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The Impact of Integrated Science and Art Activities on Creative Thinking and Problem-Solving Skills[1]

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Abstract

Both art and science share a common subject—humanity—and serve as essential means through which individuals understand and interpret the world. However, the extant literature reflects a limited level of integration between these two domains, with such integration most often treated as a mere juxtaposition rather than a genuine interdisciplinary synthesis. This research aimed to ascertain students' perceptions of art and science, and to determine the potential contributions of their integration to high-level thinking. Since this study is an action research, qualitative and quantitative data were collected and evaluated concurrently. Two experimental and two control groups participated in the study. Four separate 'Integrated Science and Art Activities (ISAA)' were prepared and implemented in experimental groups. After the implementation, it was observed that the creative thinking and the experimental groups' ability to solve problems improved significantly. The findings indicated that students in the experimental group demonstrated improved written expression skills. The findings underscored the importance of increasing the number of science and art activities – designed with appropriate materials – to encourage original thought and problem-solving skills, as well as the vital necessity of teacher training in this area.

Keywords: Art, science, creative, problem-solving, integrated

INTRODUCTION

Throughout history, science and art have been extensively contemplated as fundamental concepts; however due to their, conceptual complexity, they are difficult to define. In this context, attempts to define these concepts have focused on making sense of the notion of the 'human,' which constitutes the common focus of both science and art. Science focuses on objective reality, whereas art interprets reality subjectively by combining elements that may not be organically related (Ayaydın, 2016).This subjectivity constitutes the foundation of creativity, through which art has come to function as a system for organizing creative human expression across distinct artistic disciplines (San, 1983).The definition of art has therefore evolved continuously, shaped by historical periods, social contexts, and the particular artistic forms it encompasses. Today, art is most commonly defined as creative artistic education encompassing all components of the fine arts, taking place in both formal and informal educational contexts" (Etike & Kurtuluş, 2021; San, 1983).

Human beings tend to perceive the universe in which they live from a holistic perspective. In fact, individuals who paint, sculpt, or play musical instruments naturally draw upon scientific

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disciplines such as mathematics and physics in their work, and this occurs as part of an organic process. This integration is also evident in formal education. Therefore, the role of lessons in fostering creative thinking and problem-solving skills should not be overlooked. Numerous studies have demonstrated that practices emerging from the integration of lessons within the contexts of art and science make significant contributions to creative thinking and problem-solving abilities (Gardner, 1999; Graham & Robinson, 2007; Guilford, 1950; Hicks & King, 2007; Inwood, 2013; Lin, 2010; Tavin, 2003; Torrance, 1984; Wigert, 2013). For instance, one of the most effective ways to present scientific studies is through the use of an artistic perspective. Interpreting images obtained from satellites and aerial observations through an aesthetic lens reflects the presentation of scientific data from an artistic standpoint (Dambekalns, 1997).

For children to make sense of the world they experience, their understanding needs to be deepened, and this requires the development of thinking skills. By revealing the relationship between science and art, this study seeks to contribute to the enrichment of the existing literature on the subject and to support the generation of ideas for designing activities and practices that enhance success in science and art applications.

Creative thinking skills are defined as the capacity to produce original and unique outcomes—whether fully realized or not yet transformed into tangible forms—through a distinctive problem-solving process (Torrance, 1974). These skills are considered and evaluated in terms of fluency and flexibility in thinking, originality, willingness to engage in problem solving, and the abilities used to redefine problems and lead to solutions. Problem-solving skills, in turn, are conceptualized and evaluated as a mental process in which individuals direct and structure their thinking by using their own cognitive strategies (Gagné, 1977).

The starting point of this research is to highlight the contribution of combining science and art to fostering innovative thinking and problem-solving skills. This study was designed to determine the extent to which Integrated Science and Art Activities (ISAA) support students in developing a holistic perspective by enhancing their higher-order thinking skills.

