Thoughts of Prospective Mathematics Teachers on Educating Mathematically Gifted Students

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Abstract: The aim of this qualitative study was to explore the thoughts of primary and secondary prospective mathematics teachers about educating mathematically gifted students. For this purpose, this research was conducted with 40 prospective mathematics teachers, 17 of whom were secondary mathematics prospective teachers, and 23 were primary mathematics prospective teachers. The data was collected through (i) written explanations of all prospective teachers, (ii) one classroom discussion, and (iii) three focus group interviews. The data was analyzed by using content analysis. The findings indicated that prospective mathematics teachers mostly associated education of gifted students within the school context, such as what can be done in the classroom or out of the classroom for these students. It can be interpreted that the participants will tend to focus on out-of-class activities rather than in-class activities for the mathematically gifted students in their future classrooms.

Keywords: Mathematically gifted students; prospective mathematics teachers; teacher education; gifted education; mixed classroom

INTRODUCTION

The improvement of a society is undoubtedly related to the talents and creative potentials of its individuals. These highly potential individuals take their education in either homogenous or heterogeneous classroom settings (Davis, Rimm & Siegle, 2014; Dimitriadis, 2016b; Leikin, 2010), namely different countries have different education policies in organizing environments for these gifted students (Davis et al., 2014; Gómez-Arizaga, Conejeros-Solar & Martin, 2016; Leikin, 2011b). Consequently, equity and differentiation in education, challenging situations with gifted students in the classrooms, and teachers' awareness of gifted students' needs are some of the issues examined in the literature (Shayshon et al., 2014; Leikin, 2011b). With the awareness of the educational needs of gifted students in societies, the research has increasingly emphasized the role of several components, such as the education of gifted students, since the beginning of the 1980s (Dimitriadis, 2016a). How to educate gifted students, such as grouping the gifted students either homogeneously according to their abilities or heterogeneously with all other students, is still open

to discussion (Davis et al., 2014). There is no consensus for the right educational practices in the gifted literature (Shayshon et al., 2014). While some of these practices like grouping and compacting curriculum have been criticized because of not considering individual differences and motivation factors for gifted students, other practices have suggested modifications in all school programmes, such as differentiating curriculum for every student including gifted students (Dimitriadis, 2012). All these practices are being employed in the educational systems in line with the needs of gifted students and schools.

Educational systems mainly rely on classroom teachers to differentiate curriculum and support gifted students (Diezmann & Watters, 2000). In their first years of careers, mathematics teachers have the vital role of identifying students' strengths and adapting lessons accordingly. Suppose teachers choose tasks and activities for the average level in mixed classes. In that case, then mathematically gifted students are not able to notice their potential and get bored, or are usually labeled failed, even though teachers realize their talents (Applebaum, Freiman & Leikin, 2011; Fraser-Seeto, 2013; Leikin, 2011b; Levenson & Gal, 2013; Levenson, Tirosh & Tsamir, 2009). Teachers may find it challenging to work with gifted students due to the unique needs of them (Karp, 2010). Although studies devoted to the characteristics of mathematically gifted students are vast, there is a need for a clear study of the teaching methods in mixed classes (Karp, 2010; Karsenty, 2014; Leikin, 2011a; Levenson & Gal, 2013, Reed, 2004; Yazgan-Sağ, 2022). In this respect, for mathematically gifted students to reach their full potential, teachers' knowledge and beliefs on how to educate them are essential (Even, Karsenty & Friedlander, 2009). This study might be seen as an initial step in cultivating the awareness of prospective teachers on the challenges associated with educating these students. Therefore, this study aims to reveal the prospective mathematics teachers' thoughts on educating mathematically gifted students, especially in mixed classrooms.

