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Research Article

Examining Mathematics Instructional Practices for Gifted Students Through Student Opinions*

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Abstract – This study aims to explore the opinions of gifted students regarding the mathematics instructional practices implemented at SaAC. Conducted using a qualitative research design, the study involved 50 ninth-grade students enrolled at Halil İnalcık Science and Art Center in Nilüfer, Bursa, during the 2022–2023 academic year. Participants were selected through criterion sampling, a type of purposive sampling. Data were collected via semi-structured interviews and analyzed through content analysis. The findings are organized under six main categories: general instructional activities, subject-specific activities (Algebra, measurement and data), geometry activities, use of materials, mathematical proof and reasoning processes, and opinions on assessment methods. The findings indicate that students prefer learning environments that encourage critical thinking, incorporate real-life contexts, utilize technological and visual tools, promote collaboration, and enable active participation. Conversely, teacher-centred, rote-based, and passive instruction were perceived as inadequate. In geometry and proof-related topics, students expressed positive opinions towards the integration of dynamic software tools. At the same time, project and performance-based assessments were deemed more effective for evaluating learning outcomes. Overall, the findings highlight the need for differentiated, student-centred, and flexible instructional designs that cater to the unique learning needs of gifted individuals.

Keywords: Gifted students, mathematics instructional practices, students' opinions, differentiated instruction.

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Introduction

Gifted students occupy a distinct position among students who require special education and have unique needs compared to their peers. The concept of giftedness, often conceptualized as a multidimensional construct in the literature, is variously defined and explained through various parameters. Based on general definitions in this context, the concept of giftedness is expressed as the ability to integrate an individual's superior cognitive capacity and affective skills with curiosity, creativity, and motivation, thereby transforming them into superior performance in academic and artistic fields (Reis & Renzulli, 2010; Renzulli, 2012; Samples, 2010). Beyond their cognitive characteristics, gifted individuals, who possess distinct social and emotional characteristics, are defined as a unique group that requires a differentiated and enriched instructional approaches that extend beyond traditional education. Although the proportion of gifted individuals with high-level skills such as creativity, leadership, and productivity is relatively low in the population, literature indicates that they have the potential to transform society (Çelikdelen, 2010). Therefore, for gifted individuals, who can play an active role in the development of societies, to effectively utilize their potential, special programs tailored to the needs of individuals must be implemented and supported by special education institutions (Bakioğlu & Levent, 2013; Çetinkaya & Döner, 2012; Gagné, 2023; Hertberg-Davis, 2009; Kanevsky, 2011; OECD, 2021; Sezginsoy, 2007; Şenol, 2011; Tolppanen & Tirri, 2014).

In recent years, gifted individuals and their educational needs have gained increasing importance worldwide (Hannah et al., 2011). In countries with advanced gifted education systems, these individuals are provided with education through enriched and differentiated curricula and various instructional strategies that take into account their cognitive, social, and emotional characteristics that differ from their peers (Renzulli, 1999). This is because gifted individuals require broader and differentiated instructional opportunities rather than the standard curriculum in order to fully realize their potential. However, the transformation of the high potential possessed by gifted students into actual performance depends on many factors. Despite this necessity, a large proportion of gifted students are educated in standard classrooms and school environments alongside their typically developing peers (Özdemir, 2016). Therefore, it is evident that standard classroom environments are inadequate in supporting the advanced skills, high cognitive capacities, and learning speeds of gifted students, and that gifted students face various limitations (Dimitriadis, 2011; Tomlinson, 2014). In addition to this situation, it is stated that gifted students who cannot realize their

potential become disengaged from the lessons taught in normal classroom environments and face the risk of becoming lost within the ongoing education system (Gadanidis et al., 2011). Furthermore, even if schools have appropriate programs for gifted students, various challenges, such as overcrowded classrooms, teacher shortages, and curriculum development concerns, prevent these programs from being implemented adequately. Due to the unique characteristics of gifted students, they need special education to fully realize their potential and maintain their academic success. Additionally, it is also crucial to develop new programs or update existing ones in line with the requirements of the era, student and teacher qualifications, curriculum changes, and technological developments (Özyurt & Kuşdemir-Kayıran, 2020). For this reason, it has become imperative to develop educational institutions that are specifically tailored to and differentiated for gifted students, capable of directly addressing their needs.

In line with this requirement, Science and Art Centers (SaAC) established in Türkiye to educate gifted individuals, have been operating under the Ministry of National Education since 1995 (MoNE, 2024). SaACs are specialized educational institutions designed to serve gifted students in different age groups from elementary school to high school, develop their higher-order thinking skills and project-based learning. The mathematics instructional practices implemented at SaAC are grounded in the SaAC Directive and relevant legislation, enabling students to learn at their own pace and according to their interests. In these institutions, students undergo a five-stage educational process consisting of "Adaptation Process," "Support Education Room," "Recognition of Individual Talents," "Development of Special Talents," and "Project Production and Management" (MoNE, 2024). Within this five-stage structure, mathematics serves as a core discipline for cultivating high-level skills such as abstract thinking, creative thinking, problem solving, and collaborative learning (Yıldız, 2010). The mathematics curriculum implemented, particularly in the 'Development of Special Talents' and 'Project Production' stages, includes enriched and differentiated activities tailored to the needs of gifted students. These activities are designed to enhance students' cognitive skills, including higher-order thinking, reasoning, problem-solving, and mathematical modelling (Özdemir, 2016). Therefore, to support these abilities, SaACs in Türkiye provide a distinct educational framework for gifted students (MoNE, 2024).

One of the fundamental challenges in educating gifted students is determining the extent to which instructional practices at SaAC align with their cognitive, social, and emotional needs. While teachers are responsible for the core components of instruction such as

objectives, content, methods, and assessment, the effectiveness of these practices cannot be fully evaluated without incorporating the perspectives of students who experience them directly (Cook-Sather, 2006; Mitra, 2004). Literature highlights that gifted students are active partners in their own learning experiences and play a critical role in improving instructional processes (Cook-Sather, 2006; Fielding, 2013). In this context, the opinions of gifted students are seen as an effective quality mechanism for determining whether the prepared activities are appropriate for the target audience (Flutter & Rudduck, 2004). Gifted students, who are skilled at evaluating their own learning processes and providing feedback on these processes, possess the ability to express much more clearly than their peers the instructional methods that suit their thinking styles, the materials that interest them, and the assessment approaches that reflect their development (Kanevsky, 2011; Rogers, 2007). Consequently, their feedback is considered a reliable data source for instructional improvement. Furthermore, student perspectives offer a valuable insight into the relationship between the theoretical framework of instructional practices and their practical application (Robinson & Taylor, 2007).

