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Investigation of Science Project Performances of Gifted and Talented Students

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Abstract

The purpose of the study is to analyze gifted and talented students' project performances and views about them. In the study, explanatory sequential design, which is one of the mixed method research designs, was applied. In the quantitative phase of the study, project performances of the students were identified, while, in the qualitative phase, their views on their performances were determined. The study group consisted of the students who were enrolled in the Support Program at a Science and Arts Center during the 2017-2018 education year. According to quantitative findings, during the project preparation process, the students exhibit "fairly good" performance in producing ideas from science-related life, producing ideas for their needs and creating hypothesis about the problem. In qualitative findings, the students are seen to have no difficulty in producing ideas, as a result of which they can immediately produce ideas on their own. As regards to the project process and project content, they are observed to show "fairly good" performance in self-deciding on the sources and materials to be used for testing the hypothesis and sharing the research findings with the teacher and class while showing "satisfactory" performance in testing the hypothesis. The students stated that they did research, tested hypothesis and made inferences for hypothesis testing. They performed "fairly good" in using fluent and clear language in presentation, making the presentation within the given time and making eye contact with the audience. They expressed their opinion that they made an effective presentation as well as they were not satisfied with the presentation.

Key words: Gifted and talented students, project approach, science.

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INTRODUCTION

One of the most important issues, today, in terms of governmental policies, is to educate individuals who can produce advanced science and technology. Raising individuals with the skills to produce science and technology is also one of the important problems of education. The gifted and talented individuals are the potential candidates who can exhibit high performance and productivity in the abovementioned processes. Therefore, it appears necessary in the education of gifted students to create learning processes that are suitable for their learning characteristics and that can maximize their potential. According to NAGC (2014), it is needed to provide learning experiences with rich and comprehensive standards which require authentic problems for different, compelling, creative and innovative thinking in order to provide a continuous education process and progress in their fields.

The gifted and talented students go through rich learning experiences, which is enabled with their inclusion in the learning process. The creative activities, particularly in the courses they enjoy learning, promote their ability to use and develop their existing potential. Science is the leading course in which these students enjoy learning. The gifted and talented students have an innate interest in science because it activates their strong sense of curiosity and imagination about objects and their natural environment, and such interests differentiate them from most of their peers (Smutny & VonFremd, 2004).

The American National Research Council (NRC; 2007, 2009) states that science teaching and curriculum need to be formed to educate thinking individuals who are able to i) learn, use and interpret scientific explanations in nature, ii) produce and evaluate scientific evidence and explanations, iii) understand the nature and development of scientific knowledge, iv) perform productivity in scientific debates and events, v) gain excitement, interest and experience to learn the facts in the natural and physical world, vi) learn, use and produce scientific knowledge, and create an identity in this sense. At this point, it can be put forward that the science education of gifted and talented students should be in real contexts as much as possible, where the students should interact directly with primary sources, challenging and supporting their curiosity and learning, and providing the thinking skills based on effectively knowing, using and producing scientific knowledge and skills in their lives.

In addition to the necessity of the abovementioned qualifications of science education, it is not possible to mention a single conceptual framework for gifted students in science. In the education of gifted students, different practices are of great importance with regard to the students' levels. Based on these reasons, it is evident that the approaches which may be a very good option for learning and teaching process in science education of gifted and talented students need to be put into practice. Contrary to teacher-centred traditional approaches which are based on reading and listening from the books, Project-Based Learning (PBL) can be an option, in which students' self-discovery of the learning process is promoted and structure, resources and guidance is provided but where students are responsible for solving the best learning with the materials.

Projects are complex tasks that are based on challenging questions or problems, organizing, problem-solving, decision-making, or investigative activities, and students will complete in a relatively autonomous and long period of time ending with real products or presentations (Jones, Rasmussen & Moffit, 1997). Problem-based project work is a learning approach based on students' active participation in which they employ high-level thinking skills. Participation of students in a project process enables them to realize their own learning, to learn self-learning, and to manage the process and oneself. In other words, students will learn during the project how to learn independently and how they will be responsible.

Among the many benefits of the PBL are students' independence, their empowerment and the teachers' ability to create projects that respond to the deep and diverse needs of gifted and talented students. It is thought that problem-based and project-based approach should be formed in an integrated structure for the gifted students, and that students should be included in working in various fields of interest involving different practices for skill development (Stanley, 2012). Projects help

children develop creative thinking, problem-solving attitudes and skills independently through technical skills such as defining problem, gathering information, creating ideas, evaluating, making decisions, and communicating.