Purpose of the Research

This study has been designed to contribute to ISAA learners' active participation in the process, transfer of knowledge to their own lives, and ability to make their own interpretations of the world they live in (Erdem, 2001; MEB, 2018). This study aims to ascertain the opinion of students and teachers on art and science, and how much integrated can help students improve their capacity for original thought and problem-solving.

The importance of this research is to address science and art from a holistic perspective and thus to provide ideas for the design of activities and practices, and to contribute to the diversification of teaching services that can develop higher-order thinking skills.

Based on this study, the following questions were asked in order to find answers: whether there is a difference in the total scenario scores measuring creative thinking and problem-solving skills between the experimental groups in which ISAA was implemented and the control groups; to what extent creative thinking and problem-solving skills are reflected; and what the opinions and suggestions of third-grade primary school teachers and students are.

METHOD

This study employed the action research method, defined as research conducted by teachers within the teaching–learning environment to examine how teaching and learning processes are carried out. (Mills & Gay, 2019). The purpose of the study was conducted with the aim of triggering change in the school, structuring collaboration-based learning, encouraging reflection on the implementation, and contributing to the expansion and development of educational perspectives (Creswell, 2007). Action research was conducted in order to obtain concrete and easily applicable results that are directly related to the classroom (Gay, Mills & Airasian, 2012).

Four different ISAAs were prepared and applied by a researcher and a classroom teacher. The researcher's proximity to the data and direct involvement in the education process (Greene, 1989; Yıldırım & Şimşek, 2011) enabled the application of ISAA's intended objectives.

The study ensured validity and reliability by employing two experimental and two control groups. The school was selected based on considerations of implementation, timing, planning, and collaboration with other practitioners. As the school operates on a dual teaching schedule (morning and afternoon shifts), the experimental and control groups were assigned to separate teaching periods. Because it was not possible to create new classes, existing classes were used for the implementation. Within the scope of the study, two experimental groups and two control groups were formed from a single school. Group assignment to the experimental or control condition was determined through random assignment (Creswell, 2007; Karasar, 2009). The action research process has been meticulously planned to ensure the validity and reliability of the data obtained from the experimental group. The process is illustrated in the figure below:

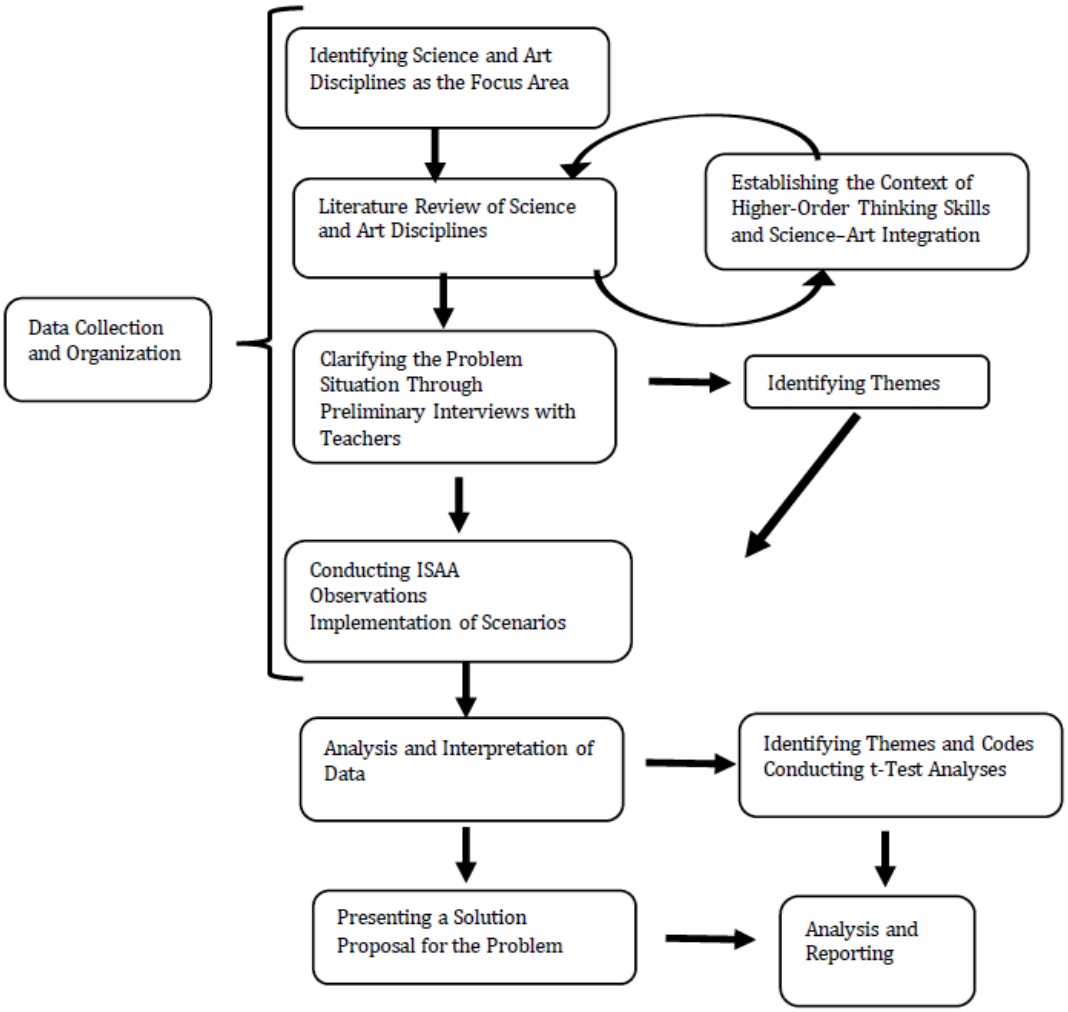

Figure 1. Schematic Diagram of the Action Research Process for Integrated Science and Art Activities

A mixed design was used, in which quantitative and qualitative data were collected simultaneously. This was done in an effort to eliminate the limitations inherent in the collection of qualitative and quantitative data (Creswell, 2018; Tashakkori & Teddlie, 2009). The data was collected by both a researcher and a different practitioner (Greene, 1989) in order to ensure that the findings were more valid and reliable. This made it possible to test the effectiveness of ISAA

in experimental groups (Henerson, Morris & Fitz-Gibbon, 1987). To determine the impact of the developed ISAAs on creative thinking and problem-solving skills and to establish the attainability of the specified objectives and behaviors (Baykul, 2000), a 'pre-test post-test control group design' (Karasar, 2009) was working. This made it possible to determine the differences between the experimental and control groups more clearly using the scores obtained from the ISAA (Fitzpatrick, Sanders & Worthen, 2010).

Using a single method in research inevitably leads to limited results that carry inherent biases; therefore, data sources and data collection tools have been diversified in this study. Based on the principle that the validity of research findings increases when two or more complementary methods are used to examine a specific phenomenon and produce convergent or supportive results. (Greene et al., 1989), quantitative and qualitative data were evaluated together during the data interpretation phase. As Creswell (2007) also states, quantitative and qualitative data were collected simultaneously, and both types of data were evaluated equally in an attempt to answer the research question.

In this context, in addition to method-based triangulation, data-driven triangulation was also used in the research. Data collection tools were also diversified, including interviews, observations, BBSE, and 'Scenarios'. This enabled the use of data-driven triangulation.

Study Group of the Research

The study's group comprised third-grade teachers and their students from a Ministry of National Education (MEB)-affiliated primary school in Ankara, Türkiye, which serves children from middle socio-economic status families and where the researcher is also employed. The purposive sampling method was used to I determine the study's groups.

In the study, two experiments and two control groups were determined by neutral assignment from a single school. The experimental and control groups were combined, and quantitative analyses were performed using a single experimental group and a single control group. The equivalence of the groups was determined using "Scenarios" developed by the researcher and validated for accuracy and reliability. Creative thinking skills pre-test scores in the experimental and control groups are presented in Table 1.