Although student feedback is recognized as a fundamental element of evaluating teaching practices, it is noteworthy that research in the field of gifted individuals has largely focused on the identification of these individuals, their characteristic traits, and the necessity of differentiated instruction (Anderson, 2013; Chamberlin & Chamberlin, 2010; Fıçıcı & Siegle, 2008; Gadanidis et al., 2011; Gentry & Peters, 2021; Hekimoğlu, 2004; Pierce et al., 2011; Plucker & Callahan, 2020; Subotnik et al., 2019). Research concerning gifted students in mathematics, however, is generally limited to the identification processes, characteristics, and general instructional approaches of these students (Leikin, 2021; Sriraman et al., 2013). Furthermore, there is a paucity of systematic research evaluating the opinions of gifted students regarding specific mathematics curricula and instructional practices (Aygün, 2019; Budak, 2007; Boran & Aslaner, 2008; Dimitriadis, 2011; Laine et al., 2019; Mogensen, 2011; Özdemir, 2018). Some of these studies focus on students' general MoNE mathematics curriculum (Gerez Cantimer, 2018; Gezgin & Bal, 2021; Memnun & Akkaya, 2010), while others focus on their evaluations of instructional practices applied in gifted education (Özçelik, 2017; Özdemir, 2016; Taş, 2018). Nevertheless, few comprehensive studies that examine SaAC instructional practices as a whole (in terms of methodology, materials, and assessment) and systematically analyse students' opinions on this module. This limitation of existing studies highlights the need for practice-based studies that evaluate the practical reflection of instructional practices in the field through student opinions. Therefore, this study

aims to systematically examine mathematics instructional practices for gifted students. Rather than focusing on the general curriculum structure, this study aims to reveal how students evaluate instructional practices through their concrete experiences with specific methods, materials and activities. In this way, the study aims to fill a gap in the literature and provide an understanding of the experiences of gifted individuals in the context of mathematics education. Accordingly, the fundamental research question guiding this study is: "What are the opinions of gifted students regarding the instructional practices carried out within the scope of the SaAC mathematics program?"

Method

Research Design

In this study, the case study approach, one of the qualitative research methods, was employed. Specifically, the holistic single-case design was used within this approach (Yin, 2014). The holistic single-case design involves examining a single case within its own integrity using a global approach within a single unit of analysis. In this context, Halil İnalcık SaAC was considered the 'single case,' while the mathematics instructional practices implemented there constituted the 'unit of analysis,' and the process was evaluated from a holistic perspective. Within this framework, students were actively involved in project work, performance tasks, examinations, and process-oriented assessment practices carried out as part of the mathematics instructional practices. Thus, their views on assessment were grounded in direct experience within the instructional process. The qualitative research approach is defined as a method in which events and phenomena are examined within their natural contexts, multiple data collection methods are used together, and the findings are presented in a realistic and detailed manner. A case study allows researchers to focus on a specific event or situation and seek answers to questions such as 'Why?', 'How?', and 'What?'. The steps involved in conducting the research are listed below (Yıldırım & Şimşek, 2016):

1) Defining the Research Question: The main research question is defined as "What are the opinions of gifted students regarding the instructional practices carried out within the scope of the SaAC mathematics program?"

2) Defining the Scope of the Study: The research has been structured to focus exclusively on teaching practices within the scope of SaAC. In this way, the scope of the study has been clarified and its focus clearly established.

3) Defining the Participant Group: Considering that the most suitable data source for examining the research question is gifted students studying at SaAC, the research is limited to this group of students.

4) Participant Selection: Purposeful sampling was preferred in determining the working group. Accordingly, 50 students studying mathematics at SaAC at different grade levels and achievement levels were included in the study.

5) Data Collection Process and Tool Development: A semi-structured interview form was developed to collect data for the research question. Expert opinions were sought during the form's development process; validity and clarity were ensured through pilot studies.

6) Data Analysis and Interpretation: The collected data were systematically analyzed using content analysis. The data were first coded and then grouped under themes and sub-themes. In this way, the students' views were examined in depth and interpreted.

7) Presentation of Findings: In the final stage, the findings were organized thematically and supported by tables; participants' views were presented alongside direct quotations. Based on these results, discussions of teaching practices were developed, and recommendations for practitioners were presented.

Participants

This study was conducted during the fall semester of the 2022-2023 academic year with 50 gifted ninth-grade students attending Halil İnalcık Science and Art Center in the Nilüfer district of Bursa. The participants were chosen through a criterion sampling method, a type of purposive sampling that involves selecting individuals with specific characteristics (Yıldırım & Şimşek, 2016). The inclusion criteria were: being a SaAC student, actively participating in a mathematics course, and volunteering to participate. The reason for focusing on ninth-grade students is that they have been at SaAC longer and are in the final phase of the program, known as "Project Production and Management." This phase is an instructional process designed to develop high-level cognitive skills such as designing, analyzing, modelling, and creating projects aligned with students' abilities (MoNE, 2024).

Instruction at Science and Art Centers includes five stages: Adaptation, Support Education, Recognition of Individual Talents, Development of Special Talents, and Project Production and Management. Ninth-grade students are particularly well-suited for this research, as they have experienced all these stages and the relevant processes. Therefore, this age group was especially targeted for the study. The unit of analysis concerns the

implementation of instructional practices within the scope of the SaAC mathematics program. For this reason, the sample size (n=50) was maintained to reflect the diversity of opinions in this context and to achieve data saturation, which is critical for validity in qualitative research. Including 50 students in the study was considered sufficient to ensure data diversity in qualitative research and to enable meaningful comparisons of opinions. Furthermore, this number of participants is expected to increase the reliability of the data and strengthen the representativeness of the findings. To protect the confidentiality of the participants, each student was assigned a code: Ö1, Ö2, Ö3 ... Ö50.

Data Collection

The research employed a case study design within a qualitative research framework and interviews were conducted with students to obtain in-depth information about the research problem. In qualitative research, interviewing is regarded as a data collection technique used to obtain detailed information about individuals' interests, attitudes, and behaviours within a social context (Balcı, 2013). In this study, a semi-structured interview form developed by the researcher was used as the data collection tool.

Design and Development of the Interview Form:

The interview form was developed based on the core elements of the SaAC mathematics instructional practices, including objectives, content, instructional process, and assessment. The questions were organized into four main categories within an analytical framework: "General Instructional Practices and Cognitive Processes," "Subject-Specific Learning Areas," "Instructional Materials and Technology Integration," and "Assessment Practices." In accordance with the principle of content validity, a total of 13 questions have been prepared to ensure that each category is covered comprehensively.

Specifically, in gifted education, subject-specific areas requiring advanced cognitive skills, such as abstract thinking, generalization, spatial reasoning, visualization, and the use of dynamic software, have been structured under two main themes: (1) algebra, measurement, and data, and (2) geometry, each of which was analyzed independently to capture nuanced student opinions. The main reason for identifying two main themes is to group learning areas according to their predominant cognitive characteristics. The areas of algebra, measurement, and data are addressed under the same theme because they are similar in terms of abstraction and analytical thinking. On the other hand, geometry has been structured as a separate theme because it involves distinctive cognitive processes such as spatial reasoning, visualization,

and the use of dynamic software. During the development of the form, expert feedback was sought from two doctoral-level mathematics teachers at SaAC and a professor of mathematics education, and the form was revised accordingly. Subsequently, preliminary interviews were conducted with two students as part of the pilot study; the clarity of the questions was tested, the necessary linguistic simplifications were made, and the final version of the form was prepared. At the end of this process, it was assessed that the students were competent enough to answer the questions. During the interviews, the researcher provided additional non-directive explanations as needed to ensure that the students fully understood the questions and could express their opinions comfortably. Some sample questions from the study, organized by category, are presented below and shown in Table 1.

