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Fostering Interdisciplinary Learning Activity for Gifted Students

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Abstract

The study focuses on the importance of interdisciplinary learning experiences for exploring diverse subjects. Qualitatively conducted with 9 gifted high school students at a Science and Arts Center in Türkiye, the research involved collaboration among teachers in science, information technologies, and English, guided by a gifted education specialist. The interdisciplinary activity spanned 16 class hours, integrating Molecular Biology and Genetics with English, cinema, and information technologies. The students undertook a DNA comparison and gel electrophoresis experiment, followed by vocabulary activities, English improvisation, and a short film creation. Feedback from students was positive, and expert evaluations noted a high level of creativity in both the short film (average score 4/5) and the poster (average score 3.75/5). The study underscores the success of the tailored interdisciplinary approach for gifted students, offering valuable insights for future research and guidance for teachers in the gifted education domain.

Introduction

The modern world is becoming increasingly complex, thus requiring various fields to engage in interdisciplinary interactions. In the early 20th century, the concept of giftedness was predominantly perceived as a unidimensional construct primarily rooted in the performances exhibited on intelligence assessments. Nevertheless, the domain has undergone a significant paradigmatic transformation towards embracing multifaceted conceptualizations of giftedness. This change can be clearly observed in Conceptions of Giftedness (Sternberg & Ambrose, 2021; Sternberg & Davidson, 1986, 2005) wherein a substantial majority of contributors' interpretations of giftedness surpass the confines of singular IQ-based deliberations. This evolution necessitates substantial modifications in both the processes of identifying gifted individuals and the methodologies employed in their educational provision.

Gifted students exhibit distinct educational needs in comparison to both typical learners and those with special needs. They typically manifest a heightened potential for learning and creativity in contrast to these aforementioned groups. Nevertheless, it is crucial to acknowledge the inherent variability among gifted learners, encompassing diverse levels of aptitude and areas of proficiency. Gifted learners necessitate an education that is customized to address their distinct learning needs and facilitates the cultivation of their talents and research proficiencies (VanTassel-Baska & Baska, 2021). Educational settings that are suitable for these students encompass the cultivation of competencies such as problem-solving, creative ideation, research skills, all of which

are deemed significant. To achieve this objective, a range of strategies such as acceleration, grouping, differentiation, and enrichment are suggested (Davis et al., 2013).

The realm of gifted education exhibits a transdisciplinary essence, wherein approaches originally devised for gifted education have permeated into broader educational contexts. For instance, Tomlinson's work on differentiation, initially conceived within the realm of gifted education (Tomlinson, 1995), has gained widespread acceptance in mainstream education. Conversely, strategies and curriculum frameworks originating beyond the scope of gifted education have been effectively customized for application among gifted learners (see Van Tassel-Baska & Little, 2021). The interconnections between disciplines bear substantial value as they foster the generation of novel knowledge through the convergence of diverse domains. Additionally, these integrative endeavors offer a vital enriched framework that effectively addresses the unique requirements of gifted learners. In gifted education curriculum, interdisciplinarity is seen as a vital component because of gifted learners' highly developed capacity to understand and handle the complexity, abstractness, and commitment that is required to work across disciplines (Jacobs & Borland, 1986; Tucker et al., 1997) and also it is considered to be important for curriculum differentiation (Kaplan, 2022; Tomlinson & Reis, 2004).

According to Sriraman and Dahl (2009), the comparison of mice navigating a maze effectively portrays a typical day in students' lives, where they have distinct and separate class periods for subjects like math, science, literature, languages, and social studies. However, real life doesn't operate in such distinct compartments. Higher order thinking skills like real life problem finding and solving, critical and creative thinking and ability to communicate are highly valued in gifted education (Davis et al., 2013; Renzulli & Reis, 2021) and these skills are required in aforementioned disciplines. Nonetheless, it is worth highlighting that a significant number of students maintain the perception that higher order thinking skills are context-dependent, such as associating critical thinking with social studies, effective communication with language studies, and problem identification and resolution with science. This perception often stems from the fact that teachers tend to emphasize and encourage these skills within specific domains (Sriraman & Dahl, 2009). Indeed, it is a well-documented fact that many eminent figures in history were polymath thinkers, individuals with expertise and achievements including multiple domains of knowledge and creativity. Also, the importance of interdisciplinary studies and the cultivation of individuals who possess the ability to think across various domains is increasing in contemporary society.

The development of interdisciplinary learning activities in the context of gifted education is considered crucial, as it provides gifted learners with the opportunity to acquire a unified view of knowledge. Through these activities, gifted learners can explore the interrelations between diverse fields of study. Interdisciplinary and integrated learning activities or educational programs shown to be effective in increasing the environmental literacy of gifted children (Nuhoğlu & İmamoğlu, 2018), increase achievement outcomes and enhance learning (Callahan et al., 2015), have positive effects on creativity (Kim et al., 2016), have beneficial effects on reading fluency and comprehension levels and help gifted learners to manage their emotional intensities (Sisk, 2022).

