms of objectives, we can see that there has been a decrease in the number of objectives in the 2018 curriculum. Some objectives have been removed, and there have been changes in the grade level for certain ones. I believe that it is a curriculum that is much more effective in terms of instruction for both students and teachers, as it is clearer and more concise. (ST-6)

When teacher opinions were examined, it was seen that some teachers stated that there was simplification in the objectives, while others mentioned the inclusion of student-centred objectives. They also stated that more up-to-date objectives were included in the renewed curriculum. Reduction in the number of objectives and their being student-centred were evaluated as positive changes by the teachers.

3. Changes in the Content

Within the theme of changes in the content, the codes of the simplification of the content, its separation from mathematics, first units being about space-related subjects, the unbalanced distribution of the subjects across the grade levels and the insufficient content of the textbooks were reached.

Some quotations from teacher opinions in the theme of changes in the content are given below:

There was more information in the former curriculum. Now, understanding what you read and interpreting what you understand are given more importance. It is free from mathematical operations. Subjects such as how to conduct scientific research in science and what the stages of scientific research are emphasized more. Dependent, independent and control variables which are very important concepts in scientific research are implicitly addressed at all grade levels. I believe the absence of mathematical operations is a negative situation. Mathematics and science are intertwined disciplines and should be used together. Science should not be solely based on understanding what is read. Mathematics is essential in science. (ST-12)

I consider the science curriculum to be good in terms of objectives, content, processes and evaluation. The new curriculum has been prepared within the framework of the constructivist approach and emphasizes the activity-based teaching and inquiry-based approach in the process of achieving the objectives. The interpretation of existing information, the use of alternative measurement and evaluation approaches, the development of scientific process skills, science, engineering and entrepreneurship applications, values

education, the use of technology, and interdisciplinary approaches are also positive aspects of the current curriculum. Additionally, in the new curriculum, one of the most significant changes compared to the former curriculum is the inclusion of specific units in the initial stages. A new unit called "The Sun, Earth and Moon" was added to 5th grade, a unit called "The Solar System and Eclipses" to 6th grade, a unit called "The Solar System and Beyond" to 7th grade and a unit called "Seasons and Climate" to 8th grade. The density of units in 6th grade is a negative aspect, along with the fact that after covering the topic of "Body Systems" in the 2nd unit, there is a return to the same topic in the 6th unit called "Body Systems and Health". The integration of the unit called "Seasons and Climate" from the Social Studies course into the Science course for 8th graders, despite its weak connection, is not considered a favourable decision.

As seen in the teacher comments above, most of the teachers stated that there is a simplification in the content of the updated curriculum, while some teachers stated that the subjects are not evenly distributed across the grade levels. Most of the teachers stated that the effect of the newly added science and engineering subjects on the course is not very positive due to the lack of teacher training, lack of class hours and lack of materials. Teachers stated that the newly added science and engineering subjects could have positive contributions to the organization of science fairs, the development of projects and the field of STEM, if necessary conditions are provided. They explained the necessary conditions as qualified teacher training, increasing the number of class hours and solving the problem of lack of materials. In the evaluation, they stated that a process-oriented evaluation is used. Another remarkable point is that the science course is separated from mathematics and that the first units at each grade level include subjects related to space. While some teachers think that the separation of science from mathematics is negative, they find it positive that the first units include space-related subjects because they increase students' sense of curiosity.

The removal of mathematical operations from the science curriculum is considered a negative change in the curriculum. Mathematics is not only about performing operations but also about developing thinking skills. Therefore, its separation from the science curriculum can have a negative impact. The newly added STEM and engineering topics in the curriculum require a significant infrastructure not only in terms of teacher training but also in terms of the physical conditions of schools.

4. The Effect of Science and Engineering Subjects on the Teaching of the Lesson

In the theme of the effect of science and engineering subjects on the teaching of the lesson, the codes of crowded classrooms, insufficient weekly class hours, examination-oriented system, insufficient teacher training and material supply and use were reached.

Some quotations from teacher opinions in the theme of the effect of science and engineering subjects on the teaching of the lesson are given below:

Due to factors such as overcrowded classrooms, the challenge of covering the curriculum and the requirement for students to bring their own materials, there are often disruptions in our teaching process. As a result, there is a risk of not being able to cover all the subjects, and therefore we have to study some subjects superficially. (ST-1)

The statement in the new science curriculum that "the design and production process of a product is carried out in the school environment" can be limiting in certain activities when the allocated class time is not sufficient for students. (ST-3)

Due to our exam-oriented system, I cannot simply stop solving questions and say, "Let's focus on science and engineering subjects." As a result, I am unable to cover these subjects sufficiently. (ST-12)

The intensity of the curriculum prevents us from allocating enough time to science and engineering applications. It takes a certain amount of time for students to both comprehend the subject, solve enough

questions to reinforce the understanding of the subject and make practices related to the subject. Unfortunately, not everything can go as planned on paper; schools have certain expectations for achievement. There is a priority given to the accomplishment of specific academic goals. Therefore, our priority is to explain the subject and solve questions. (ST-11)

When the opinions of teachers are examined, it is seen that they are unable to effectively deal with science and engineering subjects due to issues such as overcrowded classrooms, insufficient weekly class hours, inadequate teacher training and problems related to the supply and use of materials. They also stated that the exam-oriented nature of the system hinders allocating sufficient time to these subjects. Furthermore, the high academic achievement expectations by parents and administrators lead teachers to focus extensively on solving test questions.