Table 1 Sample Interview Questions Organized by Category

Category	Scope/description	Interview questions
General ınstructional practices and cognitive processes	This category covers students' opinions on mathematics instructional methods, the learning environment, and the contribution of instructional practices to cognitive skills (abstract thinking, problem solving, reasoning, etc.).	-To what extent do you think the topics in the mathematics curriculum are relevant to your interests and needs? Can you explain? -To what extent do the activities and achievements in the mathematics curriculum allow for different ways of thinking and problem-solving skills?
Subject-specific learning areas	This category presents student opinions on learning areas that constitute the content dimension, such as algebra, data, measurement, and geometry.	-Do you think the activities and topics you encounter in mathematics encourage you to learn, and why? -Do you think the geometry and algebra topics in the curriculum provide sufficient depth and variety? Can you explain?
Teaching materials and technology ıntegration	Students' opinions on the physical materials and digital tools they use in class were examined under this heading.	-Do the technology-supported content and tools in the curriculum facilitate your learning of mathematics? In what ways?
Assessment practices	This category includes students' opinions on project work, performance tasks, and process-oriented assessment methods used within the assessment dimension of the instructional practices.	-Do you find the assessment methods used in the instructional practices (projects, performance tasks, exams, etc.) sufficient and meaningful? Why?

Permissions were obtained from the relevant authorities to collect data, and 60-minute interviews were conducted with each student at SaAC on specific days and at specific times. The data obtained from these interviews were analyzed and presented in the study's findings section.

Data Analysis

Content analysis was employed to analyze the data collected in this study. When qualitative data is analyzed systematically, content analysis facilitates the identification of meaningful patterns within texts, grouping these patterns into themes and classifying them using relevant codes (Yıldırım & Şimşek, 2016). This process enables the researcher to examine the data not only superficially but also in depth, thereby facilitating the uncovering of implicit meanings and relationships (Cohen et al., 2007). As part of the research, the data obtained from participants' opinions were carefully analyzed; in order to identify the emerging themes, they were grouped and compared according to the units of meaning they contained. As part of this process, which is one of the fundamental functions of content analysis, expressions at the word, sentence, or paragraph level within the texts were carefully evaluated to identify the main themes and related sub-themes. The data were coded according to themes consistent with each research question, and these codes were systematically categorized and tabulated. Additionally, direct quotations were used to reinforce the findings and support the interpretations with participants' own words. This approach ensured that the data was presented objectively and that transparency was maintained throughout the evaluation process. The interpretation of the findings was consistent with the themes identified in the analysis, and recommendations were made accordingly.

Validity and Reliability

In qualitative research, validity and reliability are assessed through alternative conceptual frameworks. Lincoln et al. (1985) propose four corresponding criteria: dependability (internal reliability), confirmability (external reliability), credibility (internal validity), and transferability (external validity). The measures adopted in this study to address these criteria are outlined below:

Reliability Measures (Dependability and Confirmability): To enhance the dependability of data analysis and ensure confirmability within the study's reliability framework, multidimensional measures were implemented. Firstly, the data were collected voluntarily and analyzed in detail by breaking it down into paragraphs, sentences and words as part of the content analysis. Following the analysis, the research process as a whole was examined in detail and reported in clear language to ensure its confirmability. The 'Findings' section includes direct quotations to reflect the students' thought processes. To enhance the reliability of the qualitative data analysis, the coding was independently reviewed and cross-checked by a subject matter expert. Coding reliability was calculated based on the Agreement Ratio

([Agreement / (Agreement + Disagreement)) formula proposed by Miles and Huberman (1994). The comparisons revealed approximately 85% agreement between the researcher and the expert. This rate exceeds the acceptable level of reliability in qualitative research (70% and above), indicating dependability in the data analysis process. Thus, it was concluded that the codings largely overlapped and the interpretations were similar.

Validity Measures (Credibility and Transferability): Various measures were taken to enhance the credibility of the data analysis and ensure its transferability within the scope of the study's validity. First, to enhance the reliability of the study, the interviews were recorded both via audio and in writing. The validity of the data collection tool was strengthened by expert opinions and a pilot study. During the study, various criteria used in determining participants were adhered to for transferability, and the context of the research (such as the SaAC environment and student characteristics) was described in detail. This provided the necessary groundwork for readers and other researchers regarding the adaptability of the findings to similar contexts.

Findings and Discussions

In this section, the findings analyzed within the purpose of the study are categorized and examined by grouping them into main categories and subcategories. The findings are presented under six main categories: Reflections of general instructional activities on student experiences, experiences related to specific subject areas (Algebra, measurement, and data), opinions on geometry activities, student evaluations of materials use, mathematical proof and argumentation, and assessment methods. The codes obtained from the findings and the categories they belong to are shown in the tables below.

1. Student Opinions on General Instructional Practices in the SaAC Mathematics Program

The data obtained from the opinions of gifted students regarding ınstructional practices within the SaAC Mathematics Program are presented in Table 2.

Table 2 Student Opinions on Instructional Practices in the SaAC Mathematics Program

Category	Subcategory	Codes	Indicating students	f
Student opinions on general instructional practices	Positive situations	Interactive activities	Ö3, Ö5, Ö7, Ö9, Ö12, Ö15, Ö20, Ö29, Ö35,Ö37, Ö40	11
		Solving thought-provoking and difficult questions	Ö1, Ö4, Ö6, Ö7, Ö8, Ö9, Ö14, Ö15, Ö18, Ö20, Ö21, Ö25, Ö31, Ö39, Ö40	19
		Solving real-life problems	Ö8, Ö10, Ö11, Ö16, Ö24, Ö25, Ö29, Ö30 ,Ö32, Ö34, Ö35 , Ö36, Ö43, Ö45, Ö48	15
		Prove formulas and rules.	Ö8, Ö10, Ö11, Ö16, Ö19, Ö25, Ö32, Ö38, Ö45	9
		Learning theorems, formulas and proofs	Ö6, Ö8, Ö10, Ö12, Ö15, Ö20, Ö24, Ö29, Ö36	9
		Active participation in class	Ö1, Ö2, Ö9, Ö10, Ö15, Ö16, Ö20, Ö33, Ö34	9
		Geometry topics	Ö5, Ö8, Ö10, Ö11, Ö12, Ö20, Ö41, Ö44	8
		Learning with fun	Ö6, Ö8, Ö17, Ö27, Ö37, Ö38, Ö39, Ö40, Ö45	9
		Understanding the logic of the subject	Ö1, Ö3, Ö4, Ö16, Ö19, Ö20, Ö23, Ö25, Ö28, Ö29, Ö37,Ö41	12
	Negative situations	Memorization	Ö1, Ö7, Ö10, Ö13, Ö16, Ö18, Ö19, Ö29, Ö32, Ö37, Ö39	11
		Monotonous teaching	Ö2, Ö3, Ö4, Ö13, Ö14, Ö15, Ö16, Ö17, Ö20, Ö21, Ö22,Ö23, Ö24, Ö25, Ö26, Ö30,Ö33, Ö44	18
		Making proofs on paper	Ö6, Ö12, Ö15, Ö20, Ö28, Ö34, Ö35, Ö36, Ö42, Ö43	10
		Not being able to solve the question or problem	Ö16, Ö41, Ö7, Ö18, Ö27	5
		Easy questions	Ö3, Ö4, Ö5, Ö12, Ö15, Ö16, Ö18, Ö20	8
		Verbal explanation	Ö4, Ö5, Ö6, Ö12, Ö15, Ö20, Ö22, Ö25, Ö27, Ö30, Ö31, Ö35, Ö37, Ö40	14

Table 2 shows that the main category titled “Student Opinions on General Instructional Practices” was divided into two subcategories based on students' experiences in the SaAC environment: positive (satisfactory) and negative (unsatisfactory) situations. In this analysis, the students' statements were evaluated not only as general learning preferences but also as feedback on the extent to which SaAC mathematics instructional practices met these expectations.

