

Secondary School Students' Opinions on Educational Robotic Applications

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ABSTRACT

In this study, it is aimed to determine the opinions of secondary school students about educational robotics applications. The case study, which is one of the qualitative research methods, was used in the research. The research was carried out with 7th grade students of two different secondary schools in the Battalgazi district of Malatya province in the 2021-2022 academic year. The study group of the research consisted of 18 students, who were determined according to the purposive sampling method. In the study group, science lesson teaching was carried out with educational robotic applications for about two months. The data of the study were obtained with a semi-structured interview form consisting of seven questions developed by the researchers. Descriptive analysis method was used in the analysis of the obtained data. As a result of the research, most of the students stated that they liked the activities, associated the applications with daily life, their interest in the science lesson increased, they worked in collaborative groups, the lessons were fun, and they wanted robotics training sets to be used in their lessons in the future. In addition, some of the students stated that they found the applications confusing at the beginning of the studies, that they had difficulties in the coding part and that there were in-group discussions. In line with the findings, suggestions were made regarding the use of robotic applications in teaching science courses.

Keywords: Science Teaching, Educational Robotic Applications

1. INTRODUCTION

In our age, in line with the need for technology-oriented society and conscious citizens, the expectation from education is increasing day by day in order to close the gap between the currently applied science literacy level and the goals to be achieved (Demiral, 2017). When we look at the developments in the last century, it shows that the limits of science and technology are far beyond our imagination (Hurd, 1998). There is a need for individuals who know where and how to use the information obtained in accordance with the 21st century, who can analyze which solutions are appropriate in the face of problems, and who know the accuracy of the ways to reach scientific information, thanks to technology that has accelerated with scientific developments (İşman & Gürgün, 2008). Countries that are aware of this situation are developing faster depending on the rapid progress of science and technology and are trying to innovate in many ways (Aydınlı & Avan, 2017). In the face of this change in technology, teaching plans are regularly renewed in order to enable students to learn in various ways. With the advances in computer technologies, the use of multimedia tools such as animation, graphics, text and sound in educational environments is becoming widespread. Distance education, online education, smart boards, tablets, technology and design-based classes, technological materials made with the help of 3D printers, robots and legos are just a few of them. This situation requires an educational design that offers a richer educational environment to students by diversifying learning (Daşdemir & Doymuş, 2012; Ventola, 2014; Simon & Tim, 2019).

The education systems of our age, on the other hand, aim to raise individuals with 21st century skills by taking all these into account. Considering the 21st century skills that come to the fore in education, one of the prominent skills among them is technology skill. Individuals with this skill are defined as using technology effectively, taking part in the internet and social networks, having sufficient knowledge and equipment for technology. It is predicted that technology will enter every area of our lives day by day, and that accessibility is experienced, and students' technology use skills will develop in future education activities, they will take responsibility in this area and their behavior will be more affected by technology (Günç, Odabaşı & Kuzu, 2013). Therefore, the development of education systems should support the acquisition of these skills and classroom education activities should be designed for this purpose. The methods and techniques used should support this purpose, and student-centered approaches should be adopted to ensure effective learning, and methods, techniques and approaches that provide interaction and cooperation, and create rich learning environments with technological tools and software should be included (Kotluk & Kocakaya, 2015). For all these reasons, an educational approach has been created by putting

forward the need for students to grow up with knowledge in the fields of science, technology, engineering and mathematics (Science, Technology, Engineering, Mathematics - STEM) from an early age (Akgündüz Aydeniz, Çakmakçı & Çavaş, 2015).