Since it involves more stimulating and comprehensive power tasks than traditional teaching, the PBL is a good approach for the education of gifted and talented students. The teachers of gifted and talented students have to do high quality work as these students have the ability to do more. PBL allows students to operate all their skills.

Although tasks and submission dates are determined by the teacher, project work is a good document for gifted and talented students who prefer to create their own task structures and deadlines (Dunn, Dunn & Price, 1984; Renzulli, Smith & Reis, 1982; Stewart, 1981). The project studies also respond to these students' needs, interest, desire, curiosity, motivation, patience, producing knowledge and original ideas (Moltzen, 2004; Powers, 2008). It is seen that these students are better focused on the subjects of the project that are of their interest, and that working on these issues increases their enthusiasm and motivation for them (Bruning, Gregory and Norby, 2014; Jurisevic, Glazar and Pucko, 2008; Ormrod, 2013; Özarslan and Çetin, 2018). They provide students with the opportunity to put the theoretical knowledge into practice and use them in real life (Klein et al., 2009). These students have advanced observation skills and are highly aware of and responsive to the problems in their environment. Project studies offer learning opportunities that guide them with a systematic approach to these problems. In the literature, there are such opinions that the project studies bring in consideration, interest and research sensitivity in real life problems (Clark, 2002; Davalos & Haensly, 1997; Jung, Jun & Gruenwald, 2001; Loveridge and Searle, 2009; Powers, 2008). The sharing phase of the project work is a stage that allows students to develop their language, thinking and life skills. Boondee, Kidrakarn & Sa-Ngiamvibool (2011) and Jung et al. (2001) allege that students feel proud when they complete their project work and, as a result, they are motivated for better projects.

Researches show that gifted and talented students are able to create faster, better learn and preserve the content longer when they are given the opportunity to work with projects (Whitener, 1989). Similarly, the gifted and talented students are able to teach each other during the project process, denoting an increase in their learning in a beneficial way (Johnsen-Harris, 1983; Kingsley, 1986). Another advantage of PBL for gifted and talented students is the development of cooperative learning skills while working in groups to solve problems (Peterson, 1997).

It is seen that there are a limited number of researches about project studies in the education of gifted and talented students in Turkey. The national studies are seen to be over opinions of stakeholders about art and science projects as well as the effect of these projects on the students' motivation for learning biology and scientific attitudes (Özarslan & Çetin, 2018) and the participants' views about the enriched support training program project for disadvantaged special talented children (Kaplan-Sayı, 2018).

Determining what kind of experiences students have during the project process can be defined as the main purpose of this research. It is thought that the results of the research may be the source of the programs to be formed for the education of gifted and talented children, of teacher training and learning teaching processes. For this reason, it is considered that there is a need for this research.

The aim of the study is to examine the project performances of gifted and talented students and also their opinions as to them. The following questions were sought in the study.

1) What are the project performances of gifted and talented students?

2) What are the opinions of gifted and talented students about the project performances?

METHOD

In this research, which is justified according to the complementary approach based on interpreting and developing the results obtained through a particular method with the results of another method (Greene, Caracelli, Garaham, 1989), "explanatory sequential design" was employed. The explanatory sequential design is applied in two separate interactive stages, first of which is to collect and analyze quantitative data that correspond to the research question, and second is to collect and analyze qualitative data to monitor the results of the quantitative stage (Creswell and Plano Clark, 2015, p. 77). The mixed method was used in this research to explain and examine the results of quantitative data in detail by the help of the results obtained with qualitative data. In the quantitative stage of the research, the project performances of the students were determined, as well as qualitative data about the dimensions in which they showed excellent, fairly good and satisfactory performance were obtained with the qualitative methods.

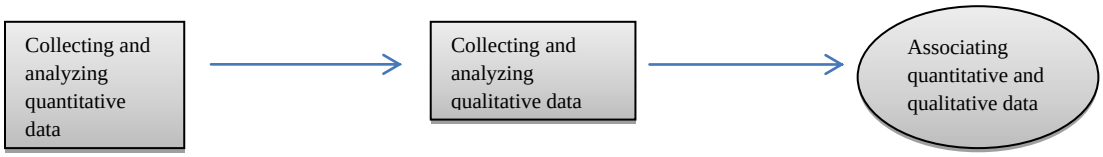

Figure 1. Explanatory Sequential Design Model (Creswell and Plano Clark, 2015, p. 77).