Education of mathematically gifted students

In this study, "mathematically gifted students" refers to students who have potential in mathematics and display significant mathematical abilities in society. One of the common myths is that due to giftedness, a gifted student does not need any special education or support in order to nurture their talents (Copper, 2009; Moon, 2009). Unlike what is believed, gifted students need to be motivated and guided purposely (Clark, 2013; Levenson & Gal, 2013; Yazgan-Sağ, 2019). Establishing of an environment for learning opportunities is crucial to making gifted students realize their potential (Dimitriadis, 2016a, 2016b; Leikin, 2010). The seminal work of Krutetskii (1976) revealed that having experiences in challenging tasks and using targeted teaching methods can lead to the development of mathematical ability. Leikin (2010) also argued that challenging environments can support mathematically gifted students in nurturing their potential. "When challenge is coupled with student choice and interest, the outcome is an intellectually stimulating learning environment that is enjoyable and meaningful" (Davis et al., 2014). However, there is no

agreement in the literature on how to enhance gifted students' potential (Shayshon et al., 2014). The issue of designing an education program that can be merged into a heterogeneous classroom or a separate program from the regular one is still open to discussion (Davis et al., 2014; Dimitriadis, 2016b). There are several educational approaches, such as acceleration, grouping, compacting, and differentiation. The curriculum aims to organize such a challenging context for gifted students (Davis et al., 2014; Leikin, 2010, 2011a; Sriraman & Haavold, 2017; Renzulli & Reis, 1985; VanTassel-Baska & Little, 2003). These approaches mostly describe the environments that might be the most suitable for gifted students and their needs. The curricular modifications also aim to construct an environment for critical, creative, and high-level thinking and to work as independent researchers in the mathematics discipline for gifted students (Little, 2018; Sriraman & Haavold, 2017). Namely, in-school or out-of-school adjustments should be made in teaching and learning methods according to the students' differentiated abilities and thinking processes (Freeman, 1999; Little, 2018; Shore & Kanevsky, 1993; Tomlinson, 2014). For example, teachers can provide extra tasks to students instead or after the main task given to the class, and they can add extra projects in line with their interests. A school can select gifted students for subject-skipping or grade-skipping and organize cluster grouping for all gifted students at each grade level. A student can take a university course, a part-time special gifted class, or go to a special school for gifted students (Davis et al., 2014).

Mathematics educators mostly highlight mathematics content and teaching action rather than the program itself for the education of mathematically gifted students (Koshy, Ernest & Casey, 2009; Sheffield, 1999). For example, Sheffield (1999) proposed the tasks should be complex, original, and open-ended which opens students' minds to think creatively. In fact, the literature offers to trigger creativity in all types of classes (Levenson, 2013, Prabhu & Czarnocha, 2014). Researchers also stated that teaching mathematically gifted students involves a higher level of challenge and requires a higher level of creativity and critical thinking from students (Casey, 1999; Koshy, 2001). In this manner, Leikin (2010) clarified how mathematical tasks (e.g., proof, inquiry, and multiple solutions) can challenge gifted students in the classrooms. Opportunities such as math contests and Olympiads, mathematical clubs, and conferences can also be offered to all students, especially for gifted students as in-school or out-of-school activities (Leikin, 2010; Sriraman & Haavold, 2017). It is clear that not all of these practices can be implemented in the heterogeneous classroom context. However, modifying ways of teaching in all of these contexts is one of the essential requirements for educating mathematically gifted students (Karp & Busev, 2015). For the mixed classroom, mathematics teachers can meet all students' needs with differentiated education (Mellroth, 2021; Tomlinson, 2014). In order not to make the students get bored and frustrated in the school context, the curriculum that will be used in the education of mathematically gifted students should be designed as accelerated, deeper, and abstract (Diezmann & Watters, 2000; Dimitriadis, 2016a; Lubinski & Benbow, 2006).

METHOD

The aim of this study was to reflect the prospective mathematics teachers' thoughts about educating mathematically gifted students. The participants of the study were 40 prospective mathematics teachers (17 prospective secondary mathematics teachers and 23 prospective primary mathematics teachers) in the Mathematics Education teaching program in Turkey. They had never taken any course related to giftedness during their education program. The researcher of the current study was also the lecturer of the course titled "Teaching Methods on Mathematics Education" for both primary and secondary mathematics teaching programs. Prospective primary teachers took this course in their fifth semester, and prospective secondary teachers took the course in the seventh semester of their teaching program.