Industry 5.0 is spoken, following technological and scientific developments closely is one of the requirements of the information age (Zhao, 2003). Our country, which is aware of the necessities of the technology age we live in, carries out many different activities in which technology and design studies are carried out, where the creativity of the students, where scientific activities are carried out, robot technologies are used, in line with the national technology move started. At the top of these are the Aviation, Space and Technology Festival (TEKNOFEST), experimental technology workshops, the Scientific and Technical Research Council of Turkey (TÜBİTAK) research projects, and international MEB robot competitions. These activities aim to raise individuals with 21st century skills, by encouraging our young people to think, observe, wonder and investigate what they are curious about, so that they can find solutions to the problems they will encounter in the future. Worldwide underwater robotics program (WaterBotics), robotic camps (Roboparty), First Lego League-FLL (First Lego League), Junior's First Lego League- FLLJr (First Lego League Junior) middle school students (RoboCupJunior) and World Robot Olympics-WRO (World Robot Olympiad) robotics and coding are used within the scope of competitions (Akarca, 2019; Eguchi , 2014).

When all these are taken into account, it is seen that there is an innovation called “Robotics” in the technological fields. This field has become a part of the science education process, which includes the fields of science and engineering, by bringing together and integrating different disciplines (Koç Şenol & Büyük, 2015). Robotics is an important field in science education and it can be seen that it provides some skills to learners as a result of studies and activities related to this field. In these activities, which are based on design and programming processes, students are observed to find alternative solutions to problems and become practical in this regard, an increase in their ability to use technology and their willingness to construct designs with their own creativity (Costa & Fernandes, 2005).

Literature on educational robotic applications, which is one of the current approaches in the field of science education, is examined, it is seen that there are many studies that are generally based on robotic coding under the name of STEM studies (Acar et al., 2018; Akçay, 2018; Chen & Chang, 2018; Kaya, Newley , Deniz & Yeşilyurt, 2017; Khanlari , 2013; Nall, 2016; Okkesim, 2014; Ortiz 2010; Strawhacker & Bers, 2015; Sullivan, 2016; Whitehead , 2010). In these studies, it has been stated that robotic applications provide many different contributions to science education. When the countries that are the pioneers in education are examined, it is seen that they have started to give software, coding and robotics training to their students at a very young age, even starting from the pre-school period (Eisenberg, 2013). In this study, it was aimed to determine the opinions of secondary school students about educational robotic applications used in teaching science courses.

2. METHOD

2. 1. Model of the Research

Designed as a case study, which is one of the qualitative studies. Millan (2000) defines case study as a method in which one or more events, programs, social groups or interconnected situations are examined in depth (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2019).

2. 2. Working Group

This research was carried out with 7th grade students in two separate public schools in the Battalgazi district of Malatya province in the 2020-2021 academic year. In determining the qualitative study group of this research, criterion sampling, one of the purposeful sampling types, will be used. Criterion sampling includes the study of situations that meet a set of predetermined criteria (Yıldırım & Şimşek, 2011). The criterion in this research is to participate in studies related to educational robotic applications or design thinking activities. On the basis of voluntariness, 18 students were selected from each group and formed the qualitative study group.

2. 3. Research Data Collection

In the scope of the research; The teaching of the force energy unit of the 7th grade science course was carried out with educational robotic applications. The research lasted 8 weeks with the data collection process. Educational plans for educational robotic applications were made by adhering to the MEB plan, which shows in which time the gains of the force and energy unit taught during the research will be given. The activities used in the lessons were designed by adhering to these teaching plans. Before the implementations, the students were divided into heterogeneous groups of five or six, and a president and a writer were selected for the groups, and the students were asked to give names to the groups they were in. After the activities carried out within the scope of educational robotic applications were examined by science education experts, their final shapes were given and the applications

were started. mBot robotics training set was used during the applications. Makeblock mBot is an easy-to-use open source robot kit designed for children to use and learn to program.

In the application phase, the students completed the worksheets prepared in advance within the framework of the lesson plans for educational robotics applications by following the engineering design process 'Determine the problem, imagine, plan, design, test and develop.

2. 4. Data Collection Tools of the Research

The data for the purpose of the research will be collected with a semi-structured interview form, which is one of the qualitative research data collection tools.