5. Contributions to the Development of Projects and Organization of Science Fairs and Competitions

Within the theme of contributions to the development of projects and organization of science fairs and competitions, the code of contribution to science education if necessary conditions are provided and subjects are covered was reached. Some quotations from teacher opinions in the theme of contributions to the development of projects and organization of science fairs and competitions are given below:

With the organization of science competitions and fairs such as TÜBİTAK and Teknofest, the field of science has become more functional. This year, a significant number of our students have developed projects in both areas as a result. In these projects, our students have benefited from scientific thinking methods, as well as from their knowledge of science and engineering and our guidance (ST-4).

I believe that these activities will definitely contribute. However, under the current physical conditions (overcrowded classrooms, material shortages, outdated printing of books in this field, time constraints, exam expectations, etc.), it seems to be impossible. (ST-1)

The use of these subjects in daily life positively affects students' attitudes towards the lesson. (ST-9)

If this curriculum can be further developed in terms of resources, it will be very useful for STEM. However, for the implementation of activities in STEM classes, the provision of resources and materials is necessary. Otherwise, we will be limited to activities that are solely based on rote learning. (ST-11)

Teachers stated that if issues such as physical conditions, crowded classrooms, material shortages and concerns about success in centralized exams are addressed, participation in science fairs and competitions will increase, thus, important contributions can be made to science education. It is believed that science fairs and competitions will contribute to students' creativity and collaborative work; however, to do so, necessary physical conditions and time should be provided.

6. Contribution to the Field of STEM

Within the theme of contribution to the field of STEM, the code of contribution to the field of STEM if necessary conditions are provided and subjects are covered was reached. Some quotations from teacher opinions in the theme of contributions to the field of STEM are given below:

Certainly, it will contribute significantly. In fact, the activities carried out in STEM classes are the result of the 2018 science curriculum. Having STEM applications in each unit and at the end of the curriculum related to science, engineering and entrepreneurship will make important contributions to the field of STEM. (ST-1)

First and foremost, it is necessary for all of our teachers to receive training about STEM and scientific inquiry-based learning. For instance, as a science teacher, I wanted to receive training on STEM, but in my district, they provided this training to primary teachers instead. I do not have the means or the economic resources to pursue these trainings on my own. The plans are great, but it is essential for us, the teachers, who will implement them, to receive this training. The opinions of teachers who are directly involved in the process should be sought during the development of these curriculums. Due to these reasons, I do not believe that the updated curriculum will make a difference in STEM-related activities. (ST-5)

Training on STEM can be provided for teachers who are interested in it by creating the conditions that can motivate them. It is essential to provide training on STEM for teachers who are trained in education faculties as well. In this regard, Science and Art Centres (BİLSEM) work much more effectively. There are both teachers and students who are interested in STEM education in BİLSEM. Without the pressure of exams, it is possible to carry out meaningful and productive work there. (ST-12)

Teachers stated that if they receive training in this regard, their opinions are taken into account during the curriculum development and they are supported in terms of activities and processes, science and engineering subjects will contribute to the development of the field of STEM. Furthermore, teachers emphasized the need for providing information about STEM subjects as part of their undergraduate education and through in-service training while they are practicing their profession. It is believed that as teachers' knowledge and awareness of STEM increase, it will lead to more productive science education.

7. Differences in Evaluation

Within the theme of differences in evaluation, the codes of being student and process-oriented and attaching importance to individual differences were reached. Some quotations from teacher opinions in the theme of differences in evaluation are given below:

The evaluation of the course achievements in the 2018 curriculum is based on a more flexible approach compared to the 2013 curriculum. It focuses on measuring and evaluating learning outcomes in cognitive, affective and psychomotor domains. (ST-1)

Students become better able to express themselves, create products and design projects, while also developing reasoning and decision-making skills. (ST-6)

In terms of evaluation, it is different from the old curriculum as it takes individual differences into account and avoids evaluating students using a single method. (ST-8)

In the new curriculum, the evaluation of any course is not solely based on written exams, but also involves better observation of the students' work within the class. This is because not every child can fully express their thoughts and achievements through written or exam-based assessments. Sometimes, we get to know a child better through their work and thought process. Therefore, we can consider it as a more positive process. (ST-10)

The majority of the teachers are of the opinion that the difference between the current curriculum and the former curriculum in terms of evaluation is that the new curriculum is student and process-oriented. The fact that the evaluation is process-oriented shows that more accurate evaluations are made. In addition, the teachers stated that individual differences are taken into consideration in the new curriculum, that evaluations are made to improve the reasoning skills of students and that evaluation methods that develop the decision-making and problem-solving skills of students are used.