In this study, the data was collected through (i) written explanations, (ii) classroom discussions, and (iii) focus group interviews with prospective mathematics teachers. Firstly, open-ended questions were asked which are related to (mathematical) giftedness, mathematically gifted students, education and teachers of these students, such as "What do you think of the education of (mathematically) gifted students?". Writing down their opinions about these questions took about one course hour (45-50 minutes). Secondly, an audio-recorded classroom discussion was organized with 23 prospective primary mathematics teachers after their written explanations were taken. The discussion lasted approximately 35 minutes. Then, two groups (primary and secondary) were asked if they would like to participate in the focus group interviews. In these focus group interviews, seven prospective secondary mathematics teachers and 11 prospective primary mathematics teachers volunteered to participate. Three focus group interviews were made with these participants. While seven prospective secondary mathematics teachers were the first focus group interview participants, the second and third interviews were conveyed with 11 prospective primary mathematics teachers by dividing them into groups of 5 and 6 participants. Each of the three focus group interviews, which were also video-typed, took approximately 100 minutes. Both classroom discussions and focus group interviews enabled the participants to reveal their thoughts more specifically. Thus, they had an opportunity to consider different aspects of giftedness, think deeply, and reflect on the other participants' views. Questions for focus group interviews were prepared by considering each participant's written statements. Yet, in order to keep the participants focused on the subject, prompts during the focus group interviews were used.

The data of this qualitative study, which aims to reveal the prospective mathematics teachers' thoughts, were analyzed through content analysis (Patton, 2002). First of all, the row data were transcribed in order to prepare them for analysis. Prospective secondary and primary mathematics teachers' written explanations were read several times and the whole classroom discussion was listened, and three focus group interviews were watched. The patterns that indicate the issues related to the education of mathematically gifted students were clarified. Literature served as a guidance while determining these patterns as categories in line with the aim of the study (Karp,

2010; Karsenty, 2014; Leikin, 2011a, 2011b; Leikin & Stanger, 2011; Levenson & Gal, 2013; Tomlinson, 92014; Reed, 2004). For instance, when the statements of the participants such as "Out-of-the class, I can ask challenging and advanced problems such as intelligence questions that enable the gifted students to reflect on them." were observed in the data sources, they were coded as "educating mathematically gifted students out the classroom" category. A number was given to each paper which included prospective teachers' written explanations. Then, these prospective teachers' names were coded as PT-X if the paper of written explanations had the number X.

FINDINGS

In this section, the prospective mathematics teachers' thoughts about how to educate mathematically gifted students will be presented. The sources of the data presented in this section are (i) written explanations, (ii) classroom discussions, or (iii) focus group interviews with prospective mathematics teachers. The prospective mathematics teachers' thoughts were coded into three categories. Firstly, the participants' general comments on these students' education will be given. Then, the prospective teachers' thoughts about how to educate these students in the school context, which were divided into two subsections as "in the classroom" and "out the classroom" will be presented.

General comments on educating mathematically gifted students

The thoughts not directly relevant to the mathematics classroom or the relation between teachers and gifted students were coded as "general comments on education mathematically gifted students". Although there were some voices among the participants that the gifted students should be educated with all the other students, the majority of the participants stated that it would be better *to educate all gifted students together in the same school* context. The participants specified several reasons for educating gifted students in the specialized schools:

> PT-20: We could educate them as scientists or successful people in several disciplines […]. If we educate them with other students, we are likely to lose those students because this education would not be sufficient for them. Therefore, I think they should be educated in separate schools both for their own future and for the future of the country.

PT-20 considered not only the individualized education of gifted students but also the education policy of their country. She emphasized educating gifted students for the sake of national interests. PT-1 also thought that improving the abilities of these students and satisfying these students' curiosity could be more feasible in such schools. In a similar manner, PT-34 highlighted that those students can get bored easily and may not be able to realize their abilities in regular schools. Prospective teachers also suggested the use of a differentiated curriculum for gifted students. PT-19's statement is as follows: "Regular curriculum can distract gifted students' attentions, and it would not satisfy them." On the other hand, some prospective mathematics teachers *hesitated to raise gifted students in special or regular schools.* Here is PT-16's explanation:

> PT-16: I am between a rock and a hard place; I could not decide on this situation. If we isolate the gifted students, they will have problems socializing with normal people. However, being in a normal class is a waste of time for those mathematically gifted students. If there are many gifted students and the teacher makes the other students feel this situation, it can cause problems.