Before creating the semi-structured interview form, the studies conducted by the researchers were examined by scanning the literature (Akman Selçuk, 2019; Çam, 2019; Akyol Ertuğrul, 2020; Gülgün, 2020; Çiftçi, 2020; Koca, Karabulut & Türkoğlu, 2021). Questions were prepared for the purpose of the research. These questions were examined by 2 experts in the field of curriculum and teaching, 3 experts in the field of mathematics and science education, and 3 Turkish teachers. In line with the suggestions received from the experts, necessary arrangements were made in the interview form and the final form was given to the seven-question interview form. With semi-structured interview forms, answers were sought to questions such as what they liked and disliked in the activities carried out within the scope of the research, how they contributed to the work with groups, what were the difficulties and differences they encountered during the studies, what they paid attention to during the practices. In order to ensure the impartiality of the data collection tools, the students' views were presented in the research as expressed by the students and without any changes.

2. 5. Analysis of Research Data

Content analysis method was used in the analysis of the research data. The purpose of content analysis is to present similar data obtained under certain themes on a regular basis (Aktaş, 2016). In the analysis of the data, the stages of coding the data specified by Yıldırım and Şimşek (2011), then classifying the codes obtained and forming the themes that best explain these codes, and arranging the data according to these codes and themes, were followed.

Within the scope of the reliability study of content analysis, coding and themes made independently by different researchers who are experts in the field were compared, and similar ones were marked as "Agreement" and those that were different were marked as "Disagreement" (Miles & Huberman, 1994). As a result of the calculations, the reliability of the research was calculated as 89%. The fact that the reliability calculations were over 70% showed that the research was reliable. During the analysis, each participant was given a code. These codes are indicated as RÖ1, RÖ2 ,..... RÖ18 for prospective science teachers.

3. FINDINGS AND COMMENT

The findings and interpretation obtained from the analysis of the students' views on educational robotic applications are included in this part of the study. The analysis of the questions in the interview form, respectively, and the data obtained as a result are given below in the form of tables.

The themes, frequency and codes given to the students regarding the analysis of the answers given to the question "What are your thoughts on the educational robotic applications performed during the teaching of the science course?" are presented in Table 1.

Table 1. Students Findings Regarding His Thoughts on Educational Robotic Applications During the Teaching of Science Course

Student Views on Educational Robotic Applications	Frequency	Code
Learning with Fun	13	RÖ1, RÖ2, RÖ4, RÖ6, RÖ7, RÖ8, RÖ9, RÖ10, RÖ11, RÖ13, RÖ14, RÖ15, RÖ18
Increasing Interest in the Course	8	RÖ3, RÖ4, RÖ5, RÖ7, RÖ9, RÖ10, RÖ16, RÖ17
Learning New Information	7	RÖ1, RÖ4, RÖ5, RÖ12, RÖ14, RÖ15, RÖ16
Willingness for the Course	7	RÖ1, RÖ3, RÖ5, RÖ10, RÖ11, RÖ13, RÖ16
Contributing to the Future	5	RÖ5, RÖ8, RÖ9, RÖ13, RÖ15

Developing Individual Skills	4	RÖ2, RÖ12, RÖ14, RÖ18
Permanent learning	2	RÖ4, RÖ17

When Table 1 is examined; stated that among the thoughts that many students expressed about robotic applications, they learned by having fun, they increased their interest and desire for the lesson, and they reached new information. Some of the students stated that they developed their individual skills and that they would benefit from such practices in the future.

The opinions of some students about educational robotic applications during the teaching of the science course are given below.

“It’s a very nice application, I became interested in writing code and the lessons were fun. I wish I could always do educational robotics applications, I already loved the science lesson, and I loved it more with robotic applications.” (RO10)

“Robotic applications made me happy. In this project, I was coding before, like the piano and apple picking game, but I think it is both good and educational to code a robot and do it with my friends in the group and my teacher.” (RO7)

“I think we did a good job with a nice robot and nice coding. I want to teach and code with this and similar robot activities. I think we will need to use coding and robots in the future.” (RO13)

“I think it was a good work, it was a different subject processing technique, we developed ourselves against such robotic applications.” (RO12)

“Our lessons were fun, we learned new information. Our engineering skills have increased. It brought me closer to technology.” (RO14)

The themes, frequency and codes given to the students regarding the analysis of the answers given to the question “What did you like about the activities with robotic training sets?” are presented in Table 2.