Table 1. Comparison of Pre-Test Scores of Experimental and Control Groups from Scenarios Measuring Creative Thinking Skills

Groups	N	$\bar{X}$	ss	Sd	t	p
Control	40	7,5000	2,19557	83	2,078	,038
Experiment	45	6,3778	2,71602			

*$p<0.05$

According to the independent samples t-test, no statistically significant difference in favor of the experimental group was found between the pre-test mean score of the control group students regarding creative thinking skills ($\bar{X}$ = 7.5000) and that of the experimental group students ($\bar{X}$ = 6.3778); it was determined that the average score of the control group was higher than that of the experimental group [$t_{(83)} = 2.078$, $p < 0.05$]. According to the results of the pre-test, no significant difference was found between the groups in terms of creative thinking skills. Problem-solving skills pre-test scores in the experimental and control groups are presented in Table 2.

Table 2. Comparison of Pre-Test Scores of Experimental and Control Groups from Scenarios Measuring Problem-solving Skills

Groups	N	$\bar{X}$	ss	Sd	t	p
Control	40	14,4500	4,21809	83	-1,436	,155
Experiment	45	15,7333	4,01927			

*$p<0.05$

According to the independent samples t-test, no significant difference [$t_{(83)}$ =-1,436, p<0,05] was found between the pre-test mean score of the control group students ($\bar{X}$=14,4500) and that of the experimental group students ($\bar{X}$=15,7333) regarding problem-solving skills. According to the pre-test results, no significant difference was found between the groups in terms of problem-solving skills.

According to these comparisons, it can be said that the groups were equivalent in terms of creative thinking and problem-solving skills at the beginning of the study.

Data Collection Tools

Pre-test Post-test Scenarios, Semi-Structured Individual Teacher Interview Form, Semi-Structured Focus Group Student Interview Form; after being carefully and meticulously conducted in light of expert opinions, they have been finalized.

Pre-test Post-test Scenarios

It consists of four different mini scenarios developed by the researcher with expert opinions. These scenarios aim to determine the level of third-grade elementary school students' ability to relate science and art disciplines and the level of development in their creative thinking and problem-solving skills in the structure of these disciplines. Krippendorff alpha statistic was used to determine whether scenarios measure creative thinking and problem-solving skills. The average compatibility percentage of Scenario I and Scenario III, which measure creative thinking skills, was found to be 0.89, while the average compatibility percentage of Scenario II and Scenario IV, which measure problem-solving skills, was found to be 1.

Torrance's four components of creativity have been used as criteria for scenarios that measure creative thinking skills. Criteria for the scenarios have been defined, and scenario questions have been prepared in this context. These criteria are briefly explained below:

- Fluency: The number of ideas or expected products, the ability to generate many different ideas
- Elaboration: The presence of expected explanations, the ability to make thoughts interesting and complex
- Flexibility: The ability to freely generate solutions and think in different ways
- Originality: The ability to think in unique and original ways, away from the ordinary (Torrance, 1984, Baas et al., 2008, Yavuzer, 1998, Ausubel and Robinson, 1987).

Semi-Structured Teacher Interview Form

Teachers were questioned about their opinion on the connection between the fields of science and art disciplines, their participation in science and art-related events, activities, or training, their opinions on the impact and feasibility of integrated practices, the publications and books they follow, and their thoughts on the contribution of lessons to creative thinking and problem-solving skills.

Semi-Structured Focus Group Student Interview Form

Students were asked what they understood by science and art, what events, activities or education they had participated in related to science and art, and what they could say when they thought about science and art together.

Validity and Reliability of the Research

The reliability and validity of the study were ensured by using multiple data collection strategies (Creswell, 2007). The research question was addressed by collecting quantitative and qualitative data simultaneously, and evaluating both types of data equally (Creswell, 2007), as required in action research. To increase credibility, opinions were obtained from three different experts working on creative thinking and problem-solving skills (Creswell, 2007; Guba & Linkoln, 1989;

Doğan, 2002; Krefting, 1991), thus ensuring that the study is free from bias. Since the experimental procedure lasted 14 (fourteen) weeks, a long-term interaction with students and teachers was able to establish a relationship based on data verification and