Moreover, the persistent misconception that academically gifted learners can excel and thrive irrespective of their educational milieu poses a substantial peril to the overall talent development of gifted students (Subotnik et al.,

2011). Educators, psychologists, curriculum developers, and the educational system as a whole should continue their concerted efforts in furnishing suitable educational opportunities for gifted learners. As emphasized by Reis and Renzulli (2010), a persistent requirement remains for the provision of gifted education, encompassing challenging/enriched programs and services, comprehensive teacher training and professional development, as well as specialized curriculum development. This assertion holds particular relevance within the context of our nation.

Gifted education in Türkiye is a steadily growing area, the establishment of Science and Arts Centers, commonly known as BILSEMs, by the Ministry of National Education (MoNE) Directorate General for Special Education and Guidance Services in 1995, is a significant step in recognizing and providing educational services for gifted learners. The fact that the number of these centers has grown to 379, despite Türkiye having 81 provinces, demonstrates the commitment to providing specialized educational opportunities for gifted learners across the country. This expansion in gifted education centers reflects a positive stride toward nurturing the potential of gifted students in Türkiye. Students who have been identified as gifted by professionals also possess the right to access educational activities within their home schools through the utilization of resource rooms. While significant progress has been made, it is evident there remains a considerable journey ahead. The need for ongoing teacher education and the development of quality curricula remains constant.

Considering gifted learners' need for depth, complexity (Kaplan, 2005), and differentiation (Tomlinson, 1995) in educational activities, the aim of the study is to design and implement an interdisciplinary learning activity which presents challenge to gifted learners and enables them to acquire and use various skills across disciplines. The primary objective of this research is to establish an enriched learning environment tailored for gifted students. This environment should provide challenges that encourage them to take risks, afford opportunities for making mistakes, correcting them, and engaging in interdisciplinary activities. Additionally, the research aims to evaluate this activity from the perspective of students and assess the interdisciplinary products resulting from the study in terms of creativity. To achieve these objectives, the following research questions are posed:

1. What kind of interdisciplinary activity should be used to establish an enriched learning environment that is challenging for gifted students and gives them opportunities to take risks, make mistakes, and learn from them?
2. What are the students' views about this activity?
3. How creative are the outcomes that the students produce during the process according to expert opinions?

Method

Research Design

The qualitative research method was used to conduct this study. In this method, data is collected directly from the field, it allows in-depth data collection and uses open-ended interviews, observations, and written documents (Patton, 2005). For gifted students' education, the process of developing an interdisciplinary activity application in enriched learning environments that is challenging triggers risk-taking and allows for making mistakes and correcting them was carried out by teachers from three different disciplines and an academic advisor. Students'

opinions about the activity in which they participated were obtained through a questionnaire. Finally, the products created by the student group during the study process were evaluated for creativity by 8 field experts using the consensus-based evaluation technique. An inter-expert agreement was calculated using the Miles and Huberman (2002) reliability formula [Consensus / (Agreement + Disagreement)].

Participants

The study was conducted with 9 gifted high school students (4 girls and 5 boys; average age: 15). All students attend a Science and Arts Center (BİLSEM) in Türkiye that provides extracurricular instruction to gifted students. This research was carried out in Şehit Prof. Dr. İlhan Varank Science and Art Center in Balıkesir province.

The selection process for BİLSEM begins with classroom teachers nominating students in the 1st, 2nd, and 3rd grades who demonstrate potential in the designated talent areas. An electronic observation form is used for this purpose. Students are then subjected to a pre-assessment phase, typically involving tablet-based applications, and the top 20% of students at each grade level are shortlisted. Following this, eligible students proceed to an individual assessment (IQ test) conducted by the provincial and central identification commissions. Assessments in general mental ability are carried out at Guidance and Research Centres, while assessments in arts and music are conducted directly at BİLSEM (Demir, 2024; MoNE, 2022).

BİLSEMs are designed to help gifted students develop as productive, problem-solving, self-actualized individuals who integrate scientific thinking and behavior with aesthetic values. Their goals include enabling students to recognize and realize their talents and creativity at an early age, to use them at the highest level, to succeed in creative thinking, discovery, invention, and social relations, and to acquire skills in innovation, leadership, communication, and the arts. BİLSEMs also aim to foster a scientific work discipline aligned with students' special abilities, promote interdisciplinary thinking, support problem-solving, and encourage project development to address identified needs (MoNE, 2022). Students attending these institutions are students who are identified as gifted by the MoNE. The 9 students who were the participants of the research were the students who had been training in BİLSEM for 6-8 years according to their talents. Science, English, and/or information technologies are among the students' talent fields in BİLSEM. In terms of formal education, 4 of the students attend a Science High School, 3 of them attend a foreign language-based High School and 2 of them study in a Science department of a High School that runs an academic program. All of the students are from the middle socio-economic level. The students participated in this activity voluntarily. No fees were charged to the students participating in the activity.