Table 2. Students Findings Regarding the Favorites in the Activities with Robotic Education Sets

Student Opinions about what they liked in the activities with robotic education sets	Frequency	Code
Ability to use the Robot	12	RÖ1, RÖ5, RÖ6, RÖ7, RÖ8, RÖ10, RÖ11, RÖ12, RÖ13, RÖ15, RÖ17, RÖ18
Activity-based Appreciation	11	RÖ1, RÖ2, RÖ3, RÖ4, RÖ7, RÖ8, RÖ9, RÖ13, RÖ14, RÖ15, RÖ16
Funny and Enjoyable Lessons	9	RÖ4, RÖ5, RÖ7, RÖ9, RÖ11, RÖ12, RÖ14, RÖ16, RÖ18
Coding Practices	6	RÖ4, RÖ6, RÖ7, RÖ12, RÖ15, RÖ17
Working as a Group	3	RÖ6, RÖ8, RÖ18
Working Independently	3	RÖ10, RÖ11, RÖ14

When Table 2 is examined; In line with the robotic applications, the students stated that they liked using robots the most, that the lessons were fun, and that they liked some of the activities more. In addition, some students stated that they enjoyed coding, working in groups and doing activities independently.

The opinions of some students about what they liked in the activities with robotic education sets are given below.

“I liked managing robots with codes the most and demolishing the houses we built from Jenga within the events . The more I code, the more I like it. It was also nice to manage the robot by speaking English in this training set and everything was a lot of fun.” (RO7)

“I really liked using the robot, managing it by coding and working in groups while doing these activities.” (RO6)

“I liked the activities and practices we did with the robot, especially the obstacle avoidance project.” (RO13)

“I loved the robot debris and barrier-free transportation because it was so much fun and we were happy to be able to work freely.” (RO14)

“I like that we can do applications on the robot, for example, change the color of the led light, encode songs on the robot, and do anything we want. I also like that we can produce solutions and write codes when there are problems.” (RO10)

The themes, frequency and codes given to the students regarding the analysis of the answers given to the question "What did you not like about the activities with robotic training sets?" are presented in Table 3.

Table 3. Students Findings Regarding Dislikes in the Activities with Robotic Education Sets

Student Opinions About What They Didn't Like About the Activities With Robotic Education Sets	Frequency	Code
There is No Activity that I Don't Like	13	RÖ1, RÖ2, RÖ3, RÖ4, RÖ5, RÖ6, RÖ8, RÖ9, RÖ11, RÖ12, RÖ13, RÖ15, RÖ16
Troubles Within the Group	4	RÖ7, RÖ14, RÖ17, RÖ18
Insufficient Lesson Hours	2	RÖ10, RÖ18
Partially dissatisfied (Based on some Specific Activities)	1	RÖ14

When Table 3 is examined; The majority of the students stated that there was no application that was not liked by the studies. Despite this, some students said that they had problems in the group, the lesson hours were short and they did not like some activities.

The opinions of some students about what they liked in the activities with robotic education sets are given below. “Actually, everything was very good, but I think there was a problem, it was about the group, not the training set. At first, when we couldn't build the robot, everyone got a little confused while talking to each other, but when we did, this problem was solved.” (RO7)

“Sometimes I couldn't get along with my friends. It was a problem. Also, I didn't like the Tozkoparan event because I couldn't do it.” (RO14)

“There was no activity that I didn't like, it was all very nice.” (RO9)

“There was nothing I didn't like, it was a very fun application, it was a good time.” (RO11)

“The activities were great fun, I just didn't like the lack of class hours.” (RO10)

The themes, frequency and codes given to the students regarding the analysis of the answers given to the question "What are the difficulties and differences you encounter in the process of educational robotics applications?" are presented in Table 4.

