Croatian Journal of Education
Vol.27; No.1/2025, pages: 153-184
Original research paper
Paper submitted: 1th May 2024
Paper accepted: 23th January 2025
https://doi.org/10.15516/cje.v27i1.5892

The Potential of Technology-Based Sound Engineering Course for Fostering Students' Musical Giftedness

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Abstract

The study aimed to quantitatively assess the effectiveness of a course that utilized music technologies for the development of musical giftedness in intellectually gifted students. Through the use of teacher surveys, 178 intellectually gifted students were selected to participate in the research. They were randomly assigned to an intervention group (N=89) and a control group (N=89). The intervention group underwent a ten-week course titled "I am a Sound Engineer," which involved familiarization with digital workstations, music creation and editing on computers, and auditory music evaluation skills. Researchers assessed the musical giftedness of the students before and after the intervention. According to the results of the study, the course impacted students' interest in music, perception of subtle musical tones, sensitivity to rhythm and various sounds, including background sounds. Practical recommendations for the education of musically gifted students are provided.

Key words: *creativity; intellectually gifted students; motivation; music technologies; musically gifted students*

Introduction

Every student has the right to equitable and inclusive education that meets their individual needs (Cook-Harvey et al., 2016). School curricula are often designed for the average student and do not take into account those who are falling behind or surpassing average students. A limited amount of literature focuses on teaching music to gifted students (Clarke, 2007). According to Renzulli and Reis (2000), 10-15% of students possess above-average abilities and high potential. One of the challenges of modern education is the timely identification of such students and the recognition of

their strengths. The students who are sometimes lazy, underachieve or misbehave are possibly gifted in a certain area (Abramo & Natale-Abramo, 2020). Teachers should be knowledgeable about the issues related to unlocking the potential of gifted students and the documented strategies for their realization (VanTassel-Baska & Brown, 2021).

One of the promising directions for supporting gifted students, particularly musically gifted, is the use of modern technologies, which can help identify and develop their creative potential in the digital age (Li & Sun, 2023). Music technologies are evolving in tandem with technological progress. Courses on digital music and the necessary hardware and software are essential for creating and editing music today. However, there is a gap in research regarding the adaptation of these technologies with the aim of meeting the unique needs of gifted students in music education. Studies on the effectiveness of interventions via musical technologies are therefore both relevant and timely. Such research forms the foundation for developing a music culture that aligns with the audience's preferences and needs while enhancing students' competence in contemporary skills (Hattie, 2023). It also provides students with opportunities to explore various approaches to creating and refining music (Randles & Burnard, 2023). The combination of gifted students' talents with their expertise in utilizing musical technologies can foster the emergence of new creative expressions. This approach not only develops their musical skills but also lays a strong foundation for the future evolution of the music industry (Clippinger, 2022).

Approaches to identifying gifted students

Representatives of any nationality or social class can exhibit giftedness (Peters et al., 2019). Individuals with high intellectual abilities, measured by an IQ test score exceeding 130, are commonly identified as gifted students (Ismail & Anuar, 2020). Anticipated outcomes include their cognitive development and personal achievements that surpass their peers (Ismail et al., 2020). The term "gifted student" (GS) was initially formulated by Lewis Terman in the early 20th century (Lubinski & Benbow, 2021). This term referred to the students who were well-adjusted and successful in school, with achievement and adaptability determined through IQ tests and observations (Lubinski & Benbow, 2021). While this interpretation still remains partially relevant today, the cognitive characteristics associated with such students have significantly expanded (Renzulli & Reis, 2000). The ability of gifted students to adapt well has been questioned, and attention to their emotional needs has been re-evaluated (Alelyani, 2020; Allotey et al., 2024; Aziz et al., 2021).

Primary strategies for identifying gifted students can be categorized as (1) assessing student performance outcomes or (2) evaluating student behaviour. Regarding the first, in the context of music arts, performance can serve as an outcome, and belonging to the gifted category is determined based on demonstrated executive mastery (Ismail et al., 2021). The later involves identifying students' gifted potential through systematic and thorough observation of their behaviour in various academic and non-academic situations within the classroom (Besnoy et al., 2016). To assess student behaviour,

teachers are presented with specific qualifying statements about potentially gifted behaviours, and they are required to evaluate individual students on a Likert-type scale. The Scales for Rating the Behavioral Characteristics of Superior Students (Renzulli, 2021), which have undergone revisions, is an example of such scales.

According to Renzulli (2021), who focused on the behaviour of individual students in specific circumstances, gifted students demonstrate above-average abilities, creative thinking and a strong commitment to their pursuits. Renzulli and Reis (2000) proposed the schoolwide enrichment model (SEM), which served as the basis for implementing programs for the gifted. These programs aim to foster partnerships between teachers and students, provide opportunities for testing new ideas, address longstanding educational challenges and cultivate a passion for learning (Renzulli & Reis, 2000).

Aziz et al. (2021) focused on studying the characteristics of gifted and talented students, the challenges they face and the need for counselling approaches to address their social and emotional issues. Aziz et al. (2021) emphasized that gifted students may experience isolation within their peer group, feelings of disillusionment and deliberate underachievement to conform to their surroundings. Moreover, they may even resort to turning their talents towards delinquency and criminal behaviour in the future. Abramo and Natale-Abramo (2020) drew attention to the fact that some gifted students may exhibit poor academic performance due to finding tasks mundane or engage in antisocial behaviour. Vulnerability, impulsiveness and lack of self-control may also be present (Abramo & Natale-Abramo, 2020). Neihart and Yeo (2018), Rice and Ray (2018) and Rinn (2018) have noted a higher propensity for psychological issues, social isolation, stress and perfectionism among gifted students compared to their typical peers.

Besnoy et al. (2016) and Goudelock (2021) employed the Traits, Aptitudes and Behaviours Scale (TABS) to identify gifted students with lower socioeconomic status or belonging to ethnic minorities. This scale was designed to capture atypical characteristics of giftedness, addressing cases where a teacher may overlook a student's giftedness and misinterpret the motives behind their behaviour (Besnoy et al., 2016). A distinguishing feature of TABS, compared to other behavioural scales, is that it provides teachers with descriptions of the ten behavioural traits associated with both typical and atypical characteristics of giftedness (Besnoy et al., 2016).

Therefore, socioemotional factors constitute a significant component of academic achievement, which can hinder gifted students from fully realizing their potential in learning. Students may be aware of their challenges but lack knowledge on how to modify their behaviour accordingly (Abramo & Natale-Abramo, 2020). It is crucial to incorporate approaches to teaching gifted students in educational programs.

Musically gifted students

Individuals who are deemed musically gifted are those who, for specific reasons, are considered "more musically" inclined than others (Ismail et al., 2021). This means

they possess a heightened musical sensitivity, exhibit superior musical memory and demonstrate enhanced abilities in rhythm and tonal perception. Moreover, individuals with musical talent exhibit heightened motivation towards learning, willingly disseminate their musical expertise, actively immerse themselves in music with passion and attentiveness and employ it as a tool for coping with emotional difficulties (Ismail et al., 2020).

According to Abramo and Natale-Abramo (2020), musically gifted students meet three criteria. Firstly, they possess an enhanced sensitivity to music, which means they are fascinated and captivated by sounds, are able to perceive expressive properties through audition, have an aptitude for perceiving sounds that others initially overlook, possess good relative pitch and exhibit profound knowledge of a specific music genre. Secondly, they possess a strong musical memory, i.e., they are able to reproduce musical excerpts from memory, retain melodies after hearing them a few times and transcribe or play music by ear. Lastly, they possess an innate understanding of the musical structure, that is, they are capable of composing songs or melodies, intuitively perceive rhythm and tonality and add their impressions to the performed compositions.

Contemporary trends in the education of musically gifted students

Modern students, including the gifted, are educated in the realm of highly developed technologies. The COVID-19 pandemic has catalyzed the direction of remote learning (Ng et al., 2022). The integration of digital tools into music education not only addresses issues related to remote learning (Liu & Shao, 2024) but also offers unique opportunities for the development of creativity and technical skills among gifted students (Biasutti et al., 2022; Rexhepi et al., 2024). According to Ismail et al. (2021), remote education pertains to structured educational endeavours conducted when there is a physical distance between students and teachers. Remote education can occur in three forms: synchronous (real-time interaction online), asynchronous (self-paced learning) or blended (a combination of both).

In response to recent developments, a considerable number of music schools have increased their offering of online classes, which has enabled students to participate in comprehensive remote instruction (Biasutti et al., 2022; Catalano et al., 2021). Additionally, students who attend in-person lessons also have access to various digital platforms, including websites, social networks and mobile applications, which facilitate and enrich their active engagement in the educational experience (Portela, 2020). However, there is a scarcity of contemporary research specifically focused on musically gifted students in music lessons, although such studies do exist and are discussed in this section.

Clippinger (2022) analyzed current trends in music education and their relevance to gifted education. Notably, Clippinger (2022) identified gaps in working with gifted students and proposed his vision of a music program tailored to gifted students in middle school. This program emphasized approaches to involve gifted students in whole-class activities. Clippinger (2022) emphasized the importance of fulfilling the

creative needs of gifted students and argued for the necessity of additional skills for their educators, such as sound engineering and recording.

Ismail et al. (2022) focused on investigating the effectiveness of online music education on student motivation among a sample of 13-year-old schoolchildren in Malaysia. According to their findings, one month of online learning significantly enhanced students' motivation, particularly in terms of expanded opportunities, usefulness, success and interest. No significant differences were observed between boys and girls or between urban and rural residents (Ismail et al., 2022). In another study, Ismail et al. (2021) examined the effectiveness of remote education for students in Malaysia, considering four parameters: learning facilities, assignments, motivation and computer skills. The study found that students positively perceived online learning due to its effectiveness in task completion, motivation enhancement and the cultivation of online learning abilities (Ismail et al., 2021).