An analysis of students’ views on general teaching practices revealed that, in mathematics classes at SaAC, the activities students most enjoyed included solving thought-provoking and difficult questions, solving real-life problems, and understanding the logic of

the subject. These findings suggest that several practices at SaAC correspond to the cognitive needs of students. When these codes were examined, 19 of the gifted students emphasized solving thought-provoking and difficult questions, 15 emphasized solving real-life problems, and 12 emphasized the importance of understanding the logic of the subject. For example, Ö16 stated, “I like solving difficult questions. I like it when the teacher explains interesting topics in detail. I like it when the formulas or rules used in class are proven or based on a starting point.” When analyzing Ö16's response, the statement “I enjoy solving difficult questions” corresponds to the code “solving thought-provoking and difficult questions,” while the statement “I like proving the formulas or rules used in class or basing them on a starting point” corresponds to the “understanding the logic of the subject” code. This indicates that the student is satisfied that the instructional process at SaAC responds to this need for “logical foundation.” Student Ö29 emphasized the effectiveness of the contextualization strategy applied by the teacher at SaAC, stating, “I like applying mathematics to real life. I like how the lesson progresses by setting examples and solving problems,” and indicated the “solving real-life problems” code.

On the other hand, among the situations that students criticized and found inadequate in SaAC applications, monotonous lesson delivery, rote learning, and verbal explanation of topics stood out. Among these codes, 18 students indicated they disliked monotonous lesson delivery, 11 students disliked rote learning and 14 students disliked the verbal explanation of topics. For example, student Ö1 said, “I hate memorization. It would be much better for us to learn proofs instead of memorizing definitions/formulas,” while Ö3 expressed their opinion by saying, “I don't like it; I prefer simple and memorable methods instead of definitions.” Student Ö20 said, "I don't like sitting and listening passively. I prefer to solve problems or participate in activities,“ and was categorized under the ”monotonous lecture style“ code. However, this situation suggests that students came to SaAC with expectations of ”in-depth learning," but some of the practices they encounter (e.g., passive listening) do not meet these expectations.

This finding is consistent with numerous studies in the literature. For example, Karabey and Yürümezoğlu (2015), in their studies with gifted students, emphasized that the practices used in mathematics lessons should be structured to concretize abstract concepts, relate them to daily life, and transition students from a passive to an active role. Similarly, Özdemir (2016) stated that students are dissatisfied with monotonous lessons, suggesting that instruction should be supported with current application examples and that the content should

be enriched and diversified. The necessity of integrating differentiation and enrichment strategies into the curriculum is strongly advocated in both national and international literature (Hertberg-Davis, 2009; Kanevsky, 2011; Karjanto & Acelajado, 2022). Therefore, the obtained data provides direct evidence regarding the effectiveness (or lack thereof in some areas) of the instructional design at SaAC, extending beyond the students' personal preferences.

2. Investigation of Specific Subject Area (Algebra, Measurement and Data) Activities in SaAC Mathematics Instructional Practices in Terms of Student Experiences

Data collected on activities related to specific subject areas within the scope of SaAC mathematics instructional practices were analyzed, and the findings are presented in Table 3.

Table 3 Student Opinions on Specific Subject Area (Algebra, Measurement and Data) Activities in the SaAC Mathematics Instructional Practices

Category	Subcategory	Codes	Indicating students	f
Student opinions on specific subject area (Algebra, measurement and data) activities in the saac mathematics instructional practices	Positive student opinions about instructional practices	Contribute to development in a specific subject area	Ö5, Ö6, Ö7, Ö9, Ö10, Ö11, Ö14, Ö18,Ö29	9
		Providing permanent learning	Ö2, Ö4, Ö6, Ö7, Ö8, Ö9, Ö12, Ö14, Ö17, Ö19, Ö22, Ö24, Ö30, Ö36, Ö41, Ö42, Ö43, Ö47, Ö48	19
		Learning through play and experimentation	Ö1, Ö4, Ö7, Ö11, Ö14, Ö19, Ö21,Ö23, Ö24, Ö34, Ö38, Ö40, Ö44	13
		Providing opportunity to discuss and express solution strategies	Ö7, Ö9, Ö15, Ö17, Ö25, Ö32, Ö45, Ö47,Ö48	9
		Group work and joint modelling in projects	Ö9, Ö10, Ö12, Ö13, Ö15, Ö20, Ö21, Ö23, Ö25, Ö27, Ö28, Ö30, Ö35, Ö40, Ö42, Ö47	16
		Active participation and hands-on problem solving	Ö3, Ö4, Ö8, Ö23, Ö25, Ö30, Ö39;Ö44, Ö45, Ö48, Ö49, Ö50	12
	Negative student opinions about instructional practices	Algebra questions or models are overly complex/abstract	Ö2, Ö5, Ö13, Ö15, Ö19, Ö22, Ö31, Ö35, Ö36, Ö39, Ö41, Ö45	12
		Spend a long time	Ö3, Ö7, Ö11, Ö13, Ö16, Ö17, Ö21, Ö23, Ö24, Ö25, Ö27, Ö31, Ö41, Ö44	14
		Boredom with monotonous exercises	Ö4, Ö8, Ö10, Ö13, Ö18, Ö20, Ö33, Ö43	8
		Repetitive activities	Ö1, Ö5, Ö7, Ö12, Ö34, Ö37, Ö42,Ö49, Ö50	9

As shown in Table 3, the main category titled "Student opinions on specific subject area (Algebra, measurement and data) activities in the SaAC mathematics instructional practices" was divided into two subcategories: "Positive student opinions about instructional practices " and "Negative student opinions about instructional practices ." When analyzing the students' opinions, it was found that, among the positive opinions related to the activities, 19 students stated that the activities helped them learn permanently, 16 students emphasized that the activities provided opportunities for group work and collaborative modelling in projects, and 13 students highlighted the importance of learning through games and experimental methods. In this context, student Ö22 explained that permanent learning was achieved because "Since the activities are better suited to our interests and abilities, what we learn becomes more permanent." Similarly, student Ö28 pointed out the motivational effect of group work and joint modelling with the remark, "The fact that the activities allow us to work on projects as a group with my friends and draw conclusions accordingly motivates me a lot." Student Ö40 emphasized the importance of learning through games and experiments by saying, "The activities are more related to daily life in terms of their content, they help me learn by playing games, and I can make better use of my time." When further analyzing student opinions, it was observed that the activities were generally complex and abstract and took a long time, which were prominent factors within the negative opinions. In this context, 14 students reported that the activities took a lot of time, while 12 students said that the topics were complex and abstract. Student Ö17 expressed this with the statement, "It is very complicated, I remember that I was dealing with a single question during the whole lesson." Student Ö45 shared their negative experience regarding the complexity and abstractness of the topics, saying, "I think the activities are complicated and abstract; they should be more creative activities instead of these."