2- Findings Regarding the Second Sub- Problem

Table 3. Themes, Codes and Frequencies Obtained From the Student Focus Group Interviews

THEME	CODE	FREQUENCY
The Way Science and Engineering Subjects are Taught in the Classroom	Insufficient time	9
	High number of mock exams	7
	Intensity of the subjects	8
	Problem solving	10
The Effect of Experiments, Projects and Other Techniques on Creativity and Inquiry Skills	Not usually done in science classes	7
	Science applications course	11
The Effect of Methods Which Make Students Active on Learning	Enjoyable and interesting	10
	Permanent learning	7
Information Given Before the Lesson	Thought-provoking questions	11
	Video on the subject	10
	Models of organs	
Materials Brought to the Class and How They are Used	Materials for experiments in the subject of sound	10
	Materials for experiments in the subject of pressure	
What is Known about STEM	A course that combines science, engineering, mathematics and technology	12
Evaluations after the Activities	Not usually done in science classes	11
	Science applications course	11

As seen in Table 3, as a result of the content analysis of the data obtained from the focus interviews with the students in the study, seven themes related to the research subject were reached. These seven themes were identified as the way science and engineering subjects are taught in the classroom, the effect of experiments, projects and other techniques on creativity and inquiry skills, the effect of methods which make students active on learning, information given before the lesson, materials brought to the class and how they are used, what is known about STEM and evaluations after the activities. This section continues with the findings and interpretations obtained through the analysis of student opinions. Explanation of the themes and codes is supported with direct quotations. These themes are explained below.

1. The Way Science and Engineering Subjects are Taught in the Classroom

Within the theme of the way science and engineering subjects are taught in the classroom, the codes of insufficient time, high number of mock exams, intensity of the subjects and problem solving were reached. Some quotations from student opinions in the theme of the way science and engineering subjects are taught in the classroom are given below:

These subjects are at the end of the units in our 6th grade textbook. We didn't have time to do them; we had so many subjects to cover. (S-1)

We have a lot of subjects to study in the 6th grade, and we are constantly taking mock exams at school. We did not study these subjects. (S-4)

We never study these subjects. Our teacher gives us homework. Then we solve questions. (S-8)
Sometimes we look at images from the smart board. But mostly we solve questions. (S-11)

The students stated that there is not enough time to study the science and engineering subjects. There are many more exams that the subjects are intense and they generally solve questions in the class.

2. The Effect of Experiments, Projects and Other Techniques on Creativity and Inquiry Skills

Within the theme of the effect of experiments, projects and other techniques on creativity and inquiry skills, the codes of not usually done in science classes and science applications course were reached. Some quotations from student opinions in the theme of the effect of experiments, projects and other techniques on creativity and inquiry skills are given below:

Within the scope of the course, we cannot create products as a group or individually because there is too much to do in classes. (S-6)

We can't create much. We have created only once about energy. We generally solve questions. (S-7)

We're experimenting in our lab, and I find this highly interesting. In terms of creativity, I can give an example of our experiments on pressure. (S-10)

The students stated that experimental techniques, projects and similar approaches are not widely used in their science classes but are used in the elective course called "Science Applications". The students also emphasized that these techniques contribute to their creativity and inquiry skills.

3. The Effect of Methods Which Make Students Active on Learning

Within the theme of the effect of methods which make students active on learning, the codes of enjoyable and interesting and permanent learning were reached. Some quotations from student opinions in the theme of the effect of methods which make students active on learning are given below:

Our teacher explains very well and keeps us active. We work actively; its strength is we can engage in activities and fun games. I don't think there is any weakness. (S-3)

Our teacher shows questions on the smart board and we solve these questions. Our teacher helps us when we have difficulties. Its strength is that we can easily solve the questions with the help of our teacher. I think it does not have any weakness. (S-6)

Our dexterity is improving. We learn to help each other. It also enables us to learn the subjects better. (S-9)

The students stated that they the lesson is more enjoyable and interesting when they are active and thus they can achieve permanent learning. Yet, they also indicated that they solve a lot of questions in classes.

4. Information Given Before the Lesson

Within the theme of information given before the lesson, the codes of thought-provoking questions and video on the subject were reached. Some quotations from student opinions in the theme of information given before the lesson are given below:

When we start a new subject, our teacher asks us thought-provoking questions, encouraging us to be active participants in the class. In addition, we start by watching videos and taking necessary notes. Afterwards, we solve questions to reinforce our understanding of the subject. (S-4)

Our teacher gives us information about the lesson before we start the lesson and helps us to prepare for the lesson comfortably. (S-8)

The majority of the students stated that their teachers first ask interesting questions about the subject. Then make them watch videos, and then they talk about the subject.