Study Group

The study group of the research consisted of 15 students of 3rd and 4th grade who were enrolled in the Support Program at a Science and Arts Center located in one of the cities in the southern part of Turkey during the 2017-2018 education year. 9 of the students are girls, 6 are boys; 12 are in the 4th while 3 are in the 3rd grade, and 12 are in the age of 10 while 3 are 9 years old. In determining the study group, purposeful sampling method was used in order to conduct in-depth research (Büyüköztürk, 2012). In this research, purposeful sampling criteria were defined as gifted and talented students and to attend the science and art center.

Data Collection Tools

Methods of observation, interview and document analysis were used to collect data. With this regard, "Science Project Performance Evaluation Form", "Semi-Structured Interview Form" and unstructured observation were employed. "Science Project Performance Evaluation Form" was developed by researchers. The performances were formed by considering the learning characteristics and project performances of the gifted students. The form was finalized by regarding the opinions of 2 instructors in evaluation and assessment, 3 instructors in education curriculum and instruction, 2 science teachers from science and art center, and a social studies teacher with a master's degree. The evaluation form consists of three parts: preparation for the project, project process and content of the project, presentation of the project and product. In the project preparation section, which is the first part of the Science Project Performance Evaluation Form, the students determine the problem and create the hypothesis; in the second part, testing the hypothesis and saving the data; and in the third part, the project presentation and product performance criteria are given. The performances were evaluated out of 4 points and scored in the range of 1-5.

Analysis of the Data

In the quantitative stage of the study, data on the project performances of gifted and talented students were obtained by three raters who evaluated 25 items independently from each other and the interrater consistency was calculated with the Fleis Kappa coefficient. As a result of the evaluation of three raters, the Fleiss Kappa coefficient was found to be 0.63. According to Landis and Kochedea (1977), this value is between 0.61 - 0.80, indicating a significant agreement between the raters.

According to this statement, it can be argued that the raters effectively observed the project process and the performance of the students during the project process, and though they evaluated independently from each other, their scores showed a significant degree of consistency.

In the qualitative stage of the study, data were obtained by semi-structured interviews about the performances that were to be explained in the quantitative data. The interviews were carried out with 7 students who performed at different levels, namely, excellent, fairly good and satisfactory. Of these students, three are boys, four are girls; five are 4th grade and two are 3rd grade; one showed an excellent performance while four were fairly good and two were satisfactory. Descriptive analysis was applied on the interview data. The analysis was carried out manually and student views were directly given in the categories while presenting the findings. When giving student views, student scores were labeled as excellent (P), fairly good (FG), satisfactory (S), unsatisfactory (U) and not evaluated (NE) while boys (B) and girls (G) were used for gender and numbers for their ages and grades. For example, (P,G,10,4) in the findings means excellent (E), girl (G), at the age of 10 and 4th grade student.

Validity and Reliability Studies on Qualitative Dimension

In order to ensure validity and reliability in qualitative research, the study should be conducted in an ethical way (Merriam, 2013). The participants were informed about the research in accordance with the ethical issues and it was paid attention to their participation on a voluntary basis. In the research process, the identities of the participants were kept confidential and they were given certain codes. Guba and Lincoln (1982) state that qualitative researches should involve persuasiveness rather than reliability and validity. They discussed the persuasiveness criteria in four dimensions: credibility, dependability, validation and transferability. They also suggest that, as a qualitative power analysis, the problem should be put forward effectively with adequate sampling. In order to ensure credibility in the research, one of the researchers observed the students and the environment by attending the classes a week before the project studies were started. The researcher was in the science and art center three days a week. Project works took 4 weeks.

In order to be certain about the participant's consent and whether their thoughts are properly represented, they should be asked if they have correctly understood (Glesne, 2015, p.66). In this study, this strategy has been frequently applied because of the fast and discursive conversations of the gifted and talented students. In preparing and analyzing interview questions of the study, expert evaluations were carried out through the teachers and academicians working in the field of qualitative research. In this study, data triangulation was achieved by using multiple data collection method such as project performance, interview and observation.

FINDINGS

Quantitative Findings of the Study

In this section, the arithmetic means of the scores given by three raters are given for each item.