Research findings indicate that active participation in practices within the SaAC mathematics program (Algebra, measurement and data) enhances long-term learning, collaboration, and motivation. However, criticisms regarding content complexity and duration highlight the need for a carefully structured instructional design that considers both student diversity and practical applicability. A review of the literature supports these findings. Özdemir (2016) stated that structuring learning materials appropriate for students' levels is effective in bringing out their potential. Likewise, Kirk et al. (2017) argue that learning processes should be designed to support students' original thinking, autonomy, and productivity. Ecker-Lyster and Niileksela (2017) emphasized that instructional practices

developed for gifted students still require improvement and that more scientific research is needed to address this gap. Various international studies demonstrate that differentiated and enriched instructional strategies contribute positively to the learning processes of this student group (Hertberg-Davis, 2009; Kanevsky, 2011; Tirri & Laine, 2017). In this context, designing mathematics activities that align not only with the curriculum but also with the students' readiness, interests, and learning styles will enhance the effectiveness and depth of the learning process.

3. Investigation of Geometry Subject Area Activities in SaAC Mathematics Instructional Practices in terms of Student Opinions

Data collected on geometry-related activities as part of the SaAC mathematics instructional practices were analyzed, and the findings are presented in Table 4.

Table 4 Student Opinions on Geometry Subject Area Activities in the SaAC Mathematics Instructional Practices

Category	Codes	Indicating students	f
Student opinions about the activities in geometry subjects in the lesson	Visualizing theorems and formulas	Ö4, Ö5, Ö7, Ö16, Ö21, Ö22, Ö24, Ö25, Ö36, Ö43, Ö45	11
	Interactive (Geogebra, Cabri Scratch, etc.) activities	Ö5, Ö6,Ö8, Ö9, Ö11,Ö14, Ö15, Ö16, Ö18, Ö19, Ö23, Ö24, Ö27, Ö28, Ö29, Ö33, Ö34, Ö35, Ö36,Ö43, Ö44	21
	Solving thought-provoking, difficult questions	Ö1, Ö14, Ö18, Ö23, Ö33, Ö34, Ö35, Ö40, Ö42	9
	Associating with daily life	Ö1,Ö17, Ö32, Ö38	4
	Prove formulas and rules.	Ö16, Ö22, Ö25, Ö44, Ö45	5
	To teach the lesson by concretizing with geometric materials	Ö6, Ö7, Ö14, Ö24, Ö26, Ö30, Ö31, Ö32, Ö43	9
	To know the history of geometry.	Ö1, Ö32, Ö38,	3
	Learning with fun	Ö6, Ö7, Ö8, Ö9, Ö11, Ö17, Ö18, Ö19, Ö20, Ö28, Ö33, Ö34, Ö35, Ö37, Ö39, Ö40, Ö41	17
	Complex and lengthy activities	Ö8, Ö9, Ö12, Ö23, Ö25, Ö33, Ö37	7
	Waste of time	Ö2, Ö18, Ö37, Ö44	4

As shown in Table 4, the main category titled "Student opinions regarding geometry subject area activities in the SaAC mathematics instructional practices" is presented. When analyzing the students' opinions, 21 students highlighted the importance of using interactive activities (GeoGebra, Cabri, Scratch, etc.), 17 students emphasized learning through enjoyment and 11 students focused on visualizing theorems and formulas. For example, the

interactive activities code was derived from the statement of Ö5, "The activities in the lesson are not enough; more technological and interactive alternatives (GeoGebra, etc.) can be used." Another student, Ö25, said, “I want to know how theorems and formulas are formed. At the same time, I want to see their proofs visually, which were categorized under visualizing theorems and formulas.” Ö20's comment, “We do not do activities in the lesson, we only solve questions. I would create games and competitions to keep the subject in mind. Thus, it would be more impressive,” was categorized under learning through enjoyment.

An analysis of students’ opinions on the geometry module of the SaAC mathematics instructional practices reveals that interactive applications such as GeoGebra and Cabri deepen conceptual understanding by visualizing formulas rather than memorizing them, thereby increasing motivation and lasting learning, unlike monotonous teaching methods. For example, studies conducted by Baki et al. (2012) have shown that dynamic geometry software significantly contributed to developing students' geometric thinking skills. Similarly, Fahlberg-Stojanovska and Stojanovski (2009) stated that such software enhances students' conceptual understanding and makes abstract geometric ideas more concrete. Topuz and Birgin (2020) mentioned that most students consider digital tools like GeoGebra as resources that make mathematics instruction more effective; this software enhances subject comprehension and supports learning by increasing the visual richness of the lesson. Additionally, Kutluca and Zengin's (2011) study emphasized that interactive geometry activities increase students' interest in the lesson, make learning more enjoyable and engaging, and help clarify difficult concepts through visualization and animation. Furthermore, Kağızmanlı and Tatar (2016) noted that GeoGebra-supported learning environments strengthen both peer interaction among students and collaboration with teachers, fostering lasting and meaningful learning. All of these findings demonstrate that integrating digital and interactive materials into geometry teaching positively influences not only conceptual understanding but also students' attitudes towards the course, motivation, and collaboration skills.

4. Examining the Use of Materials in SaAC Mathematics Instructional Practices in Terms of Student Opinions

The opinions of gifted students on the materials used in the mathematics instructional practices were presented in Table 5.

Table 5 Student Opinions Regarding the Use of Materials in the SaAC Mathematics Instructional Practices

Category	Subcategory	Codes	Indicating students	f
Student opinions regarding the use of materials in the saac mathematics ınstructional practices	Materials that students like in the mathematics lesson at SaAC	Smartboard applications	Ö2, Ö3, Ö11, Ö13, Ö25, Ö45	6
		Engineering programs	Ö7, Ö30	2
		Geogebra, Cabri	Ö10, Ö15, Ö22, Ö24, Ö25, Ö29, Ö32, Ö41, Ö42, Ö44	10
		Calculator	Ö10, Ö41,Ö44	3
		Scratch	Ö6, Ö20, Ö24, Ö27, Ö29, Ö36	6
		Online games	Ö15, Ö22, Ö27	3
		Video	Ö23, Ö33, Ö34	3
		Tangible materials	Ö8, Ö10, Ö13, Ö22, Ö35	5
	Reasons for students' use of materials in mathematics lessons at SaAC	Interactive (Geogebra, Cabri Scratch, etc.) activities	Ö1, Ö10, Ö19, Ö25, Ö28, Ö29, Ö37, Ö38, Ö39, Ö40, Ö43, Ö44, Ö45	13
		Practical use	Ö3,Ö10,Ö11,Ö14,Ö19,Ö27, Ö30, Ö35, Ö36, Ö40, Ö43	11
		Saving time	Ö2, Ö16	2
		Concretization	Ö6, Ö13, Ö17, Ö25, Ö43	5
		Increasing persistence	Ö3,Ö12,Ö24,Ö27,Ö36,Ö42,Ö43	7
		Understanding the logic of the subject	Ö3,Ö4,Ö5,Ö7,Ö15,Ö18,Ö23, Ö26,Ö32, Ö34, Ö43, Ö44,	12
		Providing three-dimensional thinking	Ö15,Ö16,Ö18,Ö20,Ö25,Ö30, Ö40	7
		Facilitating learning	Ö5,Ö6,Ö8,Ö9,Ö11,Ö12,Ö16, Ö18, Ö19, Ö21, Ö24, Ö31, Ö33, Ö40, Ö43, Ö44	16