Table 4. Students Findings Concerning Their Thoughts on the Challenges and Differences Encountered in the Process of Educational Robotics Applications

Student Views on Challenges and Differences Encountered in the Process of Educational Robotics Applications	Frequency	Code
Difficulties in Coding	9	RÖ5, RÖ7, RÖ8, FÖ6, RÖ10, RÖ11, RÖ12, RÖ16, RÖ18
Intra-Group Incompatibility	5	RÖ2, RÖ3, RÖ9, RÖ14, RÖ17
Initial Concerns	5	RÖ5, RÖ10, RÖ14, RÖ11, RÖ18
Controlling the Robot	5	RÖ1, RÖ2, RÖ6, RÖ13, RÖ15
Time Shortage	3	RÖ4, RÖ6, RÖ13

When Table 4 is examined; The students stated that they had difficulties in coding in general, however, the inconsistencies in the group and the worries at the beginning of the practices forced them. Some of the students stated that they had difficulty in controlling the robot and that they had difficulties in terms of time.

The opinions of some students about the difficulties and differences encountered in the educational robotics applications are given below.

“Sometimes we would try to quickly complete the tasks outlined in the worksheets because we had limited time. This situation forced us a little.” (RO4)

“The hardest thing for me was to write code. Because the code was different with Scratch , it was different with Mblock , but as I learned, I equated them both.” (RO7)

“At the beginning, it was very difficult for me and my team to control and connect the robot. But eventually we found a solution to that too.” (RO1)

“I had some difficulty in coding and working with the group was a different and beautiful thing. Another requirement is that I was a little excited because it was my first time doing such events and I couldn't do much coding.” (RO11)

“I had a hard time controlling the robot from the tablet, but I tried and succeeded, and during the activities, I had little arguments with my friends.” (RO2)

The themes, frequency and codes given to the students regarding the analysis of the answers given to the question "What did you pay attention to while performing educational robotic applications?" are presented in Table 5.

Table 5. Students Findings Regarding What He Pays Attention To While Performing Educational Robotic Applications

Student Opinions on Things Considered While Performing Educational Robotics Applications	Frequency	Code
Do Not Harm the Robot	11	RÖ3, RÖ5, RÖ6, RÖ7, RÖ9, RÖ10, RÖ11, RÖ13, RÖ15, RÖ17, RÖ18
Correct Encoding	10	RÖ2, RÖ5, RÖ6, RÖ7, RÖ8, RÖ10, RÖ11, RÖ14, RÖ16, RÖ17
Following the Guidelines (Worksheets)	6	RÖ1, RÖ2, RÖ3, RÖ5, RÖ8, RÖ14
Working as a Collaborative Group	5	RÖ3, RÖ4, RÖ8, RÖ9, RÖ12,
Respecting Ideas	4	RÖ1, RÖ11, RÖ12, RÖ18
Listening to Teacher Alerts	2	RÖ2, RÖ8,

When Table 5 is examined; Most of the students stated that they took care not to damage the robot and to do the coding correctly. Some students stated that they pay attention to follow the instructions, work in collaborative groups, respect everyone's opinion and listen to the teacher's warnings during the studies.

Some students' opinions on what they pay attention to while performing educational robotics applications are given below.

“I was careful to work collaboratively, to find common ground and act accordingly, and to respect each other's ideas.” (RO12)

“We paid the most attention to the problems that would happen to the robot if we made a mistake, for example, we tried to protect the robot so that if we did the forward code incorrectly, it wouldn't crash.” (RO7)

“We took care to get the opinions of our friends and to do the coding properly. We also took care to use our robot well.” (RO11)S

“We took care not to damage the robot and break parts of it.” (RO13)

“I was careful not to harm the robot, to work as a team, and to follow the order of tasks on the worksheet.” (RO3)

The themes, frequency and codes given to the students regarding the analysis of the answers given to the question "How did you contribute to the studies conducted with the group?" are presented in Table 6.