The Role of Researchers

The 3 researchers involved in this study work as teachers in BİLSEM, where the application is carried out. The branches of the teachers are science, information technologies, and English. These three researchers took on the responsibility of supplying the students with the activity gains and assisting them in the production process during the application. The study's fourth researcher, a specialist in gifted education, served as an academic advisor to the other three researchers. Three teachers collaborated to create the activity's design, drawing on their prior

interactions with these children. In the process of the study, the teachers' experience of working with gifted students at BİLSEM; a science teacher for 11 years, an information technology teacher for 6 years, and an English teacher for 4 years. By taking part in international project studies, the English teacher and the information technology teacher received training in filmmaking and filming techniques. The fourth researcher, who served as an academic advisor in the research, guided the teachers during the activity preparation process and gave feedback on the activities developed, has 15 years of experience in the field of training teachers for gifted students at a university in Türkiye.

Data Sources

In the development of interdisciplinary activity, field notes taken by teachers from 3 different disciplines during their interactions with gifted students were utilized. The questionnaire with open-ended questions, administered at the end of the activity, serves as another source of data by collecting students' feedback. The questions in the survey are as follows:

- In which areas did you integrate your knowledge while performing the study?
- What did this activity teach you?
- Which parts of this activity are your favorites?
- What parts of this activity did you find the most challenging?
- What would you like to be different if this activity were to be repeated?
- Where else can you apply your learnings from this activity?

After the questions were written by the researchers, they were read by 3 experts (linguist, special education specialist, and psychological counselor). After the experts stated that the questions were appropriate for the students, the questions were read by 3 gifted students who were excluded from the study. After it was determined that the questions were comprehensible, they were used.

The last data source is the form that was used by the experts to evaluate the short film and the poster that the students prepared in terms of creativity. The Consensual Assessment Technique (CAT) was utilized to evaluate the creativity of the short film and its poster. The CAT, developed by Teresa Amabile in the 1980s, is a method for assessing creativity through expert evaluation within specific domains. It relies on expert judgments, where creativity is determined by the consensus of multiple experts rather than predefined criteria (Kaufman et al., 2024). This domain-specific approach allows experts to assess creative works in contexts like art, writing, and problem-solving (Hlas et al., 2024; Jeffries, 2015). CAT captures the complexity of creativity by using expert consensus, making it a reliable method for evaluating creative outputs in educational and research settings (Barth & Stadtmann, 2021).

According to Kaufman et al. (2008), 1 to 10 raters are generally sufficient to provide reliable estimates in most creativity assessment contexts. In this study, eight experts with at least five years of experience in short film production and editing were selected as the jury. One of the experts also teaches graphic design and cartooning, and three of them have conducted research in the fields of art and creativity. The poster and short film were

evaluated on a 5-point scale (1 = least creative, 5 = most creative). In line with the requirements of the CAT, the tasks were open-ended to allow for greater flexibility and innovation in responses, and the open-ended nature of submitting a poster and short film met these CAT expectations (Said-Metwaly et al., 2017). The eight judges worked independently to rate the short film and the poster. Moreover, no formal definition of creativity was provided to the raters. Instead, it was assumed that the content experts would rely on their own understanding of creativity to make their evaluations (Baer & Kaufman, 2019).

Data Collection and Analysis

At the end of the activity, the students were requested to answer the questionnaire consisting of open-ended questions via Google form. The questions on the Google form were answered by each of the nine students. Inductive analysis was used to examine the responses provided by the students to the questionnaire's questions. The inductive approach enables themes to emerge from raw data without the limitations of structured methodologies (Thomas, 2003).

The Google form was piloted, and instructions were provided on the first page. In accordance with CAT guidelines, the raters were asked to evaluate the short film and the poster on a 5-point scale. Inter-rater reliability in CAT is crucial and is commonly measured using methods like Cronbach's alpha, the Spearman-Brown formula, or the intraclass correlation coefficient (ICC). In this study, the ICC for eight experts was .847, reflecting CAT's high reliability (Hennessey et al., 2011).