Clarke (2007) aimed to assess the quality of existing music programs in academic schools and classrooms from the perspectives of both teachers and students. The research topics explored by Clarke (2007) encompassed students' special needs, the nature of their music learning experiences, levels of interaction in musical activities and their perception of the quality of musical encounters. The qualitative data collected by Clarke (2007) indicated that students with special needs dictated unique educational requirements and necessitated flexible educational programs. The surveyed teachers developed their music programs with an awareness of the educational needs of all their students, including musically gifted individuals. Additionally, Clarke (2007) reported on the influence of students' ethnic backgrounds on the quality of their music education. According to the surveyed secondary school teachers, music fosters positive attitudes and relationships among peers (Clarke, 2007).

The study conducted by Tolar (2016) took place in a small liberal arts college with a music school, specifically focusing on academically gifted students. Tolar (2016) aimed to explore the conflicts experienced by academically gifted students when choosing their majors. The findings of Tolar (2016) revealed that academically gifted music students experienced conflicts in major selection more frequently than students in other humanities disciplines. Sources of conflict for academically gifted music students included deliberation between different musical directions, self-demanding tendencies, skill-building aspects of music courses and time management considerations.

Even though the use of music technologies is one of the key directions in the development of music education, the context of utilizing these technologies by academically gifted students remains largely unexplored in the literature, except for Clippinger's work (2022). However, Clippinger's study (2022) lacked quantitative data to confirm the effectiveness of technology use by gifted students in enhancing their musical giftedness. To address this gap, this study aimed to quantitatively assess the efficacy of a technology-aided sound engineering course in fostering the musical giftedness of academically talented students. The following hypotheses were formulated:

- Participation in the course "I am a Sound Engineer" will have a positive impact on the overall giftedness of the participants (H1).
- Participation in the course "I am a Sound Engineer" will lead to significant enhancement of the musical giftedness of the participants (H2).

Methodology

Class teachers were invited to select academically gifted students aged 13-14 years in six comprehensive schools located in Yangzhou, Jiangsu Province, China. Before identifying the gifted students, the teachers underwent a two-day training on the characteristics of giftedness. They were provided with information about atypical characteristics of giftedness that could be perceived as negative behaviours. The teacher training took place at the end of August. In September and October, teachers closely observed their students to form an unbiased opinion about their potential giftedness. They also collected information on whether the students attended music classes according to the school curriculum at the time and if they had prior musical experience. This information was used by the researchers to group the participants. The teacher survey was conducted in the first week of November.

The selected students (n=178) were randomized into an intervention group (N=89) and a control group (N=89). Researchers implemented the "I Am a Sound Engineer" course for gifted students from the intervention group. Students from the control group did not participate in the course. It is important to note that other aspects of the curriculum, such as general lessons, music classes and other extracurricular activities were identical for both groups.

The idea for the course was borrowed from the work of Clippinger (2022). The course aimed to familiarize students with digital workstations, sound engineering, music creation and editing using equipment and software, as well as the ability to evaluate music from a sound engineering perspective. The researchers assessed students' musical giftedness before and after the start of the course. "I Am a Sound Engineer" course was conducted by the authors of this study, with class teachers assisting them in organizational matters.

The research participants were not informed about being selected as gifted to maintain the objectivity of results. This approach helped avoid potential influences on the students' self-esteem or their behaviour during the course. Teachers presented the course "I Am a Sound Engineer" as an additional educational opportunity for those interested in music and technology. Given that the selected students had previously demonstrated an interest in music, framing the course as an "additional opportunity" aligned with their interests and did not raise any additional suspicions or psychological pressure.

Participants

A total of 178 academically gifted students were identified by their respective class teachers from the pool of 13-14-year-old students in six schools in Yangzhou. Among these students, a random selection process was employed to assign 89 students to the

intervention group and 89 students to the control group. The sample was carefully chosen to ensure homogeneity in terms of race and nationality; all participants were Chinese. Specifically, the intervention group consisted of 46 girls and 43 boys, while the control group comprised 51 girls and 38 boys.

Procedure

The course "I Am a Sound Engineer" was designed to span ten weeks, during which student intervention groups were required to overcome four distinct barriers. Barrier 1 (Weeks 1-3) involved independent music creation on the computer. Students acquired an understanding of sound fundamentals and digital audio workstations before venturing into their music production. Barrier 2 (Weeks 4 and 5) entailed individual and small-group interpretation of music. Students further enhanced their understanding of digital audio workstations and delved into the visual and auditory dimensions of digital music. Barrier 3 (Weeks 6-8) focused on the study of various forms of sound engineering. Students familiarized themselves with diverse sound engineering equipment, learned to differentiate between different types of audio devices and experimented with sound engineering techniques, such as recording by one student and mixing by others using a control panel. Barrier 4 (Weeks 9 and 10) involved collaborative project creation using digital programming in small groups. Students developed skills in editing and composing music, which involved adding effects and evaluating each other's musical creations. The course "I Am a Sound Engineer" consisted of weekly sessions lasting two hours each. Consequently, total duration of the course amounted to 20 hours (two hours per week over a period of ten weeks).

Instruments

The Gifted Rating Scale (GRS-s), developed by Pfeiffer and Jarosewich (2007) for children aged 6 to 13, was employed in this study to identify gifted participants. This scale is based on a multidimensional model that encompasses six dimensions of giftedness: (1) Intellectual Ability, (2) Academic Ability, (3) Creativity, (4) Artistic Talent, (5) Leadership Ability and (6) Motivation (Table 1). Each dimension consists of 12 items, which results in a total of 72 items. Giftedness, as measured by the GRS-s in this study, will be referred to as overall giftedness. The Internal Consistency of the GRS-s (Cronbach's Alpha) was 0.82 in this study.

Each item in the questionnaire should be rated by the teacher on a scale from 1 to 9. Scores of 1-3 correspond to below-average level, 4-6 indicate average level of giftedness, and scores of 7-9 represent above-average level of giftedness (Pfeiffer & Jarosewich, 2007). Total scores are converted into T-scores adjusted to the student's age. The results indicate the probability of giftedness in percentages. T-scores up to 55 reflect a low probability of giftedness, scores from 55 to 59 indicate moderate probability, scores from 60 to 69 suggest high probability, and scores above 70 indicate a very high probability of giftedness.

Table 1
GRS-s (Pfeiffer & Jarosewich, 2007)

The GRS-s scale	What does it reflect?	What does it measure?
Intellectual Ability	The student's verbal and(or) nonverbal cognitive skills and abilities	The student's abstract reasoning, problem-solving, cognitive processing speed and memory
Academic Ability	The student's ability to master the school curriculum	The level of mastery of the curriculum in core school subjects
Creativity	The student's capacity for generating innovative ideas and(or) products	The student's utilization of imagination, experimentation with new ideas and problem-solving abilities
Artistic Talent	The potential of abilities in dance, music, painting, singing and drama	The student's performance in artistic tasks
Leadership Ability	The student's ability to motivate and organize the activities of others	Skills in conflict resolution, initiative and interpersonal communication
Motivation	The dynamic energy that drives achievement	The inclination, perseverance and ability to work independently without external incentives

Students who obtained T-scores higher than 60 (indicating a high and very high probability of giftedness), as rated by their teachers, were invited to participate in the study. The Scales for Rating the Behavioral Musical Characteristics of Superior Students (SRBMCSS) (Renzulli, 2021) were used, which is a revised version of the 1970s scale consisting of 14 individual scales. Each scale in Renzulli (2021) is assessed separately, and the scores are not summed. The evaluation is based on the presence or absence of each characteristic in the student. The first four scales (motivation, creativity, leadership and learning characteristics) are commonly used by most schools as a single set. The remaining ten scales (artistic characteristics, musical, dramatics, communication, planning, mathematics, reading, technology and science) are used when they are deemed relevant to the program's objectives for gifted students in specific subject areas (Renzulli, 2021). Therefore, the Scales for Rating the Behavioral Musical Characteristics of Superior Students (SRBMCSS) proposed by Renzulli (2021) were utilized for assessing students' musical giftedness before and after the intervention (Table 2). The Internal Consistency of the SRBMCSS (Cronbach's Alpha) was 0.88 in this study.

Table 2
SRBMCSS (Renzulli, 2021)

Scale item	Formulation
SRBMCSS-1	Shows a sustained interest in music
SRBMCSS-2	Perceives fine differences in musical tone
SRBMCSS-3	Easily remembers melodies and can produce them accurately
SRBMCSS-4	Eagerly participates in musical activities
SRBMCSS-5	Plays a musical instrument (or indicates a strong desire to)
SRBMCSS-6	Is sensitive to the rhythm of music; responds to changes in the tempo of music through body movements
SRBMCSS-7	Is aware of and can identify a variety of sounds heard at a given moment

The questionnaire consisted of 7 items. The assessment was conducted based on the presence or absence of each of the seven characteristics in the students, using a Likert-type scale ranging from 1– indicating absence, to 6 – indicating maximum presence.

Ethical issues

The intervention procedure was approved by the ethics committees of the participating schools. Participants were informed about the objectives and the process of the intervention beforehand. No personal information was kept. All participants obtained written consent from their parents (guardians) to participate in the study.

Results

General giftedness

Table 2 displays the scores of students' overall giftedness according to GRS-s before the intervention. As evident from Table 2, the intervention group and the control group did not differ significantly in terms of overall giftedness: Intervention Group – M = 7.25, SD = 0.77; Control Group – M = 7.21, SD = 0.82 (p = 0.093). Significant differences ($p < 0.05$) were observed between the groups only on specific scales of GRS-s: Intellectual Ability and Leadership Ability. For Intellectual Ability, the intervention group had M = 7.66 and SD = 0.81, while the control group had M = 7.15 and SD = 0.84 (p = 0.021*) (Table 3). Regarding Leadership Ability, the intervention group had M = 6.64 and SD = 0.71, whereas the control group had M = 6.93 and SD = 0.81 (p = 0.003*) (Table 3).

Table 3
Students' GRS-s scores before the intervention

	Intervention group		Control group		T	p
	M	SD	M	SD		
Intellectual Ability	7.66	0.81	7.15	0.84	2.31	0.021*
Academic Ability	7.31	0.75	7.42	0.92	1.56	0.064
Creativity	7.04	0.92	6.95	0.76	1.40	0.058
Artistic Talent	6.78	0.78	6.69	0.88	1.21	0.145
Leadership Ability	6.64	0.71	6.93	0.81	2.66	0.003*
Motivation	8.06	0.65	8.11	0.74	1.16	0.105

Note: * - $p < 0.05$.