Table 6. Students Findings Concerning Their Opinions About How It Contributes to Group Studies

Student Views on Educational Robotic Applications	Frequency	Code
Helping Group Members	10	RÖ1, RÖ3, RÖ4, RÖ5, RÖ6, RÖ8, RÖ11, RÖ14, RÖ16, RÖ18
Filling in the Activity Sheet	7	RÖ2, RÖ3, RÖ6, RÖ9, RÖ10, RÖ12, RÖ15

Writing Code	6	RÖ2, RÖ3, RÖ6, RÖ7, RÖ10, RÖ17
Expressing an Idea	5	RÖ1, RÖ8, RÖ12, RÖ13, RÖ14,
Motivating the Group	3	RÖ4, RÖ13, RÖ18
Managing the Robot	2	RÖ14, RÖ17

When Table 6 is examined; Many students stated that they contributed to the work done with the group by helping group members, filling out the activity sheet, writing code and expressing their own ideas. In addition, some students stated that they participated in the studies by motivating the group and helping the management of the robot used in the applications.

Some students' views on how they contributed to the group work are given below.

"I wrote my own comments and said the answers correctly, I believe I gave motivation to my group." (RO13)

"It was good that we worked as a group because when we had difficulties where we could not do, I would get the support of our friends and I helped my friends when they needed it." (RO5)

"I made the biggest contribution by helping my team when it saw mistakes and raising awareness for my team." (RO4)

"I tried to continue the activity by answering the worksheet that our teacher gave us and putting forward ideas together." (RO12)

"I contributed by writing code because I became a good programmer and since I have mastered the main codes, he contributed by writing the desired codes." (RO7)

"Do you want to have such applications during the teaching of the science course? The themes, frequency and codes given to the students regarding the analysis of the answers given to the question "Why?" are presented in Table 7.

Table 7. Students Findings Related to Requesting Robotic Applications During the Teaching of Science Course

Student Opinions on Desire to Have Robotic Applications During the Teaching of Science Course	Frequency	Code
Positive Feedback		
Being of Enjoyable and Funny	12	RÖ1, RÖ2, RÖ3, RÖ5, RÖ6, RÖ7, RÖ8, RÖ9, RÖ11, RÖ13, RÖ15, RÖ16
Better Learning Practices	7	RÖ1, RÖ2, RÖ3, RÖ6, RÖ7, RÖ13, RÖ14
Being Curious	4	RÖ2, RÖ4, RÖ5, RÖ17
Generating Solutions to Real-Life Problems	4	RÖ9, RÖ10, RÖ12, RÖ17
Benefit from robotic applications	4	RÖ8, RÖ11, RÖ14, RÖ17
Increasing in Knowledge	4	RÖ4, RÖ8, RÖ10, RÖ12
Negative Opinions		
Being Boring	1	RÖ18

When Table 7 is examined; students Opinions on the desire to have robotic applications during the teaching of the science course are given under the "positive" and "negative" sub-themes. In the sub-theme of positive opinions, many students who wanted robotic applications to continue in the lessons explained that the reason for this was that the lessons were fun and they learned the lesson better. Some students think that robotic applications; He stated that he would like to use it again in his lessons because it is interesting, can produce solutions to daily life problems, will benefit from such applications in the future and provide new information to be learned.

The positive opinions of some students regarding the situation of wanting robotic applications during the teaching of the science course are given below.

" Yes , because the more we learn about technology, the more we can find solutions to the challenges we face in daily life." (RO12)

"I would like. It's fun and time goes by so fast. Besides, I don't get bored, there were very good lessons, I think it will be useful for me in the future." (RO11)

" Yes , I would because I learned coding while learning my lessons, I was able to solve different kinds of problems, I learned new information. Therefore, I would like to practice robotics in my lessons in the future." (RO10)

" Yes , because we learn things that will be useful in our real life, and the lessons were not boring and fun." (RO9)

" Yes , because we were learning something new while doing robotic activities and it was continuing in our lessons. I believe it will contribute a lot to me in the future, and most importantly, you had a fun time." (RO8)

In the sub-theme of negative opinions, there is a student who does not want robotic applications to continue in the lessons. He explained the reason for this situation as it can be boring to do similar applications all the time.