Results

The first sub-problem of the research is about how to conduct an interdisciplinary activity that creates an enriched learning environment for gifted students, which is challenging, where they can take risks, and what offers them opportunities to make mistakes and correct them. The notes taken by three researchers in previous years during their interactions with gifted students were informative for developing the activity aimed at addressing this sub-problem. The science teacher stated that it would be beneficial to develop an activity on "Molecular Biology and Genetics" as it was one of the areas that gifted students struggle with. At the same time, due to the limited number of activities on this subject, "Molecular Biology and Genetics" was chosen as a science subject. The Science Teacher informed other researchers of the subject's acquisitions. Based on the usage of molecular biology in the field of forensic science, the English teacher stated that teaching English words and concepts related to the identification of crimes and criminals would be beneficial in terms of improving students' language proficiency. The information technology teacher proposed using the application called "Action Bound" in the field of information technologies to make learning the subject's concepts enjoyable. Since the students are interested in foreign language (English) the English teacher suggested that this application can be completed in English. In the experimental section, it was determined that an experimental application (gel electrophoresis) related to molecular characterization could be conducted. It was stated that the activity could progress through a conceptual text using the improvisation method. It was discussed that students might use short films and posters to create final products from all the principles they learned. As a result, the activity's general outline was created.

At first, the objectives of the activity were clarified during the process of planning the details of the activity. The objectives related to Molecular Biology and Genetics were chosen among the science course objectives from previous years. By enriching the objectives in BİLSEM programs, English and information technology objectives were produced. Cinema and 21st-century skills objectives were written by the researchers. The learning-teaching methods and techniques to be used in the activity were determined in line with the objectives. The learning-teaching process was designed using appropriate methods and techniques, and the evaluation strategy was clearly defined. Once the activity plan was developed, it was submitted to the academic advisor for feedback and subsequently revised in accordance with their suggestions. The English text intended for student improvisation was also modified based on the advisor's recommendations. In addition, the content related to short film shooting techniques and editing, which was to be presented to the students, was revised following the advisor's guidance. The assessment tools were likewise developed in alignment with the academic advisor's recommendations.

In line with the recommendations of the academic advisor, the activity plan was finalized, and the application stage began. The application process is as follows: The question of how criminals are identified in forensic medicine was brought up to engage the students' interests in the topic. For this purpose, clues were given to help them reach the knowledge that molecular biology techniques are applied. The students collaborated as a group during the experimental part. Students were given a kit and asked to examine it. There were five samples stated, and it was claimed that one of them was taken from the crime scene and that was the criminal's saliva DNA. It was stated that the others were coming from suspects in the crime.

The students were instructed to use the electrophoresis technique to compare the DNA sample of the criminal in their possession to the DNA samples of potential criminals. Gel electrophoresis was introduced, and the application process began. They were asked to transfer the gel to the tray by allowing them to set up the electrophoresis tank and power supply for the application. The gel-filled tray was also put into the electrophoresis tank. They poured the running buffer into the electrophoresis tank and filled the samples into the wells using a pipette. The students witnessed that the samples were being powered by electricity from the power source. Since dyed samples were used in the study, students were able to compare the bands formed as a result of walking without using UV light. Thus, they observed how it was possible to identify genetic differences among living creatures. How these differences are used in forensic science applications to identify criminals was discussed. The students determined who committed the crime by comparing the sample taken from the crime scene with the DNA samples of potential criminals. The agarose gel electrophoresis technique's definition and its applications were discussed with the students. Figure 1 displays the experimental study.

The students kept working on their English vocabulary after receiving the technical information in the experimental section. In this step, students were provided to learn the target words by discovering them. Students were required to complete the vocabulary exercises prepared with the web 2.0 application "Actionbound" for this. In this application, the students reached the target words with the help of the application by fulfilling the specific tasks assigned to them. They were provided to discover the meaning of the word by using the clue information provided in the application. Students participated in this study in groups of two or three. Figure 2 displays the vocabulary activity used in the study, and Figure 3 displays the students using Actionbound during the vocabulary

activity.

Figure 1. Experimental Study

1- The_____ continued for nearly three years.

2- The _____received head injuries.

3- He insisted that he had not committed any _____.

4- Murrow's evidence was enough to convict Hayes of murder. Therefore, the jury found him _____ of murder.

5- Murrow's evidence was enough to convict Hayes of murder. The jury would not believe that he was _____.

6- No one had found any _____ as to where the missing girl could be.

7- Some of his colleagues at work became _____ of his behavior.

8- He refused to give _____ at the trial.

9- The police never solved the _____ of Gray's disappearance.

10- Police have appealed for _____ to come forward.

Figure 2. The Worksheet Used in the Vocabulary Activity

After the students completed the vocabulary activity, the meanings of the words were discussed with the students and then an improvisation process began. At this point, the students were given the text that contained the words they had acquired in the previous vocabulary activity, and they became familiar with it. A volunteer student was chosen to read the text aloud. Other students were asked to improvise the text simultaneously. Thus, the words in the previous study were repeated. The text used for improvisation is displayed in Figure 4. This text has been structured according to the proficiency levels of students who are continuing to learn English.