5. Materials Brought to the Class and How They Are Used

Within the theme of materials brought to the class and how they are used, the codes of models of organs, materials for experiments in the subject of sound and materials for experiments in the subject of pressure were reached. Some quotations from student opinions in the theme of materials brought to the class and how they are used are given below:

We used models of sensory organs in our class. For the subject of sound, our teacher brought a glass jar and an air evacuation pump. We evacuated the air inside the jar and observed that we couldn't hear the ticking sound of the clock inside the jar. (S-2)

Our teacher and we brought experimental materials related to the subject of pressure, and under our teacher's guidance, we conducted the experiments ourselves. (S-10)

Experiments and observations are very helpful in understanding the subjects. (S-7)

The majority of students stated that their teachers bring models and experimental materials related to science subjects. They also stated that their teachers allow them to review the lessons on these models and examine the models, enabling them to actively participate in the class and learn more effectively.

6. What is Known about STEM

Within the theme of what is known about stem, the code of a course that combines science, engineering, mathematics and technology was reached. Some quotations from student opinions in the theme of what is known about stem are given below:

Some thoughts that come to mind about STEM are that STEM is the combination of Science, Technology, Engineering and Mathematics courses and that through the projects we do in this class, we reinforce what we have learned about the subjects. (S-3)

STEM consists of a combination of 4 lessons and we do the projects by learning information in groups. (S-7)

STEM is a good lesson in which we do research and turn this research into projects. (S-12)

All of the students stated that STEM is a course that combines Science, Engineering, Mathematics and Technology. They also stated that that they learn more effectively through project works in groups.

7. Evaluations after the Activities

Within the theme of evaluations after the activities, the codes of not usually done in science classes and science applications course were reached. Some quotations from student opinions in the theme of evaluations after the activities are given below:

We generally do these projects in the "Science Applications" classes. As we have to take a lot of mock exams, our teacher assigns us tests to solve. Additionally, our teacher provides tactics and strategies for solving questions. (S-4)

In the elective course "Science Applications", our classmates provide constructive criticism and help us improve. However, there aren't many opportunities for that in regular science classes. (S-5)

Our teacher shows questions on the smart board and we solve them. If we make a mistake, our teacher and friends help us and also evaluate us. (S-11)

Our friends express their thoughts and congratulate us. (S-8)

Most of the students stated that their teachers and friends evaluate them once in the science lesson after the activity. These students stated that they usually do such studies in the Science Applications classes. In addition, many students stated that they make evaluations by solving questions in the lesson.

3- Findings Regarding the Third Sub- Problem

As a result of the content analysis of the data obtained from the interviews with the school principals in the study, three themes related to the research subject were reached. The obtained themes and codes are listed in Table 4.

Table 4. Themes, Codes and Frequencies Obtained From the Interviews with the School Principals

THEME	CODE	FREQUENCY
The way science and engineering subjects are addressed at school	Professional awareness	1
	Student motivation	2
	Preparation for life	2
	Product creating	2
Contributions to project development, science fairs and competitions	Increasing student interest	4
	Quality of science education	2
	No contribution	1

Contributions to the field of STEM	Gaining a critical perspective	1
	Lack of time	3
	Creative thinking	1

As seen in Table 4, three themes were obtained as a result of the content analysis of the data collected through the interviews with the school principals. These three themes are; the way science and engineering subjects are addressed at school, contributions to project development, science fairs and competitions and contributions to the field of STEM. This section continues with the findings and interpretations obtained through the analysis of the opinions of the school principals. Explanation of the themes and codes is supported with direct quotations.

1. The Way Science and Engineering Subjects are Addressed at School

Within the theme of the way science and engineering subjects are addressed at school, the codes of professional awareness, student motivation, preparation for life and product creating were reached. Some quotations from the opinions expressed by the school principals in the theme of the way science and engineering subjects are addressed at school are given below:

It greatly contributed to children in terms of gaining professional awareness and developing a sense of responsibility. It also helped students become aware of their own abilities and what they are capable of. (SP-1)

It has positive contributions. Students feel more interested in school and science lessons while studying these subjects. (SP-2)

In our school, at the end of the year, students showcase the projects they have done in science classes and from these projects, it becomes clear that it has contributions. (SP-6)

It was positive. I think that the interest of students in science classes has increased. (SP-5)

The school principals are of the opinions that science and engineering subjects have a significant impact on students, as they help them become aware of their own capabilities and develop a sense of responsibility. They also noted an increase in interest towards the science subjects.

2. Contributions to Project Development, Science Fairs and Competitions

Within the theme of contributions to project development, science fairs and competitions, the codes of increasing student interest, quality of science education and no contribution were reached. Some quotations from the opinions expressed by the school principals in the theme of contributions to project development, science fairs and competitions are given below:

It has made a positive contribution by reinforcing students' awareness of participation in activities and fostering a sense of achievement. It has also helped students realize that science education and innovation are fundamental in school, leading to the synthesis of ideas and taking both school and science education to a higher level. (SP-2)

No contribution, class hours are inadequate. (SP-3)

It facilitates the transfer of knowledge learned in school to daily life. It enables children to apply the knowledge they have learned to their lives. It has been beneficial in the creation of projects in TÜBİTAK science fairs. (SP-4)

I believe that science fairs and exhibitions increase students' interest and enthusiasm for science classes. Although there may be occasional material problems, I can say that it has a positive impact on the overall atmosphere of the school and the lessons. (SP-6)

Most of the school principals stated that the contribution of the newly added subjects to the science fair and competitions is positive in terms of student interest. In addition, the interviewed school principals said that science fairs and competitions would increase the quality of science education. There are also school principals who think that there is no contribution due to insufficient class hours and materials.