PT-16 especially underlined the socialization issue of gifted students in their daily lives. She also declared that although they would have mathematical knowledge, being with only gifted students could cause them to lose their self-confidence and lower their academic success. A number of participants also thought that *gifted students should come together out of their regular schools or classrooms:*

> PT-25: There are schools called Science and Art Centers. I heard that gifted students go to these schools two days a week. They can go to their regular schools the other three days of the week.

PT-25 also stated that it is essential to come together with gifted students to foster their own abilities. Besides, PT-18 added that regular schools are substantial for gifted students to adapt themselves to society, knowing their differences from others. Some of the participants also offered that there could be some special classes or inclusive education for gifted students in regular schools. For example, PT-35 said that "Perhaps a special education can be provided for these students both in mainstreaming and out of school education." Alternatively, PT-26 and PT-7 believed that having a teacher specializing in these students could be helpful in regular schools.

Prospective mathematics teachers have different views on *whether teachers of gifted students are supposed to be gifted or not.* Most participants believed that *a teacher does not have to be gifted* for a gifted student, but it is important to get education on mathematically gifted students. Here are the statements of PT-10 and PT-24:

> PT-10: The teachers don't have to be gifted. They just have to know how to use approaches and methods for gifted students.

> PT-24: The teachers do not need to be gifted, but need to get a special education. Since the teacher's communication with the student is crucial here, the teachers cannot understand what the student is thinking, and if they cannot analyze student's answers, they may misunderstand their students.

The other participants, on the other hand, stated that *it might be an advantage for the students to have a gifted teacher, but it is not necessary to* be a gifted teacher for a gifted student. For instance, PT-7 explains as "It could be an advantage if the teacher should be trained on this subject. At the very least, teachers should be able to recognize the gifted students and refer them to the experts." Some of the participants said that *gifted students' teachers must be gifted persons:*

> PT-25: Gifted teachers can better understand what gifted students can understand and how they can think. Therefore, these students don't have any troubles.
>
> PT-15: Because the gifted teacher knows best what they encountered and what they questioned […] In other words, that teacher is the person who has passed those roads and can best understand those students. Therefore, these students don't have any troubles.

These prospective teachers claim that gifted teachers can be more insightful and helpful for gifted students because of sharing similar problems in society and the classroom context. PT-33 also highlighted that gifted teacher can promote students' giftedness; otherwise, gifted students can lose their abilities.

Educating mathematically gifted students in the classroom

The participants' explanations were coded based on teachers' actions in the classroom context as "educating mathematically gifted students in the classroom". Firstly, most of the prospective teachers considered *being equal to all students.* They stated that it would be a problem, especially not for gifted students but for all the other students in the classroom.

> PT-20: We must act following the principle of equality in education. If not, the other students will feel bad, and I lose them.

As seen from above, PT-20 perceived equity principle as giving attention to all students in the same way and not behaving differently to the gifted students in the classrooms. The participants mainly care about other students' thoughts regarding their teaching actions, regardless of whether they consider gifted students' needs. A couple of prospective teachers offered to *share gifted students' needs explicitly with the whole classroom*. Here is PT-2's explanation:

> PT-2: If we work with older students, we can share their needs with others. While that gifted student is absent, we can say: "Everyone has different abilities; he/she is talented in this field. I will work with him/her separately, if there are others who are interested, we can also work together". […] I think it is very important to give feedback here. The teacher should make it feel: "You don't miss anything; he/she is just a little further."

PT-2 emphasized that studying differently with gifted students does not mean the teacher is less interested in the other students. However, the other participants do not favor this statement. They suggested that students of that age might not be able to handle this speech because of the students' own perceptions.

The prospective mathematics teachers also stated that their thoughts are related to gifted students' possible questions during the lesson. They have proposed various *ways to answer the gifted students' questions in the classroom.* Most of the participants agreed that it is important *to answer these questions at the moment the gifted students* asked. For instance, PT-23 argued about

answering gifted students' questions as much as possible when they asked during the lesson. He also stated that the teacher should not restrict the students' thinking by saying, "It is enough for you." PT-22 added that the teacher would examine why the student was asking the mentioned question:

> PT-22: While solving equations, the student may ask "Who found the equals sign?" I would ask firstly, "Why did you wonder?" Because that question is irrelevant in that moment, then I would talk about Euler.