The negative opinions of some students regarding the situation of wanting robotic applications during the teaching of the science course are given below.

"No I do not want to. In fact, while these types of applications are fun at first, dealing with robots and code all the time can be boring at times." (RO18)

4. RESULTS AND DISCUSSION

In this research, the opinions of the students about the educational robotic applications carried out with the secondary school students were taken. Within the scope of the research , answers were sought to questions such as what the students liked and did not like in the activities, how they contributed to the work done in groups, what were the difficulties and differences they encountered during the studies, what they paid attention to during the practices . The answers given by the students were gathered under certain themes.

Many students stated that they learned by having fun, they increased their interest and desire for the lesson, they reached new information, and some students stated that they developed their individual skills and that they would benefit from such applications in the future. They stated that they mostly liked using robots, entertaining lessons and some activities during robotic applications. In addition, some students stated that they enjoyed coding, working in groups and doing activities independently. However, many students who want robotic applications to continue explained the reason for this situation as the lessons were fun and they learned the lesson better. Some students think that robotic applications; He stated that he would like to use it again in his lessons because it is interesting, can produce solutions to daily life problems, will benefit from such applications in the future and provide learning new information. In the literature review, the results supporting the research were reached (Akman Selçuk, 2019; Çam, 2019; Kılıçkiran, Korkmaz & Çakır, 2020; Small & Fat, 2017; Ruf, Mühling & Hubwieser, 2014; Plunder, 2020). Ruf, Mühling & Hubwieser (2014) stated that robotic activities were found fun by students and facilitated their learning. Kılıçkiran, Korkmaz & Çakır (2020) stated that the robotic coding training they carried out in their research positively affected the students participating in the research and they found the activities enjoyable.

The students stated that they had difficulties in coding in general during the robotic applications, however, the incompatibilities occurring within the group and the worries at the beginning of the applications forced them. Some of the students stated that they had difficulty in controlling the robot and that they had difficulties in terms of time. In addition, most of the students stated that there was no application that was not liked by the studies. Despite this, some students said that they had problems in the group, the lesson hours were short and they did not like some activities. In fact, a student who did not want robotic applications to continue explained the reason for this situation as that it would be boring to make similar applications all the time. Çam (2019) stated that at the beginning of the robotic-assisted programming study, students had prejudices and concerns about the lesson and that they had difficulty in coding in the process. Koç (2019) stated in his research that robotic-assisted STEM activities take a lot of time. Star Durak, Karaoğlan Yılmaz & Yılmaz (2018) in his research examining students' views on robotic design activities, concluded that the students saw this process as fun but challenging.

Many of the students stated that they took care not to damage the robot during the applications and to make the coding correct. Some students stated that they pay attention to follow the instructions, work in collaborative groups, respect everyone's opinion and listen to the teacher's warnings during the studies. Many students stated that they contributed to the work done with the group by helping their group members, filling out the activity sheet, writing code and expressing their own ideas. In addition, some students stated that they participated in the studies by motivating the group and helping the management of the robot used in the applications. When similar studies are examined in the relevant literature, it is stated that the students participating in the robotics games like the group work, they have reached the level where they can help their friends, develop their personal ideas and designs (Akman Selçuk, 2019; Çam 2019).

Based on the results of the research, some suggestions for educational robotic applications are given below Suggestions are given;

- The use of robotic applications in lessons can be expanded.

- In line with the results obtained, changes can be made to take into account robotic applications while updating the science course curriculum.
- robotic applications on different variables such as students' motivation and self-efficacy can be investigated.
- Students participating in robotic applications can participate in scientific competitions such as TÜBİTAK TEKNOFEST where autonomous vehicles are used and project studies can be researched.

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