3. Contributions to the Field of STEM

Within the theme of contributions to the field of STEM, the themes of gaining a critical perspective, lack of time and creative thinking were obtained. Some quotations from the opinions expressed by the school principals in the theme of contributions to the field of STEM are given below:

Since the updated curriculum is student-centred, it focuses on a common area. For this reason, activities in the field of STEM foster their creativity and improve children's ability to look critically. STEM activities help students to gain a critical perspective (SP-4).

The activities in the book are usually associated with science and engineering disciplines; I have no idea how the integration of mathematics is. For this reason, there should be guides to inform teachers about the steps to be followed in activities, what is done in the activities, which activity is related to which discipline and what to consider when evaluating. (SP-3)

The time issue must be resolved. In fact, if necessary, an elective STEM course can be given so that students can gain experience for a long time through such activities. So students can have STEM skills. (SP-2)

While some of the school principals said that the update will help students gain a critical perspective and develop creative thinking skills in terms of the field of STEM field, there are some school principals who said that it will not contribute as not enough time is left for STEM activities. They also stated that STEM activities can be allocated more time in an elective course. At the same time, they stated that guidebooks should be created for teachers related to STEM subjects.

DISCUSSION, RESULTS AND SUGGESTIONS

In this study, it was stated in the interviews conducted with the teachers that the objectives were simplified, the number of subjects was reduced and the places of subjects were changed across the grade levels. In this context, it was concluded that the separation of science subjects from mathematics and the implementation of the new curriculum at all grade levels not gradually caused students at some grade levels to graduate from middle school without learning some subjects at all. The implementation of the program in this way caused students not to fully acquire the behaviours they should gain, teachers to have difficulties in adapting to the curriculum and thus the curriculum could not fully accomplish its objectives.

The teachers stated that the most obvious change in the curriculum is the addition of new science and engineering subjects. However, during the teaching of these subjects, problems are experienced due to the fact that the subjects are placed at the end of the units, the weekly class hours are not sufficient and the required materials cannot be provided. Some of the teachers who participated in the study conducted by Karabulut, Koca and Türkoğlu (2021) stated that the subjects cannot be fully covered due to insufficient class hours, crowded classes and high number of activities. The teachers participating in the current study also stated that they have to focus on solving questions in the class

because the system is exam-oriented and parents prioritize academic achievement. These problems may indicate that the curriculum is not student-centred contrary to what is claimed.

The reason why the Ministry of National Education added new science and engineering subjects to the 2018 science curriculum is because of the desire to integrate the field of STEM, which is becoming popular worldwide, into science education. It was observed that the students who were interviewed increased their awareness of this field through STEM activities conducted in the lesson. As seen in the study of Eslek (2021), integrating STEM-based activities into the science classes enables students to actively participate in the lesson and learn by doing and experiencing. In addition, as a result of the study, it was seen that the students developed a positive attitude towards the science lesson through STEM activities. This finding concurs with the findings of the current study.

In the interviews conducted with the teachers, it was concluded that they have problems in allocating time to STEM activities that they have not enough knowledge about STEM, and that in-service training on STEM should be more efficient and the number of such trainings should be increased. When the literature is reviewed, it is seen that there are some studies reporting similar results. Elmas and Gül (2020) point out that theoretical content should be given in order to fully implement STEM education. In the current study, most of the teachers stated that they do not feel competent enough about STEM. In this connection, it is seen that STEM education is not sufficient in teacher training undergraduate programs and in-service training programs. Sarı and Yazıcı (2019) concluded that science teachers feel incompetent in terms of imparting science and engineering skills to students and need training in this field. Işık (2022) concluded that teachers are indecisive in using STEM activities due to their lack of knowledge about the field of STEM. Related studies in the literature show that science teachers should be more informed about STEM during their undergraduate education and in their professional life with in-service trainings. According to the studies examined in the literature and the results obtained in the current study, greater emphasis should be put on the field of STEM during undergraduate education and more in-service trainings should be organized for active teachers during their professional career. Students seem to have a positive attitude towards STEM activities, but teachers do not see themselves competent enough in the field of STEM.