With this statement of PT-22, PT-19 offered to discuss the equality concept at the beginning of the lesson. In this way, the teacher can answer the possible questions before the gifted students ask them. PT-18 also contributed to PT-22's explanation by saying, "With a catchy short story, we can say that Euler found the equals sign." PT-23 proposed that the teacher can guide the students to investigate these questions even if the teacher knows the answer. He thought the teacher should not answer to give students more permanent knowledge. Similar to PT-23, some of the other prospective teachers stated that the teacher can *answer the question partially* during the lesson:

> PT-2: We can give a little information to satisfy student's curiosity and say, "Let's talk about this during the break". I think necessary information should also be given there.
>
> PT-6: What if I don't know the answer? If I don't know, I can't answer at that moment, nor can I lie. I can say, "Let's not interrupt the lesson for now; you write it down, come and discuss it in free time during lunch break."

While PT-2 stated that she would give a part of knowledge in order to satisfy the gifted student's curiosity at that moment and then answer the question during break time; PT-6 said that she could not explain if she did not know the answer. PT-4 also preferred to give little information about the question; otherwise, she thought that it would be confusing for the other students if they did not have enough knowledge to understand both the question and its answer.

A number of the participants expressed that a teacher can *differentiate lesson activities according to mathematically gifted students* in the classroom. They offered to adjust the task, paying attention to mathematically gifted students. However, the other participants found this teaching action challenging in the classroom context. Here are some explanations:

> PT-22: We can make plan B for the tasks. We can give them to gifted students by saying, "Now you can work on this problem, let's solve it" I think we can make different arrangements in different ways without changing our lesson plan.
>
> PT-21: When these students finish earlier, we can say, "You can look at this and think about this" without separating them from the class. This tactic also seems to be useful. We can use the existing task and add something extra.

These participants especially emphasized using the same activities during the lesson by differentiating the related tasks for gifted students and giving extra tasks while they finished them. In the same line, PT-26 stressed that mathematics teachers should *give advanced knowledge to gifted students aside from the curriculum.* PT-2 also offered to *relate the subject with the history of mathematics*. For example, a teacher can share unsolved problems like Fermat's problems with all the students but also can give these problems only to gifted students to raise their awareness and think on them during the lessons.

Some of the participants *offered to give different activities* for mathematically gifted students. For instance, PT-15 said that advanced mathematical problems and puzzles or something that is improving can be given to the gifted students. At the same time, the teacher continues the lesson plan with the other students. Similarly, PT-5 proposed to share advanced-level mathematics books related to algebra, calculus can be given to the gifted students during the lesson. PT-25 also added that if the teacher uses the same activities for the gifted students, they can easily get bored and disturb the other students in the classroom.

Some of the prospective mathematics teachers proposed to *use activities not only for mathematically gifted students but also for other students.* PT-16's statement is as follows: "For instance, after explaining negative numbers, we can ask questions like "If you defined a new negative number, how would you define it?" She mentioned *asking concept related questions* to all the students in the classroom context. However, PT-15 claimed that these questions could potentially confuse the other students' minds. Here is PT-16's thought against PT-15's statement:

> PT-16: Let them be confused too. […] Let everyone think and define something on their own. I don't expect a correct answer from everyone. For instance, we can ask why the zero power of 2 is 1. Instead of giving the proof, we can just let them think about what they would do.

Similar to PT-16's explanation, PT-26 also emphasized on *asking open-ended tasks* related to problem solving and posing activities to all students in the classroom. She said that after lecturing a subject, a teacher could give a problem-posing task to all students; in this way, every student could produce a problem according to their own abilities, and gifted students would not be bored during the lesson.