Ten weeks after the pre-test, the results of the groups showed some differences (Table 4). Statistically significant differences emerged between the two groups in most of the GRS-s scales, with Intellectual Ability being joined by Creativity, Artistic Talent and Motivation.

Intellectual Ability: intervention group – M = 7.65, SD = 0.77; control group – M = 7.22, SD = 0.84 ($d_{Cohen} = 0.507$) (Table 4). Creativity: intervention group – M = 7.56, SD = 0.81; control group – M = 7.07, SD = 0.76 ($d_{Cohen} = 0.624$) (Table 4). Artistic Talent: intervention group – M = 7.03, SD = 0.75; control group – M = 6.65, SD = 0.88

(d_{Cohen} = 0.465). Motivation: intervention group – M = 8.21, SD = 0.68; control group – M = 8.54, SD = 0.74 (d_{Cohen} = 0.591).

However, the advantage of the intervention group in terms of Leadership Ability at the same time ceased to be statistically significant: M = 7.17, SD = 0.87; control group M 7.03, SD = 0.81 (d_{Cohen} 0.267) (Table 4).

Table 4

Students' GRS-s after the intervention

	Intervention group		Control group				d_{Cohen}
	M	SD	M	SD	t	p	
Intellectual Ability	7.65	0.77	7.22	0.84	1.24	0.001*	0.507
Academic Ability	7.24	0.78	7.38	0.92	3.56	0.052	-0.023
Creativity	7.56	0.81	7.07	0.76	1.13	0.015*	0.624
Artistic Talent	7.03	0.75	6.65	0.88	0.96	0.001*	0.465
Leadership Ability	7.17	0.87	7.03	0.81	2.15	0.112	0.267
Motivation	8.21	0.68	8.54	0.74	1.34	0.01*	0.591

Note: * $p < 0.05$.

The researchers anticipated changes in specific GRS-s scales for the intervention group but not for the control group. Upon comparing the results within the groups, the intervention group showed significant improvements in Creativity (p = 0.004), Artistic Talent (p = 0.02) and Leadership Ability (p = 0.001) (Table 5). The control group also demonstrated improvements in Leadership Ability (p = 0.00) and Motivation (p = 0.001) (Table 4). Particularly, the effect size for Motivation was larger than the average.

Table 5

Comparison of results within groups

	Intervention group				p	Control group				p
	Before		After			Before		After		
	M	SD	M	SD		M	SD	M	SD	
Intellectual Ability	7.66	0.81	7.65	0.77	0.889	7.15	0.84	7.22	0.84	0.116
Academic Ability	7.31	0.75	7.24	0.78	0.306	7.42	0.92	7.38	0.92	0.503
Creativity	7.04	0.92	7.56	0.81	0.004	6.95	0.76	7.07	0.76	0.212
Artistic Talent	6.78	0.78	7.03	0.75	0.020	6.69	0.88	6.65	0.88	0.308
Leadership Ability	6.64	0.70	7.17	0.87	0.001	6.93	0.81	7.03	0.81	0.000*
Motivation	8.06	0.65	8.21	0.68	0.215	8.11	0.74	8.54	0.74	0.001*

Note: * $p < 0.05$.

Overall, the obtained results do not indicate an increase in the total level of giftedness, but there was an improvement in individual parameters, including the control group. Researchers can explain this primarily by the heightened motivation of gifted children to perform better after not being included in the intervention. Another plausible

explanation is that teachers underwent a two-day training before meeting their students in the new academic year. Their teaching strategies may have been adjusted based on the new information they acquired during the training and implemented in practice.

Musical giftedness

No significant differences were observed between the groups on any of the questionnaire items before the experiment (Table 6).

Table 6

Mean scores, standard deviations and T-tests for the differences between the intervention and control group before the experiment

	Intervention group		Control group		
	M_{Time1}	$SD_{Time\ 1}$	M_{Time1}	SD_{Time1}	p
SRBMCSS-1	4.44	0.65	4.36	0.79	0.561
SRBMCSS-2	3.89	0.78	4.11	0.56	0.110
SRBMCSS-3	4.26	0.56	4.2	0.61	0.876
SRBMCSS-4	3.61	0.6	3.24	0.64	0.095
SRBMCSS-5	2.57	0.59	2.39	0.72	0.158
SRBMCSS-6	4.69	0.77	4.51	0.7	0.207
SRBMCSS-7	3.50	0.64	3.36	0.75	0.542

As expected, no significant changes ($p < 0.05$) in terms of musical giftedness were observed for the control group over 10 weeks (Table 7).

Table 7

Mean scores and standard deviations of the control group after the experiment and the results of T-tests examining the differences between Time2 and Time1

	Control group (n = 89)			
	$M_{Time\ 2}$	$SD_{Time\ 2}$	M_{Time2} - M_{Time1}	p
SRBMCSS-1	4.48	0.77	0.12	0.133
SRBMCSS-2	4.37	0.64	0.26	0.419
SRBMCSS-3	4.06	0.71	-0.14	0.276
SRBMCSS-4	3.13	0.83	-0.11	0.255
SRBMCSS-5	2.42	0.75	0.03	0.780
SRBMCSS-6	4.47	0.79	-0.04	0.742
SRBMCSS-7	3.49	0.82	0.13	0.242

Note: * $p < 0.05$.

For the intervention group, the greatest effect was observed in four items: SRBMCSS: SRBMCSS-1, SRBMCSS-2, SRBMCSS-6, SRBMCSS-7 and SRBMCSS-1: $M_{Time\ 1}$ = 4.44, $SD_{Time\ 1}$ = 0.65 (Table 6); $M_{Time\ 2}$ = 5.67, $SD_{Time\ 2}$ = 0.71 (p = 0.003, d_{Cohen} = 0.807) (Table 8). SRBMCSS-2: $M_{Time\ 1}$ = 3.89, $SD_{Time\ 1}$ = 0.78 (Table 6); $M_{Time\ 2}$ = 4.85, $SD_{Time\ 2}$ = 0.83 (p = 0.014, d_{Cohen} = 0.731) (Table 8). SRBMCSS-6: $M_{Time\ 1}$ = 4.47, $SD_{Time\ 1}$ = 0.79 (Table 6); $M_{Time\ 2}$ = 5.83, $SD_{Time\ 2}$ = 0.72 (p = 0.001, d_{Cohen} = 0.894) (Table 8). SRBMCSS-7:

$M_{Time\ 1}$ = 3.50, $SD_{Time\ 1}$ = 0.64 (Table 6); $M_{Time\ 2}$ = 4.38, $SD_{Time\ 2}$ = 0.68 (p = 0.026, d_{Cohen} = 0.658) (Table 8).

Table 8

Mean scores and standard deviations for the intervention group after the experiment and T-tests for the differences between Time2 and Time 1

	Intervention group (n = 89)				
	M	SD	M_{Time2} - M_{Time1}	p	d_{Cohen}
SRBMCSS-1	5.67	0.71	1.23	0.003*	0.807
SRBMCSS-2	4.85	0.83	0.96	0.014*	0.731
SRBMCSS-3	4.58	0.66	0.32	0.086	-0.025
SRBMCSS-4	3.55	0.76	-0.06	0.071	0.104
SRBMCSS-5	2.76	0.79	0.19	0.097	-1.192
SRBMCSS-6	5.83	0.72	1.14	0.001*	0.894
SRBMCSS-7	4.38	0.68	0.88	0.026*	0.658

Note: * $p < 0.05$.

It is observed that the course "I Am a Sound Engineer" positively influenced, i.e., heightened interest in music, the perception of differences in musical tone and sensitivity to rhythm and sounds.

Discussion

The philosophy of quality music education is based on practical experience (Wiggins, 2001). Students are motivated to engage in activities such as playing musical instruments, creating music and performing in front of an audience (Clarke, 2007). For instance, when Clarke (2007) asked students to suggest ways to improve music programs, they identified practical activities related to instruments and composition as a means to enhance their enjoyment of learning. In Clarke's (2007) study, teachers shared their students' opinions on creating quality music programs. While not all students may expand their musical abilities, interventions (Ismail et al., 2022; Nsairat et al., 2022) like those described in this study can positively influence other aspects of giftedness, as shown in Table 4.

Now that the intervention has been implemented and quantitative data has been collected, it is time to discuss the findings. The first hypothesis of the study explored the potential for enhancing overall giftedness through a technology-based course titled "I Am a Sound Engineer" (H1). Sternberg (2005) identified music education as a means to foster intellectual development by setting meaningful goals, coordinating them and progressing toward their attainment. In the context of this research, the concept of barriers was employed. The aim for the participants was to overcome barriers (the first barrier entailed music creation via the computer, the second barrier was music interpretation, the third barrier encompassed the study of sound engineering forms, and the fourth barrier entailed the creation of a personal project using digital programming). By systematically overcoming the first three barriers, students approached the coveted fourth barrier.

According to the study findings, the intervention group demonstrated improvements in Intellectual Ability, Creativity and Artistic Talent over ten weeks. This is not surprising, as interpersonal interaction has become a crucial element in the creation of musical products (Schulkind, 2015). The collaborative nature of music composition involves nonverbal communication, a characteristic also present in drama, dance and visual arts (Schulkind, 2015). According to Sternberg (2005), three components are essential for the creation of a musical product: (1) the analytical component, which organizes and controls the elements necessary for the development and completion of the musical product; (2) the creative component, which combines automatism with nonverbal communication; and (3) the practical component, which involves the adaptive ability of students to collaborate. All three components were present in the intervention described in this article. Therefore, it is not surprising that the data obtained in the study indicate growth in Intellectual Ability, Creativity and Artistic Talent among the participants.