Table 1. Average Means of Students for Project Performance

	Items	M
	PROJECT PREPARATION PROCESS	
	Determining the Problem and Creating Hypothesis	
1.	Producing ideas from the science-related life	2,82
2.	Producing ideas for science-related needs	2,66
3.	Producing ideas independently	2,33
4.	Developing the alleged ideas by adding their own views	2,37
5.	Exploring an original problem	2,46
6.	Realizing the missing information about the problem	2,35
7.	Realizing the necessary information about the problem	2,44

8.	Recognizing the relationships related to the problem and integrating the parts in a meaningful way	2,33
9.	Creating a hypothesis about the problem	2,53
	PROJECT PROCESS AND PROJECT CONTENT	
	Testing the hypothesis and saving the data	
10.	Determining the information needed for hypothesis	2,46
11.	Being able to decide, by one's own, on the sources and materials that will be used to test the hypothesis	2,50
12.	Determining the most suitable options (methods and techniques) for testing the hypothesis	2,37
13.	Benefitting from the sources for testing the hypothesis	2,26
14.	Being able to elaborate the findings and add their views on them	2,24
15.	Integrating the findings according to scientific process steps	2,44
16.	Sharing research findings with the teachers and class	2,64
17.	Making inferences from different perspectives based on research findings	2,11
	PROJECT PRESENTATION AND PRODUCT	
	Product	
18.	Suggesting a suitable product for the problem	1,86
19.	Creating a project report covering the purpose, process, results and references of the project	0,94
	Presentation	
20.	Supporting the presentation with project-specific material (poster, model, slide, etc.)	2,88
21.	Fluent and clear language in presentation / Using fluent and clear language in presentation	3,06
22.	Making eye contact with the audience	2,89
23.	Using body language effectively	2,86
24.	Making a presentation in self-confidence	2,73
25.	Making the presentation within the given time	2,92

In the preparation part of the project, which is the first part of the Students' Project Performance Evaluation Form, students are seen to exhibit fairly good performance in producing ideas from the science-related life (M = 2.82), producing ideas for science-related needs (M = 2.66), creating a hypothesis about the problem (M = 2.53) and realizing the necessary information about the problem (M = 2.44). They showed satisfactory performance in developing the alleged ideas by adding their own views (M = 2.37), realizing the missing information about the problem (M = 2.35), but relatively low performance in producing ideas independently (M = 2.33) and recognizing the relationships related to the problem and integrating the parts in a meaningful way (M = 2.33).

In the second part, they are seen to exhibit fairly good performance in being able to decide, by one's own, on the sources and materials that will be used to test the hypothesis (M = 2.50) and sharing research findings with the teachers and class (M = 2.64) while they showed satisfactory performances in testing the hypothesis (M = 2.37, M = 2.26). However, their performance in being able to elaborate the findings and add their views on them (M = 2.24) and making inferences from different perspectives based on research findings (M = 2.11) appear satisfactory but relatively low.

It is seen that they obtained high scores about the presentation of the project and the product stage. They demonstrated fairly good performance in using fluent and clear language in presentation (M = 3.06), making the presentation within the given time (M = 2.92) and making eye contact with the audience (M = 2.89). They are seen to get satisfactory scores in suggesting a suitable product for the problem (M = 1.86); however, they failed to show a satisfactory performance in creating a project report covering the purpose, process, results and references of the project (M = 0.94).

Qualitative Findings of the Study

In this section, the students' views on the performance they exhibited according to the steps of the project process are presented.

Project Preparation Process

Findings about the performances where the students have high scores in the project preparation process:

Project preparation process: When asked what kind of intellectual processes the students experience in this process related to their performance of producing ideas from the science-related life and science-related needs, the students who obtained scores between "excellent" and "fairly good" are seen to determine the problem regarding the human body, close environment, nature, their own life and needs, the existing information or spontaneously. For instance;

> "I thought it might be to help people, like old people. It came to me from the human body. When I thought of my grandpa, I said it might be different" (E, B, 10, 4). ""My purpose was that. At the moment, people are throwing all their belongings into nature, which cannot be recycled at all, but most are recyclable" (FG, G, 9, 3). "My glasses were dirty at that time, I started out from it" (FG, G, 10, 4).

It is seen that some of the students who had "satisfactory" scores formed a problem, based on the existing information, by associating them with real life or on a subject that they regard as a problem in their life. For instance;

> "First, when I stepped out of the house, when we went out on a long vacation for more than a day, I thought we could find a solution in case the flowers went pale" (S, B, 10,4).

As regard to the performance on creating a hypothesis about the problem, the students who showed "excellent" performance are seen to have difficulty in creating a hypothesis about the problem but to focus on this performance with intrinsic motivation, while the students who showed "fairly good" performance experienced the processes such as making decision and envisioning as to the problem. For instance;

> "I had a hard time with the hypothesis. Because I wrote it the wrong way. I cared that it was related to the problem" (E, B, 10, 4). "I said I couldn't do it while I was thinking. But on the one hand, if I say I cannot do, then I cannot do, but I saw I could do when I said I can. I guided myself to do this by saying that I could do it. I think it is important to be related to the problem" (FG, G, 10, 4).