Figure 3. Students Using Action-bound Application During the Vocabulary Activity

THE HOTEL

There was a woman who was working at a very popular hotel as a housekeeper. She had a bad feeling when she started her shift that day. When she went inside to a room for clean she saw a man laying down on the floor. The victim had received head injuries. She reported it to the police and the investigation was started and they started to search for evidence. There was no vital clue in the room. The crime was committed perfectly. Police interviewed the witnesses. According to the sayings of the witnesses, some of the staff working at the hotel became suspects of the murder because of their suspicious behaviours. However, they convinced the police that they were innocent by proving they were somewhere else at the time of the murder. The crime whose guilty wasn't found remained a mystery and the hotel lost its popularity.

Figure 4. The Text Used for Improvisation

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A worksheet containing the definitions of English words was distributed to the students. The students debated the meanings of the words while reading the words' English equivalents and example sentences. Figure 5 displays improvisation.

Figure 5. Improvisation

It was stated that a short film could be shot to help the students create their animation more expertly. Short film shooting techniques were explained through examples. These techniques are 1- Distance Shot (Panoramic Shot), 2- General Shot (Mid-Distant Plan), 3- Length Plan 4-Knee Plan (American Plan), 5- Waist Plan, 6- Chest Plan, 7- Shoulder Plan, 8- Head Plan, 9- Face Shot (Close-Up), 10- Detail (Detail) Shot, 11-Amors Shot. The short film named "Remembering" was watched and the shooting techniques used in this film were discussed. Figure 6 displays the short film shooting techniques.

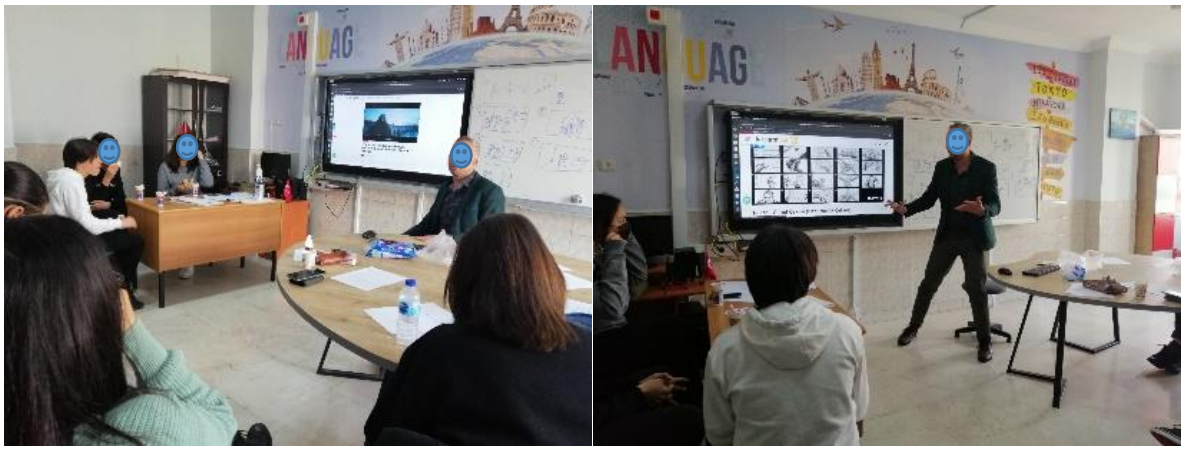

Figure 6. Short Film Shooting Techniques

Since there were 9 students, they decided to shoot the short film as a single group. Thus, the students had the opportunity to work in teams and cooperate, and peer learning took place during the study. Students were expected to put their knowledge of electrophoresis, which they acquired in the experimental section of Molecular Biology and Genetics, and apply the words they had learned during the vocabulary activity and improvisation meaningfully in practical situations. For this purpose, students were asked to write a script that would last no more than 3 minutes, using the new knowledge they acquired, and shoot their script by performing on their own. As a result, it was aimed to reinforce the previously acquired knowledge. Figure 7 displays the shooting short film.

Figure 7. Shooting Short Film

The students studied theoretically and practically for 16 class hours (40x16 minutes) to complete this project. Ten lesson hours were used to complete the remaining filming tasks, edit, and create the poster. Since the students voluntarily took part in the entire study, their evaluations of the activity were vital. The second sub-problem of this research was to determine the opinions of gifted students about this activity. Inductive analysis was used to

evaluate the students' responses to the questionnaire created for this purpose. The findings are presented below.

In the first question, students were asked to identify the areas in which they integrated their knowledge of the subject. When the answers given by the students were examined; 8 students (88.89%) answered English, 7 students (77.78%) Molecular Biology, 5 students (55.56%) Cinema, and 3 (33.33%) Information Technologies. When the students were asked what they learned in the activity they carried out, 8 students (88.89%) stated that they learned expressions about the experimental components such as DNA comparison and gel electrophoresis, 7 students (77.78%) stated that they were informed about the shooting of short films, 4 students (44.44%) stated that they learned new English words, 2 students (%22.22) stated that they learned how to work in a team, 1 student (11.11%) stated that they gained knowledge of scriptwriting, 1 student (11.11%) stated that they improved their English speaking. When the students' responses were examined:

- S1, B: “I learned how to shoot film, speak better English, and compare DNA."
- S3, G: “I gained knowledge of electrophoresis, short film production, and new English vocabulary.”
- S5, B: “I learned how to collaborate, shoot films, write scripts, and compare DNA.”