On the other hand, the control group exhibited improvements in motivation. The authors of the study consider it a positive outcome of non-inclusion. Gifted children who were not invited to participate in the intervention became more oriented towards achievements in the realm of education. Clinkenbeard (2012) explored motivation theories among gifted students and proposed the TARGET model (task, authority, recognition, grouping, evaluation and time), which suggests that students demonstrate either appropriate motivational patterns and goals or unattainable goals and inappropriate patterns (Clinkenbeard, 2012). The essence of the TARGET model lies in the qualitative dimension of motivation, with the aim of setting goals correctly and channelling the participants' efforts in the right direction (Clinkenbeard, 2012). The observed increase in motivation within the control group resulting from their non-inclusion can be regarded as an unorthodox pattern; however, when accompanied by appropriate prioritization, it has the potential to yield favourable outcomes.

The second hypothesis of the study pertained to the potential expansion of musical giftedness through the utilization of the music technology course "I Am a Sound Engineer" (H2). The results of the T-tests indicate the presence of an effect in developing an interest in music, perceiving differences in musical tone and sensing rhythm and sound. Previous literature has noted that individuals with musical training tend to view music as a learning tool and are skilled critical listeners who use their musical abilities for analysis and enhanced auditory perception (Schulkind, 2015), which aligns with the findings of this study. Keenan et al. (2001) and Schlaug et al. (2005) have documented that increased exposure to music is associated with physiological alterations in the human body. Schlaug et al. (2005) asserted that professional musicians exhibit higher concentrations of grey matter in the perirolandic region compared to non-musicians. Keenan et al. (2001) compared the brains of musicians with and without absolute pitch and concluded that only children who began engaging in music before the age of seven are capable of developing the absolute pitch.

Furthermore, Schulkind (2015) has reported that each time individuals engage in music listening, it stimulates their imagination and supports creativity while enhancing their knowledge, understanding and memory. In the context of this study, participants' musical knowledge and understanding improved, but no significant effect on melody retention was observed. This can be attributed to the specific nature of the intervention. The sound engineering course did not significantly influence musical memory.

Limitations and prospects for future research

Each student is unique regarding their abilities, life experiences and perspectives that can influence the realization of their potential. Hence, the challenge of formulating a precise set of musical qualities for the accurate assessment of students' potential musical giftedness is comprehensible, as acknowledged by Clippinger (2022). Due to this individuality, the authors consider any existing instrument, including the one used in this study, insufficiently flexible for evaluating musical giftedness. Nevertheless, identifying and evaluating various forms of giftedness, including musical, remains crucial, as demonstrated by the researchers using the SRBMCSS method (Renzulli, 2021). The development of a more comprehensive measure for assessing musical giftedness cannot be ruled out in future research.

One limitation of the study was the lack of differentiation between musical giftedness and giftedness in other key learning domains during participant selection. Although the researchers tried to maintain a balance between students attending music lessons at the time and those with prior music experience, one group might have had a higher proportion of musically gifted students, which potentially influenced the results.

Another limitation of this study was the sample size. Due to the technical requirements of implementing the planned course, the number of participants could not exceed 100. However, musically gifted students require diverse educational approaches that foster their engagement and yield high results. This study addressed two such approaches. The first approach involved providing training to class teachers regarding the characteristics of giftedness before the start of the academic year. Teachers were acquainted with the phenomenon of giftedness and the behavioural peculiarities of gifted students, including atypical behaviours. This approach laid the foundation for their further education with consideration for giftedness. The second approach involved implementing the "I Am a Sound Engineer" course. Through practical activities, interaction among themselves, interaction with researchers and exposure to technological tools, students acquired skills in sound engineering. This course proved effective in developing musical giftedness. However, future research should explore additional aspects of musical activity, such as improvisation, creativity and student engagement, which were not addressed in this study. Expanding these areas will provide a more comprehensive understanding of how different educational approaches can foster musical giftedness.

Conclusion

The participant schools received several benefits from the study. Firstly, the class teachers received additional training on the identification of gifted students. This training aimed to enhance the schools' capacity to recognize giftedness among students. Furthermore, the collection of data on gifted students in each school can serve as a valuable resource for expanding educational opportunities and cultivating exceptional accomplishments among these students. As a result, it can lead to an overall improvement in the educational level and prestige of the schools. Other schools, including school administrators and educational officials, may consider the relevance of adopting similar practices to increase attention toward educational approaches for gifted students. This would facilitate the transfer of valuable experiences and promote the implementation of effective educational strategies for gifted students.

This study suggests that teachers should not only focus on identifying giftedness but also on creating an environment that supports the development of gifted students. The effectiveness of the music technology course has been confirmed, offering an engaging and enriching experience for both teachers and students. However, not all schools have the resources to implement such courses. Nevertheless, all schools can increase teachers' awareness of the characteristics and needs of gifted students, their evaluation processes and instructional strategies tailored to their abilities. Schools can foster creativity by supporting student projects, offering encouragement and exploring ways to bring these initiatives to life. Opportunities for nurturing talent, especially in music, can be provided through competitions, performances, private lessons, courses on composition or sound engineering and internships abroad. Additionally, musical summer camps, creative gatherings and online platforms for information exchange can serve as venues for talent development. Ultimately, the key is to find an individualized approach for each gifted student and unlock their full potential.

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Potencijal nastave zvučnoga inženjeringa zasnovane na tehnologiji za razvijanje glazbene darovitosti

Sažetak

Cilj ovoga istraživanja bio je kvantitativno procijeniti učinkovitost nastave potpomognute glazbenom tehnologijom u razvoju glazbene darovitosti intelektualno darovitih učenika. Na osnovi intervjua s učiteljima odabrano je 178 intelektualno nadarenih učenika za sudjelovanje u istraživanju. Učenici su nasumično podijeljeni u eksperimentalnu (N = 89) i kontrolnu skupinu (N = 89). Učenici iz eksperimentalne skupine pohađali su tečaj „Ja sam tonski snimatelj" u trajanju od deset tjedana, koja je uključivala upoznavanje s radnim postajama za digitalni zvuk, stvaranje glazbe, montažu na računalima te vještine slušne evaluacije glazbe. Istraživači su procjenjivali glazbenu darovitost učenika prije i poslije nastave, tj. eksperimenta. Rezultati istraživanja pokazuju pozitivan utjecaj nastave na učeničke glazbene interese, percepciju suptilnih glazbenih tonova, osjetljivost za ritam i raznolike zvukove, uključujući pozadinske tonove. U ovome radu daju se i praktične preporuke za obrazovanje glazbeno darovitih učenika.

Ključne riječi: *glazbene tehnologije; glazbeno nadareni učenici; intelektualno nadareni učenici; kreativnost; motivacija*

Uvod

Svaki učenik ima pravo na pravedno i inkluzivno obrazovanje koje zadovoljava njegove individualne potrebe (Cook-Harvey i sur., 2016). Školski kurikuli često su dizajnirani za prosječne učenike i ne uzimaju u obzir one koji zaostaju ili nadilaze prosjek. Ograničeni broj znanstvenih i stručnih radova fokusira se na poučavanje glazbe nadarenim učenicima (Clarke, 2007). Prema Renzulliju i Reis (2000), 10 – 15 % učenika imaju iznadprosječne sposobnosti i visoki potencijal. Jedan od izazova modernoga obrazovanja jest pravovremena identifikacija darovitih učenika i prepoznavanje njihovih jakih strana. Učenici koji su ponekad lijeni, postižu slabiji školski uspjeh ili pokazuju probleme u ponašanju mogu biti nadareni za određeno

područje (Abramo i Natale-Abramo, 2020). Učitelji trebaju poznavati pitanja koja se odnose na oslobađanje potencijala darovitih učenika i dokumentirane strategije za njihovu realizaciju (VanTassel-Baska i Brown, 2021).

Jedan od obećavajućih smjerova pružanja podrške darovitim učenicima jest upotreba modernih tehnologija koje mogu pomoći prilikom identifikacije i razvoja njihovih kreativnih potencijala u digitalnom dobu (Li i Sun, 2023). Glazbene tehnologije razvijaju se u tandemu s tehnološkim napretkom. U današnje vrijeme predmeti u sklopu kojih se poučava o digitalnoj glazbi i neophodnom sklopovlju i programskoj podršci za stvaranje i uređivanje glazbe postaju nužnost. Unatoč tome istraživanja o temi usvajanja tih tehnologija s ciljem zadovoljavanja jedinstvenih potreba darovitih učenika u glazbenom obrazovanju su nedostatna. Studije o učinkovitosti intervencija putem glazbenih tehnologija stoga su relevantne i pravovremene. Takvo istraživanje predstavlja temelj razvoja glazbene kulture koji zadovoljava potrebe publike dok u isto vrijeme razvija suvremene kompetencije učenika (Hattie, 2023). Također učenicima pruža prilike za istraživanje različitih pristupa stvaranju i rafiniranju glazbe (Randles i Burnard, 2023). Kombinacija talenata nadarenih učenika i njihove kompetencije za korištenje glazbenih tehnologija može potaknuti pojavu novih kreativnih izričaja. Ovakav pristup ne razvija samo glazbene vještine, nego postavlja i stabilnu podlogu za budući razvoj glazbene industrije (Clippinger, 2022).

Pristupi identifikaciji nadarenih učenika

Predstavnici bilo koje nacionalnosti ili društvenoga sloja mogu pokazivati darovitost (Peters i sur., 2019). Pojedinci s visoko razvijenim intelektualnim sposobnostima, prema rezultatu na testu inteligencije višem od 130, obično su prepoznati kao nadareni (Ismail i Anuar, 2020). Predviđeni ishodi obrazovanja takvih učenika uključuju njihov kognitivni razvoj i osobna postignuća koja nadilaze ona njihovih vršnjaka (Ismail i sur., 2020). Termin „nadareni učenik" (NU) prvi je skovao Lewis Terman na početku 20. stoljeća (Lubinski i Benbow, 2021). Ovaj termin odnosio se na dobro prilagođene učenike u školi, čija su se postignuća i prilagodljivost određivala testovima inteligencije i promatranjem (Lubinski i Benbow, 2021). Dok ovo tumačenje i danas ostaje djelomično relevantno, kognitivne osobine povezane s takvim učenicima značajno su se proširile (Renzulli i Reis, 2000). Sposobnost uspješne prilagodbe nadarenih učenika dovedena je u pitanje, a usmjerenost na njihove emocionalne potrebe ponovo se evaluira (Alelyani, 2020; Allotey i sur., 2024; Aziz i sur., 2021).