Educating mathematically gifted students out of the classroom

Prospective mathematics teachers declared their thoughts on what can be done with gifted students out of the classroom context as well. The participants proposed that a teacher should study with mathematically gifted students individually aside from the mathematics lessons. For instance, PT-15 confirmed this statement with the following explanation: "Out of the class, I can ask challenging and advanced problems such as intelligence questions that enable the gifted students to reflect on

them". In a similar manner, PT-26 said that a teacher can *ask gifted students advanced problems* to prove some formulas out of the classroom:

> PT-26: For example, we can think of dividing by 7. Instead of just accepting such rules, we can ask: "How do you think we could have reached this formula? or "Why is the zero power of any number 1?" Then we can say: "Let's think about this at home."

PT-16 confirmed PT-26's statement by saying, "We can ask them to explain why exponential numbers are needed; we can make them question and investigate". PT-6 suggested that *giving an advanced level of books* can be helpful for gifted students out of the classroom context. PT-6 also stated that it is important to investigate *gifted students' questions together with them out of the lesson hours* so of not disturbing the lesson flow for the other students. PT-3 confirmed PT-6 with his explanation: "If we constantly try to answer that students' questions in the classroom, the other students will say "the teacher is fully interested in them".

The participants also emphasized *guiding the mathematically gifted students to create a product.* They proposed that a teacher should direct them to share their products with the other students. PT-16's explanation is as follows:

> PT-16: We can refer special students to math clubs. For example, the child enters the lesson I teach, and after the lesson we refer him/her to the club. They can publish journals about mathematics in the club. For example, one of our professors told us that a teacher guided a student by giving tasks related to Gauss's work, because he/she was curious about Gauss's life, and then the student stopped disturbing the lesson. Similarly, the history of mathematics can be studied with gifted students. It can be helpful to create a new puzzle type suck as Sudoku. We can ask them: "What kind of puzzles do you create?" or "Let's design puzzles, what would you do if you adapted them to mathematics?" Such studies can be done with the club. It can also be shared on school boards and in the magazines that students produce.

PT-16 stated that mathematically gifted students can study in school clubs related to mathematics. By this way, they might investigate the lives of famous mathematicians, produce puzzles in these clubs, and then share their works in some platforms such as magazines or school panels. In a similar way, PT-19 proposed that *gifted students can be guided and prepared to participate in mathematics Olympiads, projects or contests* by their mathematics teachers.

DISCUSSION AND CONCLUSION

In this study, 40 prospective mathematics teachers' thoughts were investigated on educating mathematically gifted students, and the data were gathered with their written explanations, one classroom discussion, and three focus group interviews. Although the number of participants is

relatively small, this study provides an overall picture of possible teaching acts of prospective mathematics teachers who do not have any formal university education or course on giftedness.

Prospective mathematics teachers proposed a variety of arguments about how to educate mathematically gifted students. As it is known, there are different points of views which make educating mathematically gifted students very complicated (Leikin, 2011b). Similarly, the findings revealed that the prospective mathematics teachers mentioned different options for educating gifted students. Most participants thought it would be better to educate gifted students in specialized schools. The reasons behind their thoughts were meeting their needs more easily, making them aware of their own abilities, preventing them from boredom, and training them as scientists for national interests. However, some of the other participants cited negative consequences in special schools, such as not being able to socialize appropriately in their daily lives, losing their self-confidence and getting their education in mainstream classrooms and coming together with other gifted students in schools like Science and Art Centers or special classes only for gifted students in regular schools. In brief, the participants were quite sensitive to mathematically gifted students in terms of both academic and affective needs. Although they had no formal education on giftedness, the findings revealed that most of the participants made discussions about gifted education similar to the literature. The majority of the prospective mathematics teachers considered that a teacher of gifted students was not necessarily a gifted person, but he must be an expert or educated about mathematically gifted students as stated in the literature (Leikin, 2011a; Rosemarin, 2014). They stated that knowing how to communicate and teach gifted students is crucial in order to understand the ways of their thinking process. Besides, some participants said that gifted students would benefit from having a gifted teacher who also knows what being a gifted person is and that gifted teachers could effectively understand, recognize, and guide their gifted students.