The teachers stated that with the simplification of the content of the science curriculum, the use of formulas, unit conversion and mathematical operations were removed from among the objectives, which made it difficult for teachers to teach the subjects. In addition, this may cause students to have difficulties in high school physics, chemistry and biology lessons. If students learn the subjects in science course in middle school well, they will be able to be academically more successful in higher levels of education. For this reason, the subjects in science lessons in middle school should be taught in such a way as to be understandable and permanent for students. However, the results of the current study show that the simplification of the subjects has negative consequences. When the opinions of the teachers were examined, it was concluded that despite the simplification of the content, the subjects are not evenly distributed across the grade levels. Similar results were also found in the study of Karabulut et al. (2021). Duzgunoglu and Ozcan (2017) also found that the distribution of the subjects across the grade levels is not balanced. Although the number of activities such as science fairs, projects and competitions organized in schools with the updated curriculum increased, the problems experienced in the teaching of the subjects limited the success of these activities.

The majority of the teachers found it positive that the new curriculum is process and student-oriented and takes into account the individual differences of students. In the study conducted by Karabulut et al. (2021), teachers stated that process-oriented evaluation would be positive. Use of process-oriented evaluation instead of result-oriented evaluation is a factor that increases the motivation of the student. Process-oriented evaluation is believed to lead to more accurate evaluations.

According to the data obtained from the focus interviews with the students, it is understood there are too many subjects to be covered in lessons and the activities and methods in which the students can be active during the lesson are not used much. It is emphasized that such activities can be done in the Elective Science Applications course. It was determined that students are satisfied and happy and they learn by having fun in the lessons in which they are active. It was also stated by the students that the laboratory environment is not used much in science lessons.

From the students' opinions, it was determined that since the central system exams make teachers, students and parents focused on academic success, the greatest emphasis is put on mock exams to prepare students for the centralized exams and thus, a large amount of time is allocated to solving questions in class. This was also mentioned by the teachers. The teachers also stated that they focus on solving questions because the system is exam-oriented and as a result they cannot allocate enough time to the teaching of subjects. Since the system is exam-oriented, it may be considered normal for teachers to focus on solving questions, but while there are objectives such as students creating projects and products in the curriculum, the system's being exam-oriented again creates a contradiction between the curriculum and the system.

In the interviews with the school principals, it was found that they think that the new science and engineering subjects have positive contributions in terms of developing awareness of profession in students and preparing them for life. In addition, it was understood as a result of the interviews with the principals that the necessary time cannot be allocated to science and engineering subjects and STEM because the system is exam-oriented. Another point on which teachers and principals agree is that science fairs, projects and competitions can have positive contributions. However, it is considered as an important outcome arising from discussions that these activities cannot be done effectively due to time and material constraints.

As a result, according to the principles of curriculum development and evaluation, the science curriculum, which has been implemented for 5 years, should not be static and needs to be constantly updated. In this context, the curriculum should be renewed and developed by making necessary corrections and improvements based on the feedback received from teachers and students, particularly those who are actively involved in the curriculum.

SUGGESTIONS

- Teachers and pre-service teachers can be given training on STEM.
- Necessary and supplementary materials and resources can be provided to teachers for science and engineering subjects.
- Class hours can be increased for the more effective teaching of science and engineering subjects.
- It may be beneficial for the effectiveness of the curriculum to update the curriculum by combining the results of the current study with the results of other studies.

Ethics Committee Decision

Ethical approval of Muğla Sıtkı Koçman University Social Humanities Ethics Committee (02/12/2022- 150) was obtained for this study.

Authors' Contribution Rates

Prof. Dr. Necdet Aykaç: %40, Rasime Akbulut: %30, Duygu Sidekli:%30

Conflict of Interest Statement

The author(s) declared no potential conflicts of interest regarding the research, authorship and/or publication of this article.

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GENİŞ ÖZET

Eğitimin temel amacı bireylerin hayatlarını kolaylaştırmak için günlük yaşam becerileri kazandırmak ve onları ileriki yaşamlarındaki meslekleri ile ilgili bilgi ve becerileri kazanmalarını sağlamaktır (Trilling ve Fadel, 2009). Bu nedenle ülkeler, iş ve ekonomi dünyası, okullardan öğrencilerin 21. yüzyıl becerileri olarak anılan problem çözme, eleştirel düşünme, iletişim, işbirliği ve öz-yönetim gibi becerilerini geliştirmelerini sağlamak için çaba harcamaktadırlar (National Research Council, 2012). Bunların yanı sıra bireylerin mühendislik becerilerinin gelişmesi, inovasyon ve girişimcilik yönlerinin ilerlemesi yönünde çaba harcanmaktadır. Bu açıdan bakıldığında fen eğitiminin bireylerin bilime ve teknolojiye duyarlı olması, 21.yy becerilerine sahip olmalarını sağlama ve bireylere mühendislik becerisi sağlama noktasında oldukça önemli bir yer tutmaktadır.