The students who showed "satisfactory" performance are seen to feel anxious as they do not know and thus they took help from their teachers while creating a hypothesis about the problem. For instance;

> "I knew nothing during hypothesis stage. That's why I said we would get wet due to the temperature. I didn't know much about running. That's why I wrote so. I got a little worried that I was wrong. I didn't know, so I got worried. I asked Merve teacher. She said hypothesis was something like that and I could do it" (S, G, 9, 3).

Findings about the performances where the students have low scores in the project preparation process:

Project preparation process: As to the performance of "producing ideas independently", all the students who got scores in "fairly good" and "satisfactory" stated that they produce ideas independently.

Regarding the performance of "recognizing the relationships related to the problem and integrating the parts in a meaningful way", a student showing "excellent" performance expressed that he integrated the information in sequence. However, the students who got scores in "fairly good"

addressed that they had difficulty in some cases, needed their family, tested the hypothesis, got excited and had a different experience. For instance;

> "I integrated all of them in sequence, I think I'm good" (E, B, 10, 4). "I think I could do well. First of all, we wanted, with my dad, to do it touching the glasses, but later, it spent so much battery that it got forced, thus we gave up doing so, now it slightly touches" (FG, G, 10, 4).

It is seen that the student who got scores in "satisfactory" category reached so much information and sources, and therefore she felt good. For instance;

> "I see it quite well, I mean I gathered a lot of information, I read from many websites, I used a lot of sources" (S, G, 9, 3)

Project Process and Project Content

Findings about the performances where the students have high scores in the project process and project content stage:

As regards to the performance of "sharing the research findings with the teacher and the classroom", it is observed that the students who showed "excellent" performance shared with their teacher but not with their friends. The students who scored "fairly good" are seen to think that this performance is beneficial as well as offering experiences such as sharing with the teacher and producing new ideas with his question, taking positive feedback and increasing awareness about the problem. For instance;

> "You already knew, with my other teacher, but I didn't share with the class. I mean, they can as well find this idea" (E, B, 10, 4). ""I shared a little. The teacher asked how to place that button under it. I couldn't find it. Then, I thought I could place it by taking the buttons of the toys at home. I found this way" (FG, G, 10, 4).

A student who scored "satisfactory" stated that she enabled her friends to learn. For instance;

> "Yeah, I think my friends found out, too. For example, when it is about it, we can do it together. If it is only me to know about it, then it is difficult to do. We can have more time to tell everyone" (S, G, 9, 3).

With respect to the performance of "being able to decide, by one's own, on the sources and materials that will be used to test the hypothesis", the student who scored "excellent" stated that he reached various sources. The students who showed "fairly good" performance indicated that they went through the process such as getting ideas from parents, benefitting from the tools around and researching.

> "When I searched from the internet, I paid attention that it is detailed" (E, B, 10, 4). "There were a lot of things at home. I took them together. For example, there was a propeller, a battery..." (FG, G, 10, 4).

It is seen that the student who scored "satisfactory" benefitted from researching and parents. It is observed that a student had time problems, faced difficulty and could not focus on the study. For instance;

> "I got ideas from my mother" (S, G, 9, 3).

Considering the performance of "determining the information needed for hypothesis", the student who scored "excellent" is seen to benefit from books and internet while the ones scoring

"fairly good" are seen to have experiences such as thinking over the problem, researching, internet, making decisions by oneself and getting ideas from parents. For example;

> "I also looked at the books on the human body, I read them. I made use of the internet. I paid attention to have detailed information" (E, B, 10, 4). "I sometimes forget or sometimes hear wrong information. I searched from the internet to be sure whether they are true. I also asked my father. I determined them all except for that filter, my dad said it would be better to fix filter" (FG, B, 10, 4).

The students who scored "satisfactory" are seen to make use of the research and parents. One student is observed to suffer time problem, have difficulty and not to be able to focus on the study. For instance;

> "I determined it by researching. I got some help from my mum. I mean, I had no books. I did it from the internet in my mum's pharmacy" (S, G, 9, 3).

Findings about the performances where the students have low scores in the project process and project content stage:

Regarding the performance of "being able to elaborate the findings and add their views on them", the student who scored "excellent" is seen to understand and write the information that he had found. On the other hand, the students who scored "fairly good" had experience such as adding their own ideas at some points, not being able to think because of focusing on finishing the task and producing new ideas. For instance;

> "I didn't use the information as it was. I looked there, understood how it was and wrote myself" (E, B, 10, 4). "I added my own ideas at some points but they were very little details.." (FG, G, 10, 4).