When the students were asked which aspects of the activity, they enjoyed the most, 6 students (66.67%) cited short film production, 4 students (44.44%) cited the experimental component, 1 student (11.11%) cited speaking English, and 1 student (11.11%) cited vocabulary practice. When asked which elements of the activity they found the most challenging, 3 students (33.33%) said they struggled with writing the screenplay, 3 (33.33%) with speaking English, 2 (22.22%) with shooting circumstances, and 1 (11.11%) with applying shooting skills. When the students were asked what they would change if they were to repeat it, 3 students (33.33%) responded that they wanted the activity to remain the same and that they did not want any changes. 2 students (%22.22) indicated that they wished to shoot in better weather conditions due to the unfavorable weather. 2 students (22.22%) said they wanted to make changes in the scriptwriting of the film, and 1 student (11.11%) wanted the filming order to be different, 1 student (11.11%) also stated that he wished the vocabulary activity had taken a little longer. Here are a few examples from the students' responses:

- S3, G: “We had some difficulty shooting the film because of the poor weather conditions at the time, but the other sections were excellent.”
- S7, G: The vocabulary activity could have lasted a little longer.”

When the students were asked how they would apply what they had learned in the activity in other situations, 6 students (66.67%) said they would use what they had learned in the activity to make short films, 3 students (33.33%) said they would use it in the lab, 2 students (22.22%) said they would use it in the project, 2 students (22.22%) said they would use it in the English lesson, and 1 student (11.11%) said they would use it in their future careers.

The third sub-problem of the study focuses on assessing the creativity of the students' products, as evaluated by experts. The experts evaluated the short film and the poster in terms of creativity, and it was determined that the average score for the short film was 4 out of 5, and the average score for the poster was 3.75 out of 5.

Discussion

The research aimed to identify an interdisciplinary learning activity suitable for establishing an enriched learning environment tailored to the challenges and educational needs of gifted students, fostering an atmosphere conducive to risk-taking, learning from mistakes, and overall intellectual growth. Additionally, the study sought to investigate students' perspectives on the designed learning activity and assess the creativity inherent in the outcomes they produced throughout the process, as evaluated by expert opinions. Through this comprehensive examination, the research contributed insights into effective pedagogical strategies for cultivating enriched learning experiences among gifted students. Nine gifted high school students dedicated 16 theoretical and practical class hours to undertake the initial phases of the learning activity. Subsequently, an additional ten lesson hours were allocated for the completion of the remaining filming tasks, editing, and the creation of the final poster.

The initial sub-problem was to pinpoint an interdisciplinary activity tailored for gifted students, promoting an enriched learning environment characterized by challenges, risk-taking encouragement, opportunities for mistakes, and subsequent learning. The learning activity is consistent with Rogers' (2007) assessment of research findings covering the education of gifted students from the early 19th century to the present. According to Rogers (2007), gifted students require instructional activities in their areas of interest and talent that consistently demand intellectual effort, allowing them to test their abilities. The absence of challenging and enriched learning opportunities in these areas adversely affects both the cognitive and affective domains of gifted students (Kitsantas et al., 2017). Rogers (2007) also emphasizes the need for differentiated instruction and opportunities for independent study in the areas of interest and talent. This not only facilitates socialization but also creates possibilities for gifted students to learn from their intellectually gifted peers. When suitable learning environments are not created for gifted students, they may lose the opportunity to elevate their learning to higher levels (VanTassel-Baska & Brown, 2007) and may encounter social-emotional challenges (Preckel et al., 2010). Consequently, the design of the learning activity takes into consideration the features to address the unique needs of gifted students.

The interdisciplinary learning activity was characterized by the integration of Molecular Biology and Genetics, English language, and information technology, thereby fostering a comprehensive and interconnected learning experience. Compartmentalizing subjects hinders gifted students' understanding of interconnections (Kaplan, 2021). Additionally, Gifted Programming Standards by National Association for Gifted Children [NAGC] offer pathways for interdisciplinary learning (Susan et al., 2022.). Moreover, Sternberg (1986) distinguishes between decontextualised gifted minds, which comprehend information holistically, and constructivist average minds, which require a piece-by-piece understanding with teacher support. The literature also suggests that properly designed interdisciplinary units can lessen the fragmentation that often results from attempts at providing enrichment for the gifted, highlighting the potential for interdisciplinary activities to address the unique educational needs of gifted students (Jacobs & Borland, 1986). The interdisciplinary learning activity supports holistic understanding, addressing the challenges of compartmentalizing subjects for gifted students. The selection of Molecular Biology and Genetics for gifted students emphasizes challenging and intellectually stimulating content, prompting educators to respond to their unique needs by designing a differentiated curriculum with