As shown in Table 5, the main category of "students' opinions regarding the use of materials in the mathematics instructional practices at SaAC " was divided into two subcategories: "materials that students liked in the mathematics course at SaAC" and "reasons for students' use of materials in the mathematics course at SaAC". Interactive applications, such as Geogebra, Cabri, and smartboard applications, were the most popular materials among the students. In this context, 10 students highlighted the importance of interactive applications like Geogebra and Cabri, while 6 students emphasized the importance of

smartboard applications. For example, the code “interactive applications such as Geogebra and Cabri” was derived from Ö42's statement: “We did an activity with Geogebra at SaAC, I liked it very much, I was always active in the lesson.” The code “smartboard applications” was derived from Ö25's statement: “The applications we did on the smartboard at SaAC are very nice, at least we see something different.” When analysing the reasons for using materials in mathematics lessons, 13 students mentioned interactive activities (Geogebra, Cabri, Scratch, etc.), 11 students highlighted practical use, 12 students pointed out grasping the logic of the subject, and 16 students indicated that it facilitates learning. For example, Ö25 stated, "Geogebra should be taught to us. I have difficulty in solving geometry questions; at least 3D thinking should be given to us.” The code “interactive activities” was derived from Ö16's statement: "In SaAC, technology allowed me to see the content of many subjects. It saves time in terms of fully comprehending and facilitates learning.” The codes “practical use,” “comprehending the logic of the subject,” and “facilitating learning" were also derived from Ö16's statement.

These findings are consistent with the relevant literature. For example, Çetin and Özgeldi (2018) reported that dynamic and visually rich interactive applications increase students' motivation and attention, while also supporting conceptual understanding and active participation through activities such as drawing and exploration. Similarly, in their study on gifted students, Baltacı and Yıldız (2015) highlighted the importance of tools like GeoGebra and Cabri for effective instruction. Baki and Karakuş (2012) stated that engaging with diverse materials allows students to experience different learning environments and establish meaningful mathematical relationships, thereby improving their problem-solving skills, academic achievement, and scientific process skills. Topuz and Birgin (2020) offered a different perspective on dynamic geometry software, emphasizing the characteristics of the learning environments where such software is used. Collectively, these findings indicate that the use of materials is not merely a technological aid but a holistic element fostering students' cognitive, social, and affective development.

5. Investigation of Student Opinions on Mathematical Proof and Reasoning in the SaAC Mathematics

The opinions of gifted students regarding their experiences with mathematical proof and the reasoning process within the framework of the SaAC Mathematics Instructional Practices were are presented in Table 6.

Table 6 Student Opinions Regarding Mathematical Proof and Reasoning Process in the SaAC Mathematics Instructional Practices

Category	Subcategory	Codes	Indicating students	f
Student experiences of mathematical proof and reasoning process	The effect of activities conducted in SaAC on students' perceptions of mathematical proof and reasoning	Uncertain statements supported by mathematical means	Ö4, Ö6, Ö8, Ö9, Ö10, Ö11, Ö16, Ö26, Ö28, Ö32, Ö39, Ö41, Ö43	13
		Statements accepted as true	Ö5, Ö10, Ö15, Ö19, Ö20, Ö21, Ö22,Ö25, Ö30, Ö34,Ö35,Ö40, Ö44	13
		Dialectical thinking	Ö3, Ö43, Ö13	3
		Making sense of formulas	Ö1, Ö7, Ö14, Ö17, Ö18, Ö23, Ö24, Ö25, Ö29, Ö31, Ö32, Ö36, Ö37,Ö38, Ö39	15
		Changing the opposing opinion or introducing a new idea	Ö2, Ö23, Ö33, Ö36, Ö37, Ö43, Ö45	7
		Proof of scientificity and science	Ö27, Ö12	2
	Skills acquired by mathematical proof and reasoning activities in SaAC	Proving hypotheses	Ö8, Ö9, Ö12, Ö15, Ö16, Ö19, Ö20, Ö24, Ö25, Ö30, Ö31, Ö32, Ö34, Ö35, Ö36, Ö37	16
		Understanding complex formulas	Ö1, Ö2, Ö7, Ö9, Ö11, Ö13, Ö16, Ö20, Ö21, Ö23, Ö28, Ö30, Ö41	13
		Making sure the formula is correct	Ö3, Ö4, Ö5, Ö6, Ö20, Ö21, Ö22, Ö24, Ö28, Ö41, Ö43	11
		Refute opposing ideas	Ö10, Ö13, Ö16, Ö42, Ö45	5
		The ability to make mathematical knowledge permanent	Ö3, Ö8, Ö9, Ö10, Ö20, Ö23, Ö25, Ö26, Ö27, Ö28, Ö29, Ö36	12
	Student opinions on the need for mathematical proof and reasoning	Proof by induction	Ö2,Ö4,Ö7,Ö9, Ö20, Ö21, Ö25 Ö32,Ö39,Ö40,Ö41, Ö43, Ö45, Ö50	14
		Proof by contradiction	Ö3, Ö6, Ö11, Ö15, Ö25, Ö29, Ö30,Ö33,Ö35,Ö41,Ö44	11
		Direct proof	Ö1, Ö9, Ö11, Ö17, Ö24, Ö29, Ö33,Ö45	9
		Geometric shapes proof	Ö4, Ö9, Ö11, Ö16, Ö19, Ö23, Ö32, Ö34, Ö37, Ö41, Ö46, Ö47, Ö50	13

As shown in Table 6, the main category of "student opinions regarding the process of mathematical proof and reasoning in the SaAC mathematics instructional practices " was

divided into three subcategories: “The effect of the activities conducted in SaAC on students' perceptions of mathematical proof and reasoning,” “Skills acquired by mathematical proof and reasoning activities in SaAC” and “Student opinions on the need for mathematical proof and reasoning .” When examining the effect of the activities on students' perceptions of mathematical proof and reasoning, it was observed that codes such as uncertain statements supported by mathematical means, statements accepted as true, and the ability to make sense of formulas emerged. 13 students described their opinions as “uncertain statements supported by mathematical means,” 13 students as “statements accepted as true,” and 15 students as “making sense of formulas.” For example, Ö16 stated: "They are verifications that arise as a result of theorems being supported by various mathematical means, but are not definitive. Theorems are not accepted directly; they need to be proved. This is why proof and reasoning are performed. Thus, statements that we accept as true come about." In this statement, the code for tentative statements supported by mathematical means was derived from the phrase "these are verifications that arise as a result of supporting theorems by various mathematical means but are not definite." The code for statements accepted as true was taken from "theorems are not accepted directly, they need to be proved. Thus, statements that we accept as true come about." Additionally, Ö25 said, "It is to explain in detail why the formula or theorem is the way it is. It is done to understand better how to use the formula or theorem." This response was coded as "making sense of formulas.

When examining students' opinions regarding the skills developed through mathematical proof and reasoning activities in SaAC, specific codes were identified. These include proving hypotheses (16 students), understanding complex formulas (13 students), making mathematical knowledge permanent (12 students), and concretizing concepts (13 students). For example, Ö16 stated, "The accuracy of a hypothesis can only be ensured through proof. In addition, proof and reasoning are indispensable in understanding the depth of the subject and establishing its logic, thus concretizing it." The code for proving hypotheses was derived from the statement, 'the accuracy of the hypothesis is ensured only through proof and reasoning.” Ö20 said, "To understand a subject, formula or theory, it is necessary to make proof and reasoning. This facilitates understanding while learning and increases retention." The code for understanding complex formulas was taken from the sentence “Understanding a subject, formula or theory,” and the code for the ability to make mathematical knowledge permanent was derived from the statement, "It facilitates understanding while learning and increases retention."