Yapılandırmacı yaklaşıma göre düzenlenen fen bilimler dersi öğretim programının 21.yy' a uygun bireyler yetiştirme, bireylere girişimcilik ve mühendislik becerisi kazandırma konusunda ne kadar etkili olduğu merak konusudur. Yapılan uluslararası sınavlar veya ülkemizde yapılan merkezi sınavlar bu konu ile alakalı önemli ipuçları vermektedir. Türkiye, fen okuryazarlığında katılımcı ülke ve ekonomilerin ortalamasının (458) üzerinde bulunmaktadır. Bu alanda Türkiye, 79 ülke arasında 39. sırada, 37 OECD ülkesi arasında ise 30. sırada yer almıştır(PISA 2019 Türkiye Ön Raporu). 2021 yılı LGS istatistiklerine göre Fen bilimleri testi ortalaması 20 soruda 13,67 olduğu görülmüştür. 2018 Fen Bilimleri Öğretim Programında özellikle STEM ve mühendislik ile ilgili kazanımlar mevcuttur ancak bu kazanımları öğrencilerin ne kadar içselleştirdiği birçok araştırmaya konu olmuştur. Aydın, Guzey ve Saka, (2017)'nin çalışmasında öğrencilerin STEM farkındalıklarının STEM etkinlikleri içinde bulunmuş olsalar daha yüksek olduğu vurgulanmıştır. Yani fen bilimleri öğretim programlarında

STEM etkinliklerine yönelik kazanımların bulunması öğrencilerin derse motivasyonunu artırabilir. Bu noktalara istinaden ve de hem uluslararası sınav sonuçlarının hem de ülkemizde yapılan sınavların sonuçlarının istenilen düzeyde olmaması ve sunulan raporlarda sadece nicel bilgiler verilmesi nedeniyle, programın işlevselliği ile ilgili yeterli bilgiye ulaşılamamaktadır. Ayrıca 2018 Fen Bilimleri Öğretim Programı 5 yıldır uygulanmaktadır. Bu yönüyle programın etkililiğinin saptanması oldukça önemlidir. Bu bir program için yeterince uzun bir süredir. Eğitim programı yaşayan, dinamik ve sürekli değişmesi geren bir sürece sahiptir. Teknolojinin ve gelişmelerin çok hızlı olduğu 21.yüzyılda gerekli güncelleme ve düzenlemelerin yapılabilmesi için Fen Bilimleri Dersi Öğretim Programı'nın değerlendirilme gerekliliği ortaya çıkmıştır.

Bu araştırma, değerlendirilecek program ile alakalı nitel veriler sunmasından dolayı ve programı bir bütün olarak ele almasından ötürü Aydınlatıcı Program Değerlendirme Modeli esas alınarak yürütülmüştür. Aydınlatıcı Program Değerlendirme Modeli programı bütüncül bir bakış açısı ile değerlendirerek yalnızca hedeflerin değil sürecinde programın işlevselliği hakkında önemli bilgiler verdiğini öne sürmektedir. Programın teorik kısmının ve pratik kısmının güçlü zayıf yönlerinin ortaya çıkarılmasında önemli katkılar sağlayabilir (Özüdoğru ve Adıgüzel, 2015).

Bu çalışmada ortaokulların her kademesinde 2018-2019 eğitim öğretim yılında uygulanmaya başlanan 2018 fen bilimleri dersi öğretim programına 2013 programına göre yeni eklenen fen ve mühendislik ile ilgili kazanımların etkililiğini Aydınlatıcı Program Değerlendirme Modeli ile incelediği için çalışmanın alan yazına önemli bir katkı sağlayacağı beklenmektedir. Bu yönüyle bu çalışmada 2018 Fen Bilimleri Öğretim Programının 2013 programına göre yeni eklenen Fen ve mühendislik konuları ile değişen kazanımlar açısından etkililiği; ders içi uygulamalara öğretmen ve öğrenci görüşleri alınacak ve aşağıdaki sorulara cevap aranmıştır;

1. Fen Bilimleri öğretmenlerinin, 2018 Fen Bilimleri Öğretim Programı ile bundan önceki 2013 programı ve yeni eklenen Fen ve Mühendislik konuları ile değişen kazanımlara ilişkin deneyimleri ve görüşleri nasıldır?
2. Öğrencilerin, 2018 Fen Bilimleri Öğretim Programına yeni eklenen Fen ve Mühendislik konularına ilişkin deneyimleri ve görüşleri nasıldır?
3. 2018 Fen Bilimleri Öğretim Programına yeni eklenen Fen ve Mühendislik konularının işlenmesinde karşılaşılan sorunlar nelerdir?