Osnovne strategije identifikacije nadarenih učenika mogu se kategorizirati kao (1) procjena ishoda aktivnosti učenika ili (2) evaluacija ponašanja učenika. Razmatrajući prvo u kontekstu glazbenih umjetnosti, aktivnosti mogu služiti kao ishod, a pripadanje kategoriji darovitih učenika određuje se na osnovi pokazane vještine izvedbe (Ismail i sur., 2021). Potonja kategorija obuhvaća prepoznavanje potencijala darovitih učenika kroz sistematično i temeljito promatranje njihovoga ponašanja u raznim akademskim i neakademskim situacijama u učioničkom okružju (Besnoy i sur., 2016). Za procjenu

ponašanja učenika učiteljima su dane specifične kvalifikacijske tvrdnje o potencijalnim oblicima ponašanja darovitih učenika i od njih se tražilo da ocijene učenike na Likertovoj skali. Revidirane Skale za mjerenje karakteristika ponašanja nadarenih učenika (Renzulli, 2021) primjer su takvih skala.

Prema Renzulliju (2021), koji se fokusirao na ponašanje učenika u specifičnim okolnostima, nadareni učenici pokazuju iznadprosječne sposobnosti, kreativno mišljenje i izraženu predanost vlastitim ciljevima. Renzulli i Reis (2000) predložili su školski model razvoja (SEM) koji je služio kao osnova za primjenu programa za nadarene učenike. Ti programi nastoje produbiti partnerstvo između učitelja i učenika, osigurati prilike za testiranje novih ideja, riješiti stare obrazovne izazove i kultivirati strast za učenjem (Renzulli i Reis, 2000).

Aziz i suradnici (2021) proučavali su osobine nadarenih i talentiranih učenika, izazove s kojima se suočavaju i potrebe za savjetodavnim pristupima koji bi pomogli u rješavanju njihovih društvenih i emocionalnih problema. Aziz i suradnici (2021) naglasili su da daroviti učenici mogu doživljavati izolaciju u skupini vršnjaka, osjećati se razočarano i namjerno postizati slabiji uspjeh kako bi se uklopili u okružje. Štoviše, čak je moguće da u budućnosti svoje talente iskoriste u delinkventnom ili kriminalnom miljeu. Abramo i Natale-Abramo (2020) skrenuli su pozornost na činjenicu da neki daroviti učenici mogu imati loš akademski uspjeh jer su im školski zadatci preobični ili pokazuju oblike antisocijalnoga ponašanja. Ranjivost, impulzivnost i manjak samokontrole također mogu biti prisutni (Abramo i Natale-Abramo, 2020). Neihart i Yeo (2018), Rice i Ray (2018) i Rinn (2018) primijetili su veću sklonost psihološkim problemima, socijalnoj izolaciji, stresu i perfekcionizmu među darovitim učenicima nego njihovim prosječnim vršnjacima.

Besnoy i suradnici (2016) i Goudelock (2021) primijenili su Skalu osobina, stavova i ponašanja (engl. akronim TABS) kako bi identificirali nadarene učenike slabijega socioekonomskog statusa ili pripadnike etničkih manjina. Ova skala dizajnirana je kako bi obuhvatila atipične karakteristike nadarenosti, uključujući slučajeve kada učitelj ne primijeti darovitost učenika i krivo protumači motive njihova ponašanja (Besnoy i sur., 2016). Za razliku od ostalih skala, ova skala sadrži opise svih deset ponašajnih osobina koji se povezuju s objema tipičnim i atipičnim karakteristikama darovitosti (Besnoy i sur., 2016).

Socioemocionalni faktori stoga čine značajnu komponentu akademskoga uspjeha, što može sprečavati darovite učenike u punom ostvarenju vlastitih potencijala za učenje. Učenici mogu biti svjesni zahtjeva, ali možda nemaju znanja o tome kako u skladu s tim promijeniti svoje ponašanje (Abramo i Natale-Abramo, 2020). Važno je uključiti pristupe poučavanju darovitih učenika u obrazovne programe.

Glazbeno nadarenih učenici

Glazbeno nadarenim učenicima smatraju se oni koji zbog specifičnih razloga pokazuju veću sklonost prema glazbi od ostalih (Ismail i sur., 2021). To znači da

posjeduju povišenu glazbenu osjetljivost, superiorno glazbeno pamćenje i razvijene sposobnosti percepcije zvuka i ritma. Štoviše, glazbeno talentirani pojedinci imaju povišenu motivaciju za učenje, voljni su dijeliti svoju glazbenu stručnost, aktivno su uključeni u glazbu, pri čemu pokazuju strast i pažnju te glazbu koriste kao alat za prevladavanje emocionalnih teškoća (Ismail i sur., 2020).

Prema Abramou i Natale-Abramo (2020), glazbeno nadareni učenici zadovoljavaju tri kriterija. Prvo, posjeduju razvijeniji senzibilitet za glazbu, što znači da su fascinirani i opčinjeni zvukovima, sposobni percipirati ekspresivna svojstva glazbe prilikom slušanja, sposobni su primijetiti zvukove koje ostali inicijalno previde, odlikuju se dobrom relativnom visinom tona i pokazuju opsežno znanje o specifičnim glazbenim žanrovima. Drugo, imaju razvijeno glazbeno pamćenje, tj. sposobni su reproducirati glazbene isječke iz pamćenja, mogu zapamtiti melodije nakon što ih čuju nekoliko puta te napisati i izvoditi glazbu po sluhu. Naposljetku, posjeduju urođeno razumijevanje glazbene strukture, tj. sposobni su komponirati pjesme, intuitivno percipirati ritam i tonalitet te dodavati svoje impresije izvođenim kompozicijama.

Suvremeni trendovi u obrazovanju glazbeno nadarenih učenika

Moderni učenici, pa tako i daroviti, obrazuju se u svijetu visoko razvijenih tehnologija. Pandemija COVID-19 inducirala je pravac učenja na daljinu (Ng i sur., 2022). Integracija digitalnih alata u glazbenom obrazovanju obuhvaća ne samo pitanja učenja na daljinu (Liu i Shao, 2024) već i jedinstvene prilike za razvoj kreativnosti i tehničkih vještina nadarenih učenika (Biasutti i sur., 2022; Rexhepi i sur., 2024). Prema Isamilu i suradnicima (2021), obrazovanje na daljinu obuhvaća strukturirano obrazovano djelovanje u okolnostima fizičke razdaljine između učenika i učitelja. Obrazovanje na daljinu ima tri oblika: sinkrono (*online* interakcija u realnom vremenu), asinkrono (učenje prema individualnom ritmu) ili miješano (kombinacija obaju oblika).

Kao odgovor na nedavna zbivanja značajan broj glazbenih škola proširilo je ponudu *online* nastave, što je omogućilo učenicima sudjelovanje u sveobuhvatnoj poduci na daljinu (Biasutti i sur., 2022; Catalano i sur., 2021). Osim toga, učenici koji osobno pohađaju nastavu također imaju pristup digitalnim platformama, uključujući mrežne stranice, društvene mreže i mobilne aplikacije, što omogućuje i obogaćuje njihov aktivni angažman u obrazovanom iskustvu (Portela, 2020). Ipak, mali je broj suvremenih istraživanja posebno usmjerenih na glazbeno darovite učenike u nastavi glazbe, iako takve studije postoje i o njima će biti riječi u nastavku ovoga dijela.

Clippinger (2022) je analizirala trenutačne trendove u glazbenom obrazovanju i njihovu važnost za obrazovanje darovitih. Ponajprije, ukazala je na propuste u radu s nadarenim učenicima i predložila viziju vlastitoga glazbenog programa krojenoga prema potrebama darovitih učenika u višoj osnovnoj školi. Ovaj program naglašava pristupe koji uključuju darovite učenike u aktivnostima s cijelim razredom. Clippinger (2022) je naglasila važnost zadovoljavanja kreativnih potreba nadarenih učenika i zalagala se za nužnost stjecanja dodatnih vještina njihovih edukatora, poput zvučnoga inženjeringa i snimanja glazbe.

Ismail i suradnici (2022) istraživali su utjecaj *online* glazbenoga obrazovanja na učeničku motivaciju na uzorku trinaestogodišnjaka u Maleziji. Rezultati su pokazali da je *online* nastava u trajanju od jednoga mjeseca značajno povisila motivaciju učenika, posebno u odnosu na proširene prilike, korisnost, uspjeh i interes. Nisu pronađene značajne razlike između dječaka i djevojčica niti između učenika iz ruralnih i urbanih područja (Ismail i sur., 2022). U drugom istraživanju Isamil i suradnici (2021) ispitivali su utjecaj obrazovanja na daljinu na učenike u Maleziji prema četirima parametrima: sposobnosti učenja, obrazovni zadatci, motivacija i računalne vještine. Rezultati pokazuju da su učenici pozitivno doživjeli *online* učenje zbog njegove učinkovitosti u izvršenju zadataka, povećanja motivacije i razvijanja sposobnosti *online* učenja (Ismail i sur., 2021).

Clarke (2007) je istraživala kvalitetu postojećih glazbenih programa u školama iz perspektive učitelja i učenika. Istraživačke teme koje je uključila Clarke (2007) obuhvaćale su posebne potrebe učenika, prirodu njihovih doživljaja učenja glazbe, razine interakcije u glazbenim aktivnostima i percepciju kvalitete glazbenih susreta. Kvalitativni podatci koje je prikupila Clarke (2007) pokazali su da učenici s posebnim potrebama diktiraju jedinstvene obrazovne zahtjeve i fleksibilne obrazovne programe. Intervjuirani učitelji razvili su svoje glazbene programe sa sviješću o obrazovnim potrebama svih učenika, uključujući i glazbeno darovite pojedince. Osim toga, Clarke (2007) je izvijestila o utjecaju etničke pripadnosti učenika na kvalitetu njihova glazbenoga obrazovanja. Prema anketiranim srednjoškolskim učiteljima, glazba potiče pozitivne stavove i odnose među vršnjacima (Clarke, 2007).