When the student statements regarding the proof methods used in the SaAC mathematics were examined, it was seen that students mostly used proof by induction (14 people), proof by contradiction (11 people) and proof by geometric shapes (13 people). For example, when the statement of one of the students, Ö39, “When I make a proof, I usually first act on various examples and then generalize as a result, I think this is the inductive method, this is the easiest way to prove,” was examined, the code of proof by induction was obtained. Student Ö11 said, "I cannot prove the theorems directly, but I try them in opposite situations and go to the proof accordingly. This is how I do proof and reasoning more easily. Thus, proofs that we accept as true emerge." The code of proof by contradiction was obtained from this statement. Student Ö47:" I can prove why my formula or theorem is the way it is with geometric shapes. I can show how to use the formula or theorem very easily with software, and it will be very easy in the proof." The code of proof with geometric shapes was determined.

These findings indicate that students understand the concept of proof not only in theoretical contexts but also in practical situations. These findings align with the study by Öztürk et al. (2017) in which the students described proof using definitions such as “unverified statements supported by strong reasons,” “propositions accepted as true,” and “conclusions reached through study.” Conversely, Harel and Sowder (2007) considered proof from two perspectives. They stated that establishing a proof eliminates doubts, and persuading aims to eliminate others' doubts. This perspective directly matches the students' explanations regarding the goals of proving hypotheses, understanding formulas, and convincing others. Furthermore, the findings related to students' methods in the proof process align with Sriraman's (2005) study involving gifted students. By analyzing the strategies students preferred during proof-making, Sriraman sought to obtain detailed information about students’ cognitive characteristics and proof-making approaches. In this regard, it demonstrates that proof-making and reasoning activities in SaAC mathematics teaching practices support students’ logical thinking, argumentation skills, and the development of abstract knowledge.

6. Student Opinions on Assessment Methods in SaAC Mathematics Instructional Practices

Data on assessment methods used in mathematics instructional practices were analyzed and the findings are presented in Table 7.

Table 7: Student Opinions on Assessment Methods in SaAC Mathematics Instructional Practices

Category	Codes	Indicating students	f
Student opinions on assessment methods	Self-evaluation	Ö7, Ö9, Ö16, Ö22, Ö23, Ö24, Ö25, Ö33, Ö41,Ö42	10
	Peer evaluation	Ö4, Ö7, Ö9, Ö10, Ö13, Ö15, Ö17, Ö18, Ö20, Ö23, Ö25, Ö26, Ö29, Ö30, Ö32, Ö39, Ö42, Ö44	18
	Project evaluation	Ö1, Ö2, Ö4, Ö7, Ö9, Ö11, Ö13, Ö14, Ö18, Ö19, Ö20, Ö22, Ö23, Ö26, Ö27, Ö29, Ö30, Ö33, Ö34, Ö35, Ö40, Ö42, Ö43, Ö44,	24
	Performance evaluation	Ö1, Ö4, Ö5, Ö7, Ö9, Ö11 ,Ö13, Ö17, Ö20, Ö25, Ö26, Ö27, Ö32, Ö34, Ö35, Ö36, Ö38, Ö39, Ö42, Ö43, Ö50	21
	Evaluation with open-ended questions	Ö2, Ö3, Ö5, Ö7, Ö8, Ö10, Ö12, Ö13, Ö15, Ö16, Ö22, Ö25, Ö26, Ö27, Ö31, Ö32, Ö34, Ö35, Ö41, Ö44, Ö45	21
	Product file	Ö4, Ö7, Ö13, Ö23, Ö29, Ö30, Ö31, Ö32, Ö43, Ö45, Ö48	11
	Rubrics	Ö2, Ö4, Ö6, Ö7, Ö14, Ö15, Ö24, Ö25, Ö32, Ö38, Ö42	11
	Test solving	Ö5, Ö7, Ö9, Ö12, Ö15, Ö20, Ö35, Ö42	8
	Digital measurement tools (e.g., Kahoot, GeoGebra, Google Forms)	Ö5, Ö6, Ö8, Ö9, Ö10, Ö17, Ö18, Ö19, Ö22, Ö29, Ö32, Ö34, Ö35 ,Ö38, Ö39, Ö40, Ö41, Ö43, Ö45	19

In line with the data presented in Table 7, the opinions of students collected under the main category of "Student Opinions on Assessment Methods in SaAC Mathematics İnstructional Practices" were analyzed. According to the participants' statements, the main assessment practices were categorized into three key areas: project assessment, performance assessment, and open-ended questions. In this context, 24 students emphasized project-based assessment processes, 21 students referred to assessment practices based on performance tasks and 21 students mentioned assessment activities with open-ended questions at the end of the course. For example, a student identified as Ö13 highlighted the importance of project-based assessments, saying, "We are evaluated by presenting the projects we prepare in class." Similarly, the student coded Ö20 expressed both assessment and contribution to learning by saying, "After the lesson, our teacher gives performance assignments on the subject, we understand what we have learned better; sometimes we present these assignments in class." The focus on open-ended questions is reflected in the following statement by the student

coded Ö41: “After doing activities in math class, they ask us to solve questions that we find the answers to ourselves.”

The assessment methods used in the SaAC mathematics instructional practices are designed not only to measure students' academic achievement but also to support their learning progression. In particular, project-based and performance-based assessments help students improve their creative thinking, collaboration, problem-solving, and presentation skills. These findings are consistent with the “assessment to improve learning” approach advocated by Andrade (2019) and Brookhart (2020). It is clear that open-ended questions, which require students to actively participate in the solution process, help diversify thinking strategies and produce original answers. This highlights the need for assessment practices that include the process and provide students with feedback for their individual growth. Black and Wiliam (2018) and Piirto (2021) also emphasize that an effective assessment process should be flexible, student-centred, and multidimensional. Therefore, to enhance the program's success, both process- and product-oriented practices should be balanced in the assessment stages, offering students regular, structured, and developmental feedback.

Conclusions and Suggestions

This study examined SaAC mathematics instructional practices based on the opinions of gifted students who had direct experience with the program. In line with the findings, instructional practices are discussed below with respect to SaAC's general instructional approach, subject areas, use of technology, proof processes, and measurement and evaluation dimensions.

The study analyzed the opinions of gifted students regarding mathematics instructional practices at SaAC and found that students developed positive attitudes toward opportunities such as “solving thought-provoking and challenging questions,” “engaging with real-life problems,” and “understanding the logic of topics.” These findings are consistent with the principles advocated by VanTassel-Baska and Stambaugh (2005) and Renzulli's (2012) “Schoolwide Enrichment Model,” both of which emphasize that gifted students need more structured and discovery-based environments in which they can actively participate in lessons. For this reason, SaAC’s ability to stand out from traditional structured educational curricula by offering students an enriched learning environment is the institution’s greatest strength. In contrast, students expressed dissatisfaction and resistance to approaches characterized by rote memorization and teacher-centred verbal instruction, as well as repetitive instructional practices. These findings suggest that gifted students require more structured and discovery-

based learning environments that facilitate active engagement. Consequently, students fall into the position of "passive listeners" in lessons, and this situation contradicts the principle of "student-centeredness," which is the fundamental philosophy of SaAC. However, the fact that students sometimes complain about "monotonous lessons" indicates that there are some difficulties in moving from theory to practice in terms of the "differentiated instruction" strategies emphasized by Tomlinson (2014). At the same time, when compared to acceleration-focused international models, such as the "Study of Mathematically Precocious Youth (SMPY)" program in the USA (Lubinski & Benbow, 2006), it is understood that the enrichment strategies applied at SaAC theoretically meet students' need for deep learning, but there are some shortcomings in practice. Therefore, activities used in mathematics lessons should be designed to meet students' cognitive, affective, and social needs; learning environments based on discovery, inquiry, and active participation should be created.