As regards to the performance of "making inferences from different perspectives based on research findings", the students who showed "excellent" performance are seen to produce different ideas while reading information related to the problem. The students who scored "fairly good" are observed to deal with the problem from different perspectives. One student stated that he could produce no idea while an other student expressed that he took different perspectives into account though they are contrary to his views. For instance;

> "I mean, I was looking how it would circulate in human veins.. Different ideas come to my mind as I read there" (E, B, 10, 4). "At that time, I just thought of fulfilling my task, I couldn't do it. I then thought over it and came up with differrent ideas, but now I cannot remember" (FG, G, 9, 3).

Project Presentation and Product

Findings about the performances where the students have high scores in the project presentation and product stage:

Considering the performance of "fluent and clear language in presentation", the student who scored "excellent" stated that he got prepared for it while the students showing "fairly good" performance pointed out being courageous, family support, experience, having command of the presentation and reading book. For instance;

> "I'd worked at home when I did it on the computer" (E, B, 10, 4). "Yes, I'm very confident in my speech performance. I think it is due to being courageous and also to my parents' support" (FG, G, 10, 4). "Yes, I absolutely know the project, that's it" (F, G, 10, 4). "Yes, this is due to reading book" (FG, B, 10, 4).

The students who scored "satisfactory" did not find her speech fluent with regard to this performance. For instance;

> "Well, my friends weren't listening to me much. They were talking too much. They talked too much during all presentations, too. We couldn't understand most of them. Therefore, I was not fluent" (E, G, 9, 3).

Regarding the performance of "making the presentation within the given time", the student who scored "excellent" stated that he got prepared by keeping time. On the other hand, the students who showed "fairly good" performance indicated that they exhibited good performance because of being experienced and making preparation. For instance;

> "I think it was good. We kept time while working" (E, B, 10, 4). "Yes, we would make presentations for some weeks; I gave a presentation then, that's why I think I used the time well" (FG, G, 10, 4).

The student who performed "satisfactorily" stated that she could not use the time well. For instance;

> "No, I was distracted most of the time due to the others' talking; I had to start the sentence from the beginning" (S, G, 9, 3).

As regards to the performance of "making eye contact with the audience", the student who scored "excellent" stated that it was necessary to make eye contact. The students who scored "fairly good" find eye contact necessary to be clear and to better understand. For instance;

> "Without eye contact, I feel as if I couldn't exchange information with them" (E, B, 10, 4). "Yes, I generally read it, but after a few words, I also kept eye contact. This made me understand that I followed speech rules" (FG, G, 9, 3).

The student who scored "satisfactory" stated that she sometimes made eye contact. For instance;

> "Well, I sometimes turned my eyes away but I still made eye contact and this made me excited" (S, G, 9, 3).

Findings about the performances where the students have low scores in the project presentation and product stage:

Considering the performance of "suggesting a suitable product for the problem", the student who scored "excellent" is seen to pay attention to details and ordering according to the problem. The students who scored "fairly good" are observed to pay attention to clarity of the product, being interesting and understandable, functioning, greatness, moving the important information to the centre and ordering. For instance;

> "First, ordering; then, details. I mean, I put them in order according to the problem" (E, B, 10, 4). "I cared whether it wiped the glasses but it didn't work as it spent too much energy and was too heavy" (FG, G, 10, 4). "I wouldn't make it so big but it was impossible. But it is always so, they first make it bi, then make smaller, like computer, telephone, I thought so. I mean I supposed technology can be transported as it develops, for example in 1000-year time" (FG, B, 10, 4).

With respect to the performance of "creating a project report covering the purpose, process, results and references of the project", the student who scored "excellent" stated that he didn't consider writing report necessary. The students who scored "fairly good" are seen to have experiences such as

underlining and glossing, getting lazy due to previous experiences and having difficulty because of not being able to envision. For instance;

> "Well, I knew how to do it but I didn't find it necessary" (E, B, 10, 4). "While writing the report, I got mixed up when I did something wrong.. I wasn't nice on small pieces of paper, but at last, it became good on it" (FG, B, 10, 4). "I didn't have any problem by doing and thinking over what I did before" (FG, G, 9, 3).

The student who scored "satisfactory" is seen that she could not write a report since she didn't know how to do it. For instance;

> "No, I didn't know how to do it" (S, G, 9, 3).