advanced and complex material, thereby creating a tailored learning environment (Karnes & Bean, 2021). Language proficiency was actively cultivated through the strategic incorporation of forensic English vocabulary within the contextual framework of the subject matter. The use of the "Action Bound" application in information technology showcases technological integration, enhancing the learning process and seamlessly incorporating technology into the educational environment (McKoy & Merry, 2023; Phelps, 2022; Siegle, 2023; Siegle & Hook, 2023).

The incorporation of a gel electrophoresis experiment introduced a hands-on, inquiry-based, and exploratory dimension to the learning process. Gómez-Arizaga et al. (2020) emphasize that gifted students value problem-solving, critical thinking, and exploring, essential considerations for interdisciplinary activities. Çeken (2021) and Ayverdi and Öz Aydın (2022) underscore the importance of incorporating interdisciplinary relationships and hands-on activities in science learning for gifted students. Additionally, empirical evidence suggests that inquiry-based activities within the STEM domains yield positive outcomes for gifted students, underscoring the potential benefits of such activities for their intellectual and academic development (Chrysovalantis & Drigas, 2020). Finally, Arslan (2013) highlights an activity that enhances scientific creativity, empathy, and research skills in gifted students, showcasing the potential of hands-on activities to foster creativity. These elements contributed to a well-rounded hands-on educational experience for gifted students.

The facilitation of creative expression was apparent in the directive for gifted students to produce short films and posters as culminating projects, serving as mediums for the synthesis and manifestation of their grasp of underlying principles. Kim et al. (2016) delves into the exploration of gifted students' creativity within integrated math-science instruction, elucidating potential benefits in interdisciplinary learning. The research of Stoltz et al. (2015) and Piske et al. (2016) underscore theorists' (including Vygotsky, Piaget, Morin, and Steiner) significant contributions to fostering creativity among gifted students. Additionally, Ambrose (2021) offers illustrative examples of how interdisciplinary thinking can augment creativity in gifted students. Meanwhile, Çelik-Şahin and Schmidt (2014) deliberate on English teaching activities, accentuating the pivotal role of creative teaching styles in nurturing creativity among gifted students. In summary, the intentional promotion of creativity in the learning activity has been informed by empirical and theoretical research results.

The second sub-problem sought to capture the perspectives of gifted students regarding the learning activity, examining their views and insights. In response to the inquiry about integrating subject knowledge, most students demonstrated proficiency, with 88.89% identifying English, 77.78% Molecular Biology, 55.56% Cinema, and 33.33% Information Technologies. Regarding learning outcomes, 88.89% reported acquiring knowledge about experimental components such as DNA comparison and gel electrophoresis, while 77.78% indicated being informed about short film production. Additionally, 44.44% noted learning new English words, and 22.22% gained insights into teamwork. Research has shown that interdisciplinary learning activities can significantly enhance students' knowledge acquisition across various disciplines. Finlay et al. (2018) reported that students acquired new methodological skills, gained exposure to diverse disciplines, built interdisciplinary understanding, and cultivated professional development through interdisciplinary engagement. Additionally, interdisciplinary learning activities have been found to predict students' interdisciplinary competence, indicating a positive impact

on their knowledge acquisition (Song & Wang, 2021). Interdisciplinary and integrated learning activities especially for gifted children, supported by research (Callahan et al., 2015; Nuhoğlu & İmamoğlu, 2018; Sisk, 2022), effectively enhance environmental literacy, achievement outcomes, and reading fluency and comprehension levels.

Enjoyment was predominantly derived from short film production (66.67%), while challenges included screenplay writing (33.33%), speaking English (33.33%), and shooting circumstances (22.22%). Middleton et al. (1992) underscore the intrinsic motivation of students, specifically highlighting the pleasure that gifted students derive from engaging in interdisciplinary learning activities. This aligns with Taber's (2014) assertion about the importance of intellectually challenging activities in engaging gifted students. Wati and Yuniawatika (2020) discuss the characteristics of fun learning, such as a stress-free environment and sensory involvement, which are applicable to interdisciplinary learning activities for gifted students. Sel (2022) underscores how interdisciplinary practices, being enjoyable and connecting to real-life, foster a positive attitude in students. Newman and Hubner (2012) further stress the significance of designing challenging science experiences for high-ability learners, reinforcing the idea that interdisciplinary learning activities are both enjoyable and challenging for gifted students.