Findings on subject areas and activity design reveal that the majority of students opinion applications such as "experimental and game-based activities" and "interactive digital tools" as tools that facilitate lasting learning, which supports the "interest-based learning applications" approach advocated by Gentry and Peters (2021). However, some students noted that these activities can sometimes be complex, abstract, and time-consuming. This highlights the need for a balance between the level of difficulty in activity design and students' readiness. This finding shows the risk that the "complexity" principle in Maker's (1982) curriculum differentiation model may be confused with 'incomprehensibility' or "unnecessary workload" in some applications during the implementation process. The literature indicates that the complexity and time management challenges observed in SaAC programs should be supported by "research units," which involve longer-term and interdisciplinary studies, as is the case in the International Baccalaureate (IB) programs.

The integration of technology and the use of dynamic software such as geoGebra in geometry instruction is one of the areas where high-achieving students score the highest. This finding is consistent with Leikin's (2021), which demonstrates how dynamic geometry software develops gifted students' visualization and spatial reasoning skills. The integration of technology within SaAC's learning environments represents a significant advantage that distinguishes the institution from traditional schools. However, students' demand for "more technology" reflects the need for a geometry instructional approach that extends beyond NCTM (2000) standards and incorporates contemporary STEM integration and coding-based approaches (e.g., geometry with Python).

Data collected regarding the process of mathematical proof and reasoning revealed that students found the instructional methods implemented in SaAC to be meaningful in terms of testing, understanding complex formulas, reinforcing knowledge, and concretizing concepts. This situation, in which students' opinions serve the process of persuasion and understanding rather than merely as a means of verification, is consistent with Harel and Sowder's (2007) "Proof Schemes" theory. The fact that students are able to use various strategies—such as induction, reduction to contradiction, and proof using geometric figures—demonstrates that the teaching practices at SaAC support the relationship between mathematical proof and creativity (Sriraman, 2005). This shows that students focus not only on producing findings in the proof process but also on developing their reasoning approaches. It is observed that SaAC offers students opportunities to actively engage with their mental processes, unlike formal education, which is based on memorizing formulas and overlooks the proof process (Oflaz et al., 2016). Therefore, activities aimed at developing mathematical proof and reasoning skills should be diversified, and open-ended tasks that allow students to prove using different strategies should be promoted.

Data on the assessment methods used in SaAC show that these methods not only determine students' academic levels but also actively support their learning processes. In particular, practices such as project-based assessment and performance tasks help develop higher-level skills such as analysis, synthesis, problem solving, collaboration, and creativity. Students' positive orientations toward project and performance-based assessment demonstrate that Black and Wiliam's (2018) "Assessment for Learning" approach is reflected in SaAC instructional practices. Project- and performance-based assessment methods support not only students' academic achievement but also their learning processes. In particular, these approaches encourage the development of higher-order skills—such as analysis, synthesis, problem-solving, and collaboration—which are emphasized in the ECHA (European Council for the Gifted) standards. However, it should also be considered that some students reduce certain assessment practices to merely presenting a product. This situation suggests that process-oriented assessment methods need to be communicated more clearly to students and that effective feedback systems need to be established.

In conclusion, this study demonstrates that SaAC mathematics instructional practices provide a learning environment that fosters deep learning among gifted students, effectively integrates technology, and supports higher-order thinking skills (proof, reasoning). However, some areas need improvement in terms of the complexity level of instructional practices, time

management and process-oriented assessment. The SaAC model serves as a vital complementary component in the educational development process of gifted students by filling gaps in formal education; however, in order for SaAC to achieve a world-class structure, its pedagogical practices need to be standardized and deepened. In this context, it is imperative to evaluate the SaAC mathematics program in Türkiye in light of successful international programs such as the International Baccalaureate (IB), Study of Mathematically Gifted Youth (SMPY), and European Council for High Ability Children (ECHA). Furthermore, practical in-service training programs on "curriculum compacting" and differentiation techniques should be organized for teachers; educational materials and content should be diversified accordingly. Finally, this research was conducted on a limited sample of 9th-grade students attending Halil İnalcık SaAC. Therefore, it is recommended that the findings be deepened through mixed-method, large-scale studies that include different age groups, regions, and disciplines, and that utilize both quantitative and qualitative approaches.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

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Research Involving Human Participants and/or Animals

The study involves human participants. This study is part of a doctoral thesis, and ethics committee permission (notified by the letter of Uludağ University Rectorate, Student Affairs Department dated 8.4.2022 and numbered 53989) was obtained from the university.

Üstün Yetenekli Öğrenciler için Matematik Öğretim Uygulamalarının Öğrenci Görüşlerine Dayalı Olarak İncelenmesi

Özet:

Bu çalışma, BİLSEM matematik öğretim uygulamaları kapsamında yürütülen süreçlere ilişkin üstün yetenekli öğrencilerin görüşlerini incelemeyi amaçlamaktadır. Nitel araştırma deseniyle yürütülen çalışma, 2022-2023 eğitim-öğretim yılında Bursa Nilüfer Halil İnalcık Bilim ve Sanat Merkezi'ne kayıtlı 50 dokuzuncu sınıf öğrencisi ile gerçekleştirilmiştir. Katılımcılar, amaçlı örnekleme yöntemlerinden biri olan ölçüt örnekleme yoluyla belirlenmiştir. Veriler yarı yapılandırılmış görüşme formu kullanılarak toplanmış ve içerik analizi yaklaşımıyla analiz edilmiştir. Bulgular; genel öğretim etkinlikleri, alana özgü etkinlikler (cebir, ölçme, veri), geometri etkinlikleri, materyal kullanımı, matematiksel ispat ve akıl yürütme süreçleri ile ölçme-değerlendirme yöntemlerine ilişkin görüşler olmak üzere altı ana kategori altında düzenlenmiştir. Araştırma sonuçları, öğrencilerin eleştirel düşünmeyi teşvik eden, gerçek yaşam bağlamlarını içeren, teknolojik ve görsel araçlardan yararlanan, işbirliğini destekleyen ve aktif katılıma olanak tanıyan öğrenme ortamlarını tercih ettiklerini ortaya koymuştur. Buna karşın, öğretmen merkezli, ezbere dayalı ve pasif öğretim süreçleri yetersiz olarak değerlendirilmiştir. Geometri ve ispatla ilgili konularda öğrenciler, dinamik yazılım araçlarının entegrasyonuna yönelik olumlu görüş bildirmişlerdir. Aynı zamanda, öğrenme çıktılarının değerlendirilmesinde proje ve performans temelli değerlendirmelerin daha etkili olduğu belirtilmiştir. Genel olarak bulgular, üstün yetenekli bireylerin özgün öğrenme ihtiyaçlarını karşılayan farklılaştırılmış, öğrenci merkezli ve esnek öğretim tasarımlarına duyulan ihtiyacı vurgulamaktadır.

Anahtar Kelimeler: Üstün yetenekli öğrenciler, matematik öğretim uygulamaları, öğrenci görüşleri, farklılaştırılmış öğretim.

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