DISCUSSION

As regards to the gifted and talented students' performances of "producing ideas from the science-related life and for science-related needs" which are categorized under "determining the problem and creating hypothesis", some of the students who scored "excellent" and "fairly good" are observed to determine the problem with reference to human body, immediate environment, nature, student's own life and needs, existing information or spontaneously. On the other hand, some of the students who scored "satisfactory" are seen to determine the problem by associating with real life through existing information or about an issue which they considered as a problem in their life. It is known that gifted students have talents such as sharp observation, high awareness and attention (Davis and Rimm, 1998). Considering the performances of producing ideas from the science-related life and for science-related needs, all the students are observed to produce problem states related to their own body, immediate environment and their observations in nature. This can result from the gifted students' tendency and talents such as sharp observation, high awareness, attention and sensitivity.

In the context of science and higher-order thinking skills, it is seen that gifted students have a great interest in science during the project period and find it very easy to determine the problem. This finding is similar to the view by Newman & Hubner (2012), Van Tassel-Baska, Gallagher, Bailey & Sher (1993) that gifted students are well-versed in finding a problem.

During project preparation process, the students who scored "excellent" and "fairly good" for the performance of creating a hypothesis about the problem are seen to have difficulty in this performance. However, though they had difficulty, the students went through the processes such as focusing on the performance, making decision and envisioning with internal control. This result of the study corresponds to the characteristics of the gifted students which are high internal control, imagination and higher-level reasoning skills (Davis and Rimm, 1998). Based on this result, it appeared that gifted and talented students operated on high internal control, imagination and higher-level reasoning skills when creating hypothesis.

Although the students have quantitatively a low mean score with regard to the performance of "producing ideas independently", they are found to produce their ideas independently based on qualitative findings. In this respect, quantitative and qualitative findings are not consistent. This may be due to the fact that the evaluators could not observe or interact well enough with them in the process.

As for the performance of "recognizing the relationships related to the problem and integrating the parts in a meaningful way", some students expressed they had difficulty while some others stated they did not. It is seen that students went through cognitive processes such as integrating the information in the order and testing the hypothesis; in other words, they used high level thinking skills. It seems that one of the students reached a lot of information and resources and s/he felt good about herself/himself. It is observed that students experience emotional processes such as feeling excited and feeling good at this stage. Gifted students also have the ability to enjoy learning, which is of their

typical traits (Davis, Rimm, 1998). Based on this finding, it appeared as a result of excitement and production in the learning process that they experienced emotions such as feeling good as a reflection of the satisfaction for learning.

Problem-based project work is a learning approach based on students' active participation in which they employ high-level thinking skills. In this study, gifted and talented students operated on high-level thinking skills such as integration of information in sequence and testing the hypothesis. According to Newman and Hubner (2012), gifted students enjoy active learning in science. It was observed during this research process that students felt excited and good.

With respect to the performance of "Sharing the findings with the teacher and class" during project process and project content, in which students had high mean scores, it is observed that the students who had "excellent" performance shared with their teacher but not with their friends; on the other hand, the students who had "fairly good" performance shared with their teacher and produced new ideas along with his question. Projects are a kind of work that enables students to produce new and many ideas about the question or problem. In this process, the teacher has a very critical role in guiding and paving the way for the students. During the project work, the students' ideas about the problem through the guidance of the teachers are considered important in terms of developing the sub-dimensions of creative thinking skills such as fluency and resistance to early closure. The students think that sharing with the teacher and the class is beneficial for them, they receive positive feedback in this process and their awareness about the problem improves. One student showing "satisfactory" performance stated that they helped their friends learn and shared their positive opinions on working together. This result of the research is consistent with the findings of the studies by Johnsen-Harris (1983) and Kingsley (1986) which revealed that gifted and talented students' teaching each other within the project process boosted their learning.

It is seen, in relation to the performance of "Being able to decide, by one's own, on the sources and materials that will be used to test the hypothesis", that students who had "fairly good" performance went through such processes as applying to various sources, getting ideas from parents or researching". Similarly, the student who showed "satisfactory" performance is observed to benefit from the researches or parents. One student is seen to have a time problem, have difficulty and could not focus on the work.