Tolar (2016) je provela istraživanje na malom koledžu humanističkih znanosti, u sklopu kojega je bila glazbena škola, s posebnim fokusom na akademski nadarene studente. Cilj Tolarinoga istraživanja (2016) bio je ispitati teškoće koje su doživljavali akademski nadareni studenti prilikom odabira smjera studija. Prema dobivenim rezultatima, akademski nadareni studenti glazbe češće su doživljavali teškoće prilikom odabira smjera studija nego studenti ostalih humanističkih disciplina. Izvori sukoba akademski nadarenih studenata glazbe uključivali su odluku između različitih glazbenih smjerova obrazovanja, sklonost samonametnutim zahtjevima, aspekte razvoja vještina na nastavi glazbe i upravljanje vremenom.

Iako je upotreba glazbenih tehnologija jedan od ključnih smjerova u razvoju glazbenoga obrazovanja, kontekst upotrebe tih tehnologija od strane akademski nadarenih učenika ostaje uvelike neistražen u literaturi, osim istraživanja autorice Clippingering (2022). Ipak, kvalitativni podatci dobiveni u njezinu istraživanju (2022) nedostatni su za potvrdu učinkovitosti upotrebe tehnologije u povećavanju glazbene darovitosti akademski nadarenih učenika. Kako bismo adresirali spomenuti nedostatak, ovim istraživanjem nastojalo se kvantitativno procijeniti učinkovitost nastave zvučnoga inženjeringa upotrebom tehnologije u razvoju glazbene darovitosti akademski talentiranih učenika. Formulirane su sljedeće hipoteze:

- Sudjelovanje u tečaju „Ja sam tonski snimatelj" imat će pozitivan utjecaj na ukupnu darovitost sudionika (H1).
- Sudjelovanje u tečaju „Ja sam tonski snimatelj" vodit će značajnom povećanju glazbene darovitosti sudionika (H2).

Metodologija

Razredni učitelji pozvani su na odabir akademski nadarenih učenika u dobi od 13 do 14 godina u šest gimnazija u gradu Yangzhou u provinciji Jiangsu u Kini. Prije identifikacije nadarenih učenika učitelji su pohađali dvodnevni trening o obilježjima darovitosti. Učitelji su dobili informacije o atipičnim osobinama nadarenosti koje bi se mogle promatrati kao negativna ponašanja. Obrazovanje učitelja odvijalo se krajem kolovoza. U rujnu i listopadu učitelji su pomno promatrali učenike kako bi nepristrano prosudili njihove potencijalne darovitosti. Također su prikupili informacije o tome pohađaju li učenici nastavu glazbe prema školskom kurikulu i imaju li prijašnje glazbeno iskustvo. Ove informacije koristili su istraživači kako bi grupirali sudionike. Anketa s učiteljima provedena je u prvom tjednu studenoga.

Odabrani učenici (N = 178) nasumično su podijeljeni u eksperimentalnu (N = 89) i kontrolnu grupu (N = 89). Istraživači su proveli tečaj „Ja sam tonski snimatelj"" za nadarene učenike iz eksperimentalne skupine. Učenici iz kontrolne skupine nisu sudjelovali u nastavi. Važno je napomenuti da su ostali aspekti kurikula, poput općih predmeta, nastave glazbene kulture i ostale izvannastavne aktivnosti bile identične za obje skupine.

Zamisao o provedenom tečaju posuđena je iz rada autorice Clippingering (2022). Cilj tečaja bio je upoznavanje učenika s radnim postajama za digitalni audio, zvučnim inženjeringom, glazbenim stvaranjem i montiranjem pomoću opreme i programske podrške, kao i sposobnosti evaluacije glazbe iz perspektive zvučnoga inženjeringa. Istraživači su procjenjivali glazbenu darovitost učenika prije i poslije nastave. Tečaj „Ja sam tonski snimatelj" proveli su autori ovoga istraživanja, a razredni učitelji su im pomagali u organizacijskim pitanjima.

Sudionici istraživanja nisu bili informirani o tome da su odabrani kao daroviti kako bi se postigla objektivnost rezultata. Ovim pristupom isključeni su mogući utjecaji na učeničko samopoštovanje ili njihovo ponašanje tijekom eksperimenta. Učitelji su predstavili tečaj „Ja sam tonski snimatelj" kao dodatnu obrazovnu priliku za učenike zainteresirane za glazbu i tehnologiju. S obzirom da su odabrani učenici prije pokazali zanimanje za glazbu, određivanje tečaja kao „dodatne prilike" bilo je u skladu s njihovim interesima i nije izazivalo dodatne sumnje ili psihološki pritisak.

Sudionici

Razredni učitelji izabrali su ukupno 178 akademski nadarenih učenika za sudjelovanje u istraživanju. Nadalje, istraživači su nasumično podijelili učenike u dvije skupine po 89 učenika, eksperimentalnu i kontrolnu. Uzorak učenika pažljivo je odabran kako

bi se osigurala homogenost u smislu rase i nacionalnosti; svi sudionici bili su Kinezi. Specifično, eksperimentalna grupa obuhvatila je 46 djevojčica i 43 dječaka, a kontrolna skupina 51 djevojčicu i 38 dječaka.

Postupak

Tečaj „Ja sam tonski snimatelj" osmišljen je za provedbu u trajanju od deset tjedana tijekom kojih se od učenika iz eksperimentalne skupine očekivalo da prevladaju četiri istaknute prepreke. Prva prepreka (prvi do treći tjedan) uključivala je samostalno stvaranje glazbe na računalu. Učenici su stekli osnove razumijevanja zvukova i radnih postaja za digitalni audio prije nego su pristupili samostalnom stvaranju glazbe. Drugi zadatak (četvrti i peti tjedan) podrazumijevao je samostalnu i interpretaciju glazbe u malim skupinama. Učenici su produbili svoje razumijevanje digitalnih radnih postaja i proučavali vizualne i auditivne dimenzije digitalne glazbe. Treća prepreka (šesti do osmi tjedan) fokusirala se na proučavanje raznih oblika zvučnoga inženjeringa. Učenici su upoznati s raznolikom opremom za tonsko snimanje, naučili razlikovati različite vrste audiouređaja i eksperimentirati s tehnikama zvučnoga snimanja, uključujući jednoga učenika koji provodi tonsko snimanje i ostale koji su zaduženi za tonsku obradu pomoću upravljačke ploče. Četvrti zadatak (deveti i deseti tjedan) uključivao je suradnički projekt stvaranja upotrebom digitalnoga programiranja u malim grupama. Učenici su razvili vještine montaže i komponiranja glazbe, što je uključivalo dodavanje efekata i međusobnu evaluaciju zvučnih uradaka. Tečaj „Ja sam tonski snimatelj" sastojao se od tjednih radionica u trajanju od dva sata, što znači da je ukupno trajao 20 sati (dva sata tjedno u periodu od deset tjedana).

Instrumenti

Kao mjerni instrument za identifikaciju darovitih sudionika u ovom istraživanju upotrijebljene su Skale za ocjenjivanje darovitosti (engl. akronim GRS), koju su razvili Pfeiffer i Jarosewich (2007) za djecu u dobi od šest do trinaest godina. Ova skala zasnovana je na višedimenzionalnom modelu koji uključuje šest dimenzija darovitosti: (1) intelektualna sposobnost, (2) akademska sposobnost, (3) kreativnost, (4) umjetnički talent, (5) sposobnost vođenja i (6) motivacija (Tablica 1). Svaka dimenzija sastoji se od 12 čestica, a skala ukupno obuhvaća 72 čestice. Na darovitost mjerenu GRS-om u ovom istraživanju će se referirati kao na sveukupnu darovitost. Unutarnja pouzdanost GRS-a (Cronbachov Alpha koeficijent) u ovome istraživanju iznosila je 0,82.

Svaku česticu upitnika ocjenjivao je učitelj na skali od jedan do devet. Rezultati od jedan do tri odgovaraju ispodprosječnoj razini, od četiri do šest prosječnoj razini nadarenosti, a rezultati od sedam do devet predstavljaju iznadprosječnu razinu darovitosti (Pfeiffer i Jarosewich, 2007). Ukupni rezultati pretvoreni su u T-rezultate prilagođene dobi učenika. Rezultati pokazuju vjerojatnost darovitosti u postotcima. T-rezultati do 55 odražavaju nisku vjerojatnost darovitosti, rezultati od 55 do 59

umjerenu mogućnost, rezultati od 60 do 69 ukazuju na visoku vjerojatnost i rezultati iznad 70 znače visoku vjerojatnost darovitosti.

Tablica 1
GRS-s (Pfeiffer i Jarosewich, 2007)

GRS-s skala	Što odražava?	Što mjeri?
Intelektualna sposobnost	Verbalne i(ili) neverbalne kognitivne vještine i sposobnosti učenika	Učeničko apstraktno mišljenje, rješavanje problema, brzinu kognitivnoga funkcioniranja i sposobnost pamćenja
Akademska sposobnost	Učeničku sposobnost svladavanja školskoga kurikula	Razinu usvojenosti kurikula osnovnih školskih predmeta
Kreativnost	Učeničku sposobnost stvaranja inovativnih ideja i(ili) produkata	Upotrebu mašte učenika, eksperimentiranje s novim idejama i sposobnosti rješavanja problema
Umjetnički talent	Potencijalne sposobnosti u području plesa, glazbe, slikanja, pjevanja i glume	Izvedbu učenika na umjetničkim zadatcima
Sposobnost vodstva	Učeničku sposobnost motiviranja i organiziranja aktivnosti drugih	Vještine rješavanja sukoba, inicijativu i interpersonalnu komunikaciju
Motivacija	Dinamičku energiju koja potiče postignuće	Sklonosti, ustrajnost i sposobnost rada neovisnoga o vanjskim poticajima

Učenici s T-rezultatima iznad 60 (što ukazuje na visoku i vrlo visoku vjerojatnost darovitosti), kako su ih ocijenili njihovi učitelji, bili su pozvani na sudjelovanje u istraživanju. Korištena je verzija Skala za mjerenje ponašajnih glazbenih osobina superiornih učenika (engl. akronim SRBMCSS) (Renzulli, 2021). Spomenuta skala revidirana je verzija skale iz 1970-ih i sastoji se od 14 pojedinačnih ljestvica. Svaka Renzullijeva (2021) skala procjenjuje se odvojeno, a rezultati se ne zbrajaju. Evaluacija se zasniva na prisutosti ili odsutnosti svake osobine učenika. Prve četiri skale (motivacija, kreativnost, vodstvo i osobine učenja) većina škola obično koristi kao jedan set. Preostalih deset skala (umjetnost, glazba, drama, komunikacija, planiranje, matematika, čitanje, tehnologija i znanost) koriste se kada su važne za programske ciljeve za nadarene učenike u specifičnim predmetnim područjima (Renzulli, 2021). Stoga su za procjenu glazbene nadarenosti učenika prije i poslije intervencije upotrijebljene Skale za mjerenje ponašajnih glazbenih osobina superiornih učenika (SRBMCSS) koje je predložio Renzulli (2021) (Tablica 2). Koeficijent unutarnje pouzdanosti SRBMCSS-a (Cronbachov Alpha) u ovome istraživanju iznosio je 0,88.