The participants also stated their thoughts about what can be done inside and outside the classroom regarding the education of mathematically gifted students. Firstly, the prospective teachers prioritized behaving all students in the same way. These thoughts may be due to their concerns about not being equal to all the students in their classrooms. In fact, the participants misinterpreted the equity principle which does not mean to give exactly the same instructions to all students. Instead, the equity principle "demands that reasonable and appropriate accommodations be made to promote access and attainment for all students" (National Council of Teachers of Mathematics [NCTM], 2000, p. 12). They mostly prioritized other students' situations in a heterogeneous classroom and preferred not to reveal that they knew the giftedness of relevant students.

The study showed that most participants offered to answer gifted students' questions as soon as they asked during the lesson. However, they also stated that it is important to make both gifted and the other students think about the related concepts of the questions. Some of the prospective students mentioned that they just gave part of the answers because they did not know the whole answer, did not confuse the other students' minds, and guided gifted students to research independently. The prospective teachers also suggested differentiating the lesson plan to nurture the needs of gifted students, such as making plan B's, giving extra tasks, solving advanced

problems and books, and asking concept-related questions to gifted students. Some of the participants offered to ask concept-related questions and open-ended questions to all students in the classroom. For example, PT-16 offered to ask how to define a negative number while introducing negative numbers. This approach can be helpful to improve both gifted students' and other students' abilities to use the language of mathematics and mathematical notations to express mathematical ideas clearly (NCTM, 2000). Similarly, PT-16 and PT-26 gave a conceptual example of exponential numbers: "how can we define the zero power of any number?" Rather than directly giving proof to the students, using this kind of concept-related questions in learning environments can trigger especially gifted students' mathematical reasoning in a creative way (Singer, 2018). Mathematically gifted students can reflect on both mathematical concepts and the relations between these concepts. PT-26 offered to differentiate problems after introducing the related subject. This approach can be associated with making plan B's for the class. She exemplified such differentiation with problem-posing activities. Students most probably pose the problems according to their cognitive levels. In this sense, mathematically gifted students may pose relatively difficult problems. It can be used in mixed classrooms and also improve mathematically gifted students' talents. Mathematics teachers can meet gifted students' needs in this way (Singer et al., 2016). These strategies are beneficial ideas that can be implemented in classrooms where mathematically gifted students are also involved. However, prospective mathematics teachers also predicted that the organization of the differentiation would be challenging for the teachers (Sisk, 2009; VanTassel-Baska & Stambaugh, 2005). They emphasized taking advantage of the history of mathematics and transcending the curriculum with gifted students. They thought studying with gifted students outside of the classroom would be better. This finding is parallel with the literature which stresses that teachers less prefer to adjust their lesson plans in relation to gifted students in regular classes (Leikin, 2011b; Leikin & Stanger, 2011; Levenson et al., 2009; VanTassel-Baska & Stambaugh, 2005). The participants proposed to guide mathematically gifted students out of the classroom by asking advanced problems and books, answering their questions during the break time, or giving them research work. The participants also mentioned that they guided gifted students to create mathematics magazines and puzzles, and investigate the famous mathematicians' lives and works. They also suggested guiding gifted students to participate in mathematics-related contests, which play a crucial role in the improvement of their motivation and knowledge (Renzulli, 1994). It is clear that the prospective mathematics teachers suggested a wide variety of creative ideas that could be applied while educating gifted students inside and outside the classroom. This may be the result of their taking the teaching methods course. When they become mathematics teachers, the next step might be to observe and investigate if these participants will use their ideas with mathematically gifted students in their classrooms.

Despite the limited time the researcher spends with participants and the limited data collection tools, it can be assumed that these prospective mathematics teachers will pay attention to potentially gifted students in their future classes with out-of-class activities instead of differentiating the lesson plan. This may be because they did not have any professional experience with mathematical giftedness during their teacher education. However, "it is worth noting that teacher education by no means ends in college." (Karp, 2010). If they take formal gifted education courses or interact with gifted students in their professional careers, their thoughts may change in

other ways. Teacher education programs should also enhance prospective mathematics teachers' knowledge and awareness about the diversity of classrooms including gifted students. As Yazgan-Sağ (2020) stated, discussing possible mathematics classroom environment scenarios related to gifted students can also broaden the prospective teachers' ideas about what to do in the classrooms in teaching education programs.

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