Gifted students expressed a desire for continuity in the activity (33.33%) or suggested improvements related to weather conditions (22.22%) and scriptwriting changes (22.22%). Students also desire for an extended vocabulary activity. Regarding application, 66.67% intended to utilize learned skills in making short films, with other applications mentioned in laboratory work (33.33%), projects (22.22%), English lessons (22.22%), and future careers (11.11%). Hagge (2017) emphasizes the positive effect of self-directed learning opportunities on motivation, which aligns with the idea that interdisciplinary learning activities stimulate interest and future career aspirations for gifted students. Similarly, Ye and Xu (2023) found that an interdisciplinary thematic learning environment fosters creative thinking and encourages collaboration. This may support the idea that such activities stimulate skills and future career development. Vaughn et al. (2021) emphasize that interdisciplinary research opportunities contribute to the development of skills needed for future careers, reinforcing the notion that interdisciplinary learning activities stimulate skills and future career development for gifted students. Scruggs et al. (1986) discuss the positive effects of interdisciplinary learning on attitudes, cooperative skills, and career choices, indicating that such activities stimulate skills and future career development for gifted students. Akpınar (2023) found that gifted students who participated in a 16-hour English and art education program blended with creativity reported developing positive attitudes towards English classes. The gifted students expressed an increased willingness to attend the classes and found them enjoyable. Additionally, interdisciplinary activities facilitated the application of learned content to their experiences and contributed to the development of interest in artistic disciplines for gifted students. Brown (2023) underscores the importance of providing activities that stimulate the interests and career planning of gifted adolescents. The learning activity also triggered students' interests and raised awareness about career possibilities, providing insight into where they can apply the acquired knowledge.

The third sub-problem of the research aimed to assess the creative quality of student-generated products with input from eight experts in the fields of creativity, language, and film. Evaluation of the short film yielded an

average score of 4 out of 5, while the poster received an average score of 3.75 out of 5, as determined by expert perspectives. Çelik-Şahin & Schmidt (2014) and Kim et al. (2016) suggest that creativity is a vital trait of giftedness, indicating that activities promoting creativity, such as interdisciplinary learning, are advantageous for gifted students. Ayverdi and Öz Aydın (2020) found that interdisciplinary activities enhance the scientific creativity of gifted students, while Avcu and Er (2020) discovered that engaging in interdisciplinary design-thinking problems improves their figural creativity. Yahya and Hashim (2021) also suggest that interdisciplinary learning enhances creative thinking in STEM education. Akpınar (2023) determined that a 16-hour art education program blended with creativity in English instructional design contributes to the enhancement of creativity and the development of self-confidence in gifted students.

In this learning activity, students engaged in inquiry and problem-solving processes. The positive impacts of inquiry-and problem-based learning on motivation and academic performance are well-documented, indirectly fostering creativity in gifted students (Thomson, 2010). Piske et al. (2016) underscore the demotivating consequences of repetitive instructional approaches on gifted students, suggesting a plausible impediment to the cultivation of creativity and emphasizing the potential influence of interdisciplinary learning activities. Lee (2011) emphasizes the significance of creating interdisciplinary curricula, recommended as a crucial element in effective curriculum structures for gifted students, with the potential to stimulate creativity. May (1997) suggests that simulations and active learning provide avenues for gifted students to express themselves creatively and make independent decisions, contributing to the potential stimulation of creativity. We suggest that our interdisciplinary learning activity provide avenues for gifted students to express themselves creatively.

Conclusion

In conclusion, our interdisciplinary learning activity effectively caters to the needs of gifted students, fostering creativity and intellectual growth. The hands-on approach, incorporation of diverse subjects, and emphasis on creativity align with existing literature. Students demonstrated proficiency, positive outcomes, and an intention to apply learned skills in various contexts, including future careers. The expert evaluation affirmed the creative quality of student-generated products. Overall, the research highlights the success and positive impact of our tailored interdisciplinary approach for gifted students.

Recommendations

The participation of only 9 gifted students can be considered a limitation of the study. Additionally, the assessment of creativity based on a Consensual Assessment Technique restricts the evaluation of student products. In assessing students' creativity, it is important to employ various and diverse methods (Kanlı, 2020). Future studies could employ alternative measures such as the Torrance Creative Thinking Test battery or self-report creativity scales to comprehensively measure changes in students' creativity. Collecting quantitative and qualitative data through various assessment tools could offer a more comprehensive examination of the impacts of interdisciplinary activities on students. Diversifying and implementing similar interdisciplinary activities could enhance students' skills in acquiring knowledge across different subjects and further augment their creativity.

Regularly collecting student feedback and continuously improving activities based on this feedback is also recommended. Designing customized interdisciplinary learning experiences that focus more on individual areas of interest for students is another suggestion. Providing continuous training for educators on interdisciplinary learning strategies and guidance skills is crucial. Lastly, sharing the achieved successes and learnings with the community can encourage similar efforts and create a broader impact.

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Notes

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