The student who had "fairly good" score as to the performance of "Determining the information needed for hypothesis" stated that he made use of books and Internet and cared much about it to become detailed. This finding of the study is consistent with that of Newman and Hubner (2012) which denotes gifted and talented students have the characteristics of acquiring and preserving information. It is seen that the students who showed "fairly good" experienced such processes as thinking on the problem, making decisions on their own, getting ideas from parents and researching; whereas, the student who got "satisfactory" score benefitted from researching or parents. On the other hand, areas of interest of gifted and talented students are frequently changed and disorganized, which shows they have tendencies such as impatience, carefree behaviour, lack of diligence and disorganization (Ataman, 2009; Caglar, 2004; Heacox Cash, 2014; Karakus, 2010). With regards to this, it is seen that a student had time problems, had difficulty and could not focus on the work.

The students who had high mean scores in the process of determining the information needed for hypothesis are observed to follow individual strategies such as making use of books and Internet, having elaborate ideas and making own decision. As the mean scores fall down, they seem to tend to get external support such as obtaining idea and benefitting from parents. In addition, they experience processes such as time problems, difficulties and inability to focus on work.

It is seen in project process and project content that the students who scored "excellent" about the performance of "Being able to elaborate the findings and add their views on them", in which they have low mean scores, could understand and write the information they attained. The students who scored "fairly good" are observed to go through such processes that they added their own views at

some points, they could not think over due to focusing on completing the task and could produce different ideas. In addition to elaborating on the findings during problem solving process, it is of more importance for the gifted and talented students to be enabled to add their own views rather than reaching the result or completing the task. However, it was found out in this study that the students could not reserve enough time for these processes or focus on them.

With regards to the performance of "Making inferences from different perspectives based on research findings", the student who showed "excellent" performance is seen to read the information about the problem and produce different ideas. The students who scored "fairly good" are observed to approach the problem from different perspectives. One of the students stated that he took different views into consideration during the research though they contrast with his views while another student expressed that he could not produce any idea. As a result, gifted and talented students appear to experience flexibility sub-dimension of thinking processes such as producing different ideas about problem, dealing with the problem from different points of view and taking various perspectives into consideration.

Regarding the performance of "Using fluent and clear language in presentation" within the project presentation and product, the student who showed "excellent" performance is seen to have made preparation; whereas, the students who scored "fairly good" stated that they were courageous, took family support, made use of previous experiences, had comprehensive knowledge of the project and read book. The student who demonstrated "satisfactory" performance addressed that he did not find his speech fluent.

As regards to the performance of "Making the presentation within the given time", the students who showed "excellent" and "fairly good" performance stated that they performed well depending on working by keeping time, being experienced and making preparation. The student who scored "satisfactory" indicated that he could not use the time well.

Considering the performance of "Making eye contact with the audience", the student who showed "excellent" performance emphasized that making eye contact is necessary. The students who scored "fairly good" indicated that they kept eye contact to better-understand and be understood; whereas, the student showing "satisfactory" performance expressed that he sometimes made eye contact.

It is seen in project presentation and product stage that the student who scored "excellent" about the performance of "Suggesting a suitable product for the problem", in which he has a low mean score, is seen to make a proper sorting and pay attention to details. The students who showed "fairly good" performance are observed to pay attention to points such as the product being distinctive, attracting attention and comprehensibility, functioning, size and placing important information into the centre.

With respect to the performance of "Creating a project report covering the purpose, process, results and references of the project", the student who showed "excellent" performance did not find necessary to write a report. The students who scored "fairly good" are seen to go through experiences such as drawing and glossing, being lazy due to previous experiences, and having difficulty in envisioning. The student who performed "satisfactorily" is seen not to write a report as he did not know how to do it.

SUGGESTIONS

As for determining the problem and creating hypothesis by the gifted and talented students, some of the students are observed to determine the problem by the help of human body, immediate environment, nature, one's own life and needs, existing information or spontaneously. Science education of gifted and talented students should be carried out in real contexts, with the original

problems, through processes involving learning experiences based on rich and comprehensive standards.

It was observed that gifted and talented students have difficulty in the performance of forming hypothesis about the problem. In science education of gifted and talented students, as well as the emphasis on project studies, processes based on the development of high-level thinking skills to create hypothesis should be effectively constructed.

In the research process, it was concluded that the students could not think in detail about the findings they had reached and add their own views because of focusing on completing the task. Therefore, they should be allowed to think in detail about the findings and to add their own views in the problem solving process.

In science teaching of gifted and talented students, creative-thinking-skills-based processes should be constructed to produce ideas independently.

Students should be provided with skills related to research and knowledge in order to be able to self-decide on the resources and materials to test hypothesis.

During project works of gifted and talented students, product creation skills should be developed by providing effective guidance to students in the process of product creation.

During project works of gifted and talented students, cooperative learning skills through cooperative learning experiences should be ensured.

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