Araştırmada nitel araştırma yöntemlerinden durum çalışması deseni kullanılmıştır. Durum çalışmasının en belirgin özelliği bir ya da birkaç durumun derinlemesine incelenmesidir. Bir durum ile ilgili faktörler (ortam, kişiler, olaylar, süreçler vb.) bütünsel açıdan araştırılır. İlgili durumu nasıl etkilediği ve bu durumdan nasıl etkilendiği üzerine odaklanır (Şimşek ve Yıldırım, 2018). Araştırmanın çalışma grubunu Muğla ili devlet okullarında görev yapan 12 fen bilimleri öğretmeni ve 8 okul müdürü ile Muğla ili devlet okullarında öğrenim gören 12 öğrenci oluşturmaktadır. Veri toplama aracı olarak araştırmacılar tarafından geliştirilen yarı yapılandırılmış görüşme sorularından oluşan öğretmen, öğrenci ve okul müdürü görüşme formları kullanılmıştır. Görüşme formları program geliştirme uzmanı ve ölçme değerlendirme uzmanından görüş alınarak gerekli düzeltmeler yapılarak son hali verilmiştir. Bu hali ile öğretmen görüşme formu 6, öğrenci görüşme formu 7 ve okul müdürü görüşme formu 3 maddeden oluşmuştur. Veri analizinde nitel veri analiz yöntemlerinden içerik analizi kullanılmıştır. Araştırmadan elde edilen verilerin çözümlenmesinde Yıldırım ve Şimşek (2008) tarafından belirlenen aşamalar izlenmiştir. Yapılan görüşmelerin kayıtları yazılı doküman haline getirilmiş, verilere ilişkin temalar ve kodlar oluşturularak kodların tekrarlanma sıklığı belirlenmiştir.

Araştırmadan Elde Edilen Bulgular: Programa fen ve mühendislik konuları eklenmiştir. Ayrıca problem çözme ve girişimcilik becerisini artıran değişiklikler yapılmıştır. Kazanımların öğrenci merkezli olduğu belirtilmiştir. Kazanımlarda sadeleşme yapılmıştır. Konuların sınıf düzeyleri arasında dengeli dağılmadığı ve ders saati yetersizliğinden dolayı fen ve mühendislik konularına yeterli zaman ayrılmadığı belirtilmiştir. Ayrıca fen bilimleri dersinin matematikten arındırılmış olmasının doğru

olmadığı belirtilmiştir. Araştırmada görüşme yapılan öğretmenler sınıfların kalabalık olması, haftalık ders saatinin yeterli olmaması, öğretmen eğitimi yetersizliği, malzeme temini ve kullanımı ile ilgili sıkıntılardan dolayı Fen ve Mühendislik konularını pek uygulayamadıklarını belirtmişlerdir. Öğrenci görüşleri incelendiğinde öğrenciler Fen ve Mühendislik konularının derste işleme sürecinde sürenin yetmemesi, deneme sınavlarının çok olması, konuların yoğun olması ve genellikle derslerde soru çözdüklerini belirtmişlerdir. Okul müdürleri fen ve mühendislik konularının öğrencilere katkısının büyük olduğunu, kendi yeterliliklerinin farkına varmalarını sağlayarak sorumluluk bilinci kazandırdığı fen bilimleri dersine ilginin arttığı yönünde görüş belirtmişlerdir. Ayrıca öğretmenler fiziki koşullar, sınıf mevcudu, materyal eksiklikleri ve merkezi sınavlardaki başarı kaygısı gibi sıkıntılar giderilirse; bilim fuarı ve yarışmalara katılımın artacağını ve bununla birlikte fen eğitimine de katkı sağlayacağını belirtmişlerdir. Bilim fuarı ve yarışmaların öğrencilerin yaratıcılığına ve işbirliği içinde çalışmasına katkı sağlayacağı düşünülmektedir ancak öğretmenler öncelikle gerekli fiziksel koşulların sağlanması ve zaman yönetimindeki sıkıntıların giderilmesi gerektiği yönünde de görüş belirtmişlerdir. Araştırmaya katılan öğretmenler STEM konusu ile ilgili olarak lisans eğitimi sürecinde ve mesleklerini icra ederken hizmet içi eğitim olarak bilgi verilmesi gerektiğini belirtmişlerdir. Öğretmenlerin STEM ile alakalı bilgisi ve farkındalığı arttıkça fen eğitimi açısından daha verimli olacağı düşünülmektedir. Öğrencilerin tamamı STEM' in Fen, Mühendislik, Matematik ve Teknolojinin birleştiği bir ders olduğunu belirtmişlerdir. Öğrenciler bu derste grupça proje çalışmaları sayesinde daha etkili öğrendiklerini belirtmişlerdir. Okul müdürlerinin bazıları güncellenen STEM alanı açısından öğrenciye eleştirel bakış açısı ve yaratıcı düşünme becerisi kazandıracığını söylerken okul müdürlerinden STEM etkinliklerine zaman kalmadığını için katkı sağlamayacağını belirtenlerin de olduğu görülmektedir. Değerlendirme sürecine ilişkin olarak da öğretmenler mevcut program ile önceki program arasındaki değerlendirme açısından farkın yeni programın öğrenci ve süreç odaklı olduğu yönünde görüşlerini ifade etmişlerdir. Ayrıca öğretmenler yeni programda bireysel farklılıklara dikkat edildiğini, öğrencilerin muhakeme becerilerini geliştirilecek değerlendirmeler yapıldığını, öğrencilerin karar verme ve problem çözme becerilerini geliştiren değerlendirme yöntemleri kullanıldığını ifade etmişlerdir.