Upitnik je uključivao sedam čestica. Procjena je provedena na osnovi prisutnosti ili odsutnosti svake od sedam karakteristika učenika pomoću Likertove ljestvice u rasponu od 1, što je indiciralo odsutnost, do 6, što je ukazivalo na maksimalnu prisutnost.

Tablica 2
SRBMCSS (Renzulli, 2021)

Čestica skale	Formulacija
SRBMCSS-1	Pokazuje održani interes za glazbu
SRBMCSS-2	Primjećuje suptilne razlike u glazbenom tonu
SRBMCSS-3	S lakoćom se prisjeća melodija i može ih točno producirati
SRBMCSS-4	Rado sudjeluje u glazbenim aktivnostima
SRBMCSS-5	Svira glazbeni instrument (ili pokazuje snažnu želju za tim)
SRBMCSS-6	Osjetljiv je na ritam glazbe; reagira na promjene u tempu glazbe pokretima tijela
SRBMCSS-7	Svjestan/svjesna je i može identificirati raznolike zvukove koje čuje u danom trenutku

Etička pitanja

Provedeni eksperiment odobrio je etički odbor škola sudionica. Prije same intervencije sudionici su informirani o ciljevima i postupku eksperimenta. Osobne informacije o sudionicima nisu zadržane. Svi sudionici priložili su pisano odobrenje roditelja (skrbnika) za sudjelovanje u istraživanju.

Rezultati

Opća darovitost

U Tablici 2 prikazani su rezultati učenika s obzirom na opću nadarenost prema GRS-u prije intervencije. Vidljivo je da se eksperimentalna i kontrolna grupa ne razlikuju značajno u smislu opće nadarenosti: eksperimentalna grupa – M = 7,25, SD = 0,77, kontrolna grupa – M = 7,21, SD = 0,82 ($p = 0,093$). Značajne razlike ($p < 0,05$) otkrivene su između grupa samo za specifične skale GRS-a: intelektualnu sposobnost i sposobnost vodstva. Za intelektualnu sposobnost vrijednosti eksperimentalne skupine bile su M = 7,66 i SD = 0,81, a za kontrolnu skupinu M = 7,15 i SD = 0,84 ($p = 0,021$*) (Tablica 3). S obzirom na sposobnost vodstva, rezultati u eksperimentalnoj skupini bili su M = 6,64 i SD = 0,71, a u kontrolnoj M = 6,93 i SD = 0,81 ($p = 0,003$*) (Tablica 3).

Tablica 3

Deset tjedana nakon predtesta rezultati grupa bili su donekle različiti (Tablica 4). Statistički značajne razlike otkrivene su između dvije skupine u većini GRS skala, a intelektualnoj sposobnosti pridružile su se kreativnost, umjetnički talent i motivacija.

Intelektualna sposobnost: eksperimentalna skupina: M = 7,65, SD = 0,77; kontrolna skupina M = 7,22, SD = 0,84 ($d_{Cohen} = 0,507$) (Tablica 4). Kreativnost: eksperimentalna skupina: M = 7,56, SD = 0,81; kontrolna skupina M = 7,07, SD = 0,76 ($d_{Cohen} = 0,624$) (Tablica 4). Umjetnički talent: eksperimentalna skupina: M = 7,03, SD = 0,75; kontrolna skupina: M = 6,65, SD = 0,88 ($d_{Cohen} = 0,465$). Motivacija: eksperimentalna skupina: M = 8,21, SD = 0,68; kontrolna skupina: M = 8,54, SD = 0,74 ($d_{Cohen} = 0.,591$).

U isto vrijeme prednost eksperimentalne skupine u sposobnosti vodstva ipak je izgubila statističku značajnost: eksperimentalna skupina: M = 7,17, SD = 0,87; kontrolna skupina M 7,03, SD = 0,81 (d_{Cohen} 0,267) (Tablica 4).

Tablica 4

Istraživači su očekivali promjere u specifičnim GRS skalama za eksperimentalnu skupinu, ali ne i za kontrolnu. Nakon usporedbe rezultata unutar grupa, učenici iz eksperimentalne skupine pokazali su značajno poboljšanje kreativnosti ($p = 0,004$), umjetničkoga talenta ($p = 0,02$) i sposobnosti vodstva ($p = 0,001$) (Tablica 5). Učenici iz kontrolne skupine također su pokazali veću sposobnosti vodstva ($p = 0,00$) i motivaciju ($p = 0,001$) (Tablica 4). Specifično, veličina učinka motivacije bila je veća od prosjeka.

Tablica 5

Sveukupno dobiveni rezultati ne pokazuju povećanje ukupne razine nadarenosti, ali je dokazano poboljšanje individualnih parametara, uključujući kontrolnu skupinu. Istraživači objašnjavaju ovaj rezultat prvenstveno činjenicom povišene motivacije nadarene djece za boljom izvedbom nakon što nisu bili uključeni u eksperiment. Još jedno uvjerljivo objašnjenje je činjenica da su učitelji sudjelovali u dvodnevnom obrazovanju prije susreta s učenicima u novoj akademskoj godini. Njihovo obrazovanje i strategije poučavanja možda su prilagođeni na osnovi novih informacija koje su učitelji stekli tijekom obrazovanja i primijenili u praksi.

Glazbena darovitost

Prije eksperimenta nisu zamijećene značajne razlike između grupa niti za jednu česticu upitnika (Tablica 6).

Tablica 6

Kako je i očekivano, nisu pronađene značajne promjene ($p < 0,05$) s obzirom na glazbenu darovitost učenika iz kontrolne skupine tijekom perioda od deset tjedana (Tablica 7).

Tablica 7

Najveći učinak u eksperimentalnoj grupi zabilježen je na četiri čestice: SRBMCSS: SRBMCSS-1, SRBMCSS-2, SRBMCSS-6, SRBMCSS-7 i SRBMCSS-1: $M_{\text{Mjerenje 1}} = 4.44$, $SD_{\text{Mjerenje 1}} = 0,65$ (Tablica 6); $M_{\text{Mjerenje 2}} = 5,67$, $SD_{\text{Mjerenje 2}} = 0,71$ ($p = 0.003$, $d_{\text{Cohen}} = 0,807$) (Tablica 8). SRBMCSS-2: $M_{\text{Mjerenje 1}} = 3,89$, $SD_{\text{Mjerenje 1}} = 0,78$ (Tablica 6); $M_{\text{Mjerenje 2}} = 4,85$, $SD_{\text{Mjerenje 2}} = 0,83$ ($p = 0,014$, $d_{\text{Cohen}} = 0,731$) (Tablica 8). SRBMCSS-6: $M_{\text{Mjerenje 1}} = 4,47$, $SD_{\text{Mjerenje 1}} = 0,79$ (Tablica 6); $M_{\text{Mjerenje 2}} = 5,83$, $SD_{\text{Mjerenje 2}} = 0,72$ ($p = 0,001$, $d_{\text{Cohen}} = 0,894$) (Tablica 8). SRBMCSS-7: $M_{\text{Mjerenje 1}} = 3,50$, $SD_{\text{Mjerenje 1}} = 0,64$ (Tablica 6); $M_{\text{Mjerenje 2}} = 4,38$, $SD_{\text{Mjerenje 2}} = 0,68$ ($p = 0,026$, $d_{\text{Cohen}} = 0,658$) (Tablica 8).

Tablica 8

Nastava tečaja „Ja sam tonski snimatelj" pokazala se učinkovitom u razvijanju interesa za glazbu, povećanju percepcije različitosti glazbenih tonova, razvijanju osjećaja za ritam i povećanju osjetljivosti na zvukove.

Rasprava

Filozofija kvalitetnoga glazbenog obrazovanja zasnovana je na praktičnom iskustvu (Wiggins, 2001). Učenici su motivirani za sudjelovanje u aktivnostima poput sviranja glazbenih instrumenta i nastup pred publikom (Clarke, 2007). Na primjer, kada je Clarke (2007) zatražila učenike da predlože načine poboljšanja glazbenih programa, oni su naveli praktične aktivnosti vezane uz instrumente i kompoziciju kao alate koji bi povećali njihovo uživanje u učenju. U istraživanju Clarkeove (2007) učitelji su dijelili mišljenje učenika o kreiranju kvalitetnih glazbenih programa. Iako možda neće svi učenici poboljšati svoje glazbene sposobnosti (Ismail i sur., 2022; Nsairat i sur., 2022), intervencije poput provedene u trenutačnom istraživanju mogu pozitivno utjecati na aspekte darovitosti, kako pokazuju podatci u Tablici 4.

Nakon provedbe eksperimenta i prikupljanja kvalitativnih podataka slijedi rasprava o rezultatima. Prva hipoteza istraživanja odnosi se na istraživanje potencijala za povećanje sveukupne nadarenosti kroz tečaj „Ja sam tonski snimatelj" koji se temelji na uporabi tehnologije (H1). Sternberg (2005) je odredio glazbeno obrazovanje kao sredstvo poticanja intelektualnoga razvoja putem postavljanja smislenih i važnih ciljeva, njihove koordinacije i napretka u njihovoj realizaciji. U kontekstu ovoga istraživanja primijenjen je koncept prepreka. Prevladavanje tih prepreka bio je cilj za sudionike (prva prepreka bila je stvaranje glazbe na računalu, druga se odnosila na interpretaciju glazbe, treća na učenje oblika tonskoga snimanja i četvrta na stvaranje osobnoga projekta putem digitalnoga programiranja). Sustavnim svladavanjem prve tri prepreke, učenici su pristupili realizaciji željenoga četvrtog cilja.

Rezultati istraživanja pokazuju poboljšanje intelektualne sposobnosti, kreativnosti i umjetničkoga talenta učenika eksperimentalne skupine tijekom deset tjedana. Ovaj rezultat nije neočekivan jer je interpersonalna interakcija postala krucijalan element u stvaranju glazbenih produkata (Schulkind, 2015). Suradnička priroda glazbenoga komponiranja uključuje neverbalnu komunikaciju, također prisutnu u dramskom izričaju, plesu i vizualnim umjetnostima (Schulkind, 2015). Prema Sternbergu (2005), tri sastavnice su nužne za stvaranje glazbene kompozicije: (1) analitička komponenta, koja se odnosi na organizaciju i kontrolu elemenata nužnih za dovršavanje glazbenoga produkta; (2) kreativna komponenta, koja se odnosi na kombiniranje automatizma s neverbalnom komunikacijom i (3) praktična sastavnica, koja obuhvaća sposobnost prilagodbe učenika na suradnju. Sve tri komponente bile su prisutne u eksperimentu opisanom u ovom radu. Stoga ne čudi da dobiveni rezultati ukazuju na poboljšanje intelektualne sposobnosti, kreativnosti i umjetničkoga talenta sudionika.

S druge strane, učenici iz kontrolne skupine pokazali su poboljšanje u području motivacije. Autori ovoga istraživanja smatraju taj rezultat pozitivnim učinkom neuključenosti. Nadarena djeca koja nisu bila pozvana na sudjelovanje u eksperimentu postala su orijentiranja na obrazovna postignuća. Clinkenbeard (2012) je istraživala teorije motivacije nadarenih učenika i predložila TARGET model (zadatak, autoritet, prepoznavanje, grupiranje, evaluacija i vrijeme), koji sugerira da učenici pokazuju ili

primjerene motivacijske uzorke i ciljeve ili nedostižne ciljeve i neprimjerene uzorke ponašanja (Clinkenbeard, 2012). Bit TARGET modela jest u kvalitativnoj dimenziji motivacije, s ciljem ispravnoga postavljanja ciljeva i usmjeravanja nastojanja sudionika (Clinkenbeard, 2012). Opaženi porast motivacije učenika kontrolne skupine, koji je rezultat njihove isključenosti, može se smatrati neortodoksnim uzorkom, ipak kada je popraćen odgovarajućim postavljanjem prioriteta, ima potencijal postizanja željenih rezultata.

Druga hipoteza istraživanja odnosila se na potencijalno proširenje glazbene darovitosti primjenom glazbene tehnologije u tečaju „Ja sam tonski snimatelj" (H2). Rezultati T-testova pokazuju prisutnost učinka na razvoj interesa za glazbu, percipiranje različitosti glazbenih tonova i senzibilnosti za ritam i zvuk. U dosadašnjoj relevantnoj literaturi navodi se kako su glazbeno obrazovani pojedinci skloni doživljavati glazbu kao sredstvo za učenje i da su vješti kritički slušatelji koji koriste svoje glazbene sposobnosti za analizu i naprednu slušnu percepciju (Schulkind, 2015), a što je u skladu s rezultatima ovoga istraživanja. Keenan i suradnici (2001) te Schlaug i suradnici (2005) dokumentirali su da je povećano izlaganje glazbi povezano s psihološkim promjenama ljudskoga tijela. Schlaug i suradnici (2005) otkrili su da profesionalni glazbenici imaju više koncentracije sive tvari u perirolandičkoj regiji mozga nego pojedinci koji se ne bave glazbom. Keenan i suradnici (2001) usporedili su mozak glazbenika s apsolutnom visinom tona i onih bez sposobnosti produkcije savršene visine tona i zaključili da su samo oni pojedinci koji su se počeli baviti glazbom prije sedme godine života sposobni reproducirati savršenu visinu tona.

Osim toga, Schulkind (2015) je otkrila da svaka prigoda u kojoj pojedinci slušaju glazbu potiče njihovu maštu i razvija kreativnost, a u isto vrijeme produbljuje njihovo znanje, sposobnost razumijevanja i pamćenja. U trenutačnome istraživanju pokazano je poboljšanje glazbenoga znanja i razumijevanja sudionika, ali nije dokazan značajan učinak na zapamćivanje melodije. Ovaj rezultat može se objasniti specifičnom prirodom intervencije. Tečaj zvučnoga inženjeringa nije značajno utjecala na glazbeno pamćenje.

Ograničenja i implikacije za buduća istraživanja

Svi učenici su jedinstveni s obzirom na sposobnosti, životna iskustva i perspektive koji utječu na ostvarivanje njihovih potencijala. Stoga je izazov formuliranja precizne grupe glazbenih osobina za točnu procjenu potencijalne glazbene darovitosti učenika opsežan, kako tvrdi Clippinger (2022). Autori smatraju kako je zbog individualnosti bilo koji mjerni instrument, uključujući i skale korištene u ovom istraživanju, nedovoljno fleksibilan za evaluaciju glazbene darovitosti. Ipak, identifikacija i evaluacija raznih oblika darovitosti, uključujući glazbenu, ostaje krucijalna, kako su pokazali istraživači primjenjujući SRBMCSS metodu (Renzulli, 2021). Buduća istraživanja ne bi trebala isključiti primjenu sveobuhvatnije mjere za procjenu glazbene darovitosti.

Jedno ograničenje ovoga istraživanja jest nedostatak diferencijacije između glazbene darovitosti i darovitosti u drugim ključnim područjima učenja tijekom odabira

sudionika. Osim toga, iako su istraživači nastojali održati ravnotežu između učenika koji su u trenutku istraživanja pohađali nastavu glazbe i onih s prijašnjim glazbenim iskustvom, jedna skupina možda je imala višu proporciju glazbeno nadarenih učenika, što je moguće utjecalo na rezultate.

Još jedno ograničenje ovoga istraživanja jest veličina uzorka. Zbog tehničkih zahtjeva provedbe planirane nastave, maksimalan broj sudionika bio je 100. Ipak, glazbeno nadareni učenici zahtijevaju primjenu raznolikih obrazovnih pristupa koji potiču njihov angažman i postignuće visokih rezultata. U ovom istraživanju ispitivala su se dva takva pristupa. Prvi pristup uključivao je obrazovanje učitelja o karakteristikama nadarenosti prije početka akademske godine. Učitelji su upoznati s fenomenom nadarenosti i ponašajnim posebnostima darovitih učenika, uključujući atipična ponašanja. Ovaj pristup postavio je temelj za njihovo buduće obrazovanje u području darovitosti. Drugi pristup uključivao je provedbu tečaja „Ja sam tonski snimatelj". Kroz praktične aktivnosti, međusobnu interakciju, interakciju s istraživačima i izlaganje tehnološkim alatima, učenici su stekli vještine zvučnoga inženjeringa. Ovaj tečaj pokazao se učinkovitom u razvoju glazbene darovitosti. Buduća istraživanja trebala bi ispitati dodatne aspekte glazbene aktivnosti poput improvizacije, kreativnosti i angažmana, koje nisu bile dio ovoga istraživanja. Proširenje tih područja osigurat će sveobuhvatnije razumijevanje načina na koji različiti obrazovni pristupi mogu poticati glazbenu darovitost.

Zaključak

Škole sudionice imale su nekoliko koristi od provedenoga istraživanja. Prvo, razredni učitelji pohađali su dodatno obrazovanje o identifikaciji nadarenih učenika s ciljem povećanja sposobnosti prepoznavanja darovitosti među učenicima u svojim školama. Osim toga, prikupljanje podataka o darovitim učenicima u svakoj školi može poslužiti kao vrijedan resurs za proširenje obrazovnih prilika i njegovanje izuzetnih postignuća tih učenika, što posljedično može voditi sveukupnom poboljšanju obrazovne razine i prestiža tih škola. Ostale škole, uključujući njihove administratore i obrazovne službenike, mogu razmotriti važnost usvajanja sličnih praksi s ciljem usmjeravanja pažnje prema obrazovanim pristupima za darovite učenike, što bi olakšalo prijenos vrijednih iskustava i promociju primjene učinkovitih obrazovnih strategija za darovite učenike.

Ovo istraživanje pokazuje da se učitelji ne bi trebali usmjeravati samo na identificiranje darovitosti nego i na stvaranje okoline koja podržava razvoj darovitih učenika. Učinkovitost poučavanja glazbene tehnologije je dokazana. Takva nastava ponudila je privlačno i bogato iskustvo za učenike i za učitelje. Iako sve škole nemaju potrebne resurse za provedbu takve nastave, ipak mogu povećati svijest učitelja o karakteristikama i potrebama nadarenih učenika, procesu njihove evaluacije i strategijama poučavanja krojenima prema sposobnostima nadarenih učenika. Škole mogu njegovati kreativnost podržavajući učeničke projekte, dajući poticaje i istražujući načine kako da te inicijative ožive. Prilike za razvoj talenata, posebno u glazbi, mogu se pružiti kroz natjecanja, nastupe, privatne sate, nastavu na temu kompozicije ili zvučnoga inženjeringa te

stažiranja u inozemstvu. Osim toga, moguće je razvijati talente i kroz ljetne glazbene kampove, kreativna okupljanja i *online* platforme za razmjenu informacija. Naposljetku, ključno je pronaći individualizirani pristup za svakog učenika i otključati njegov/njezin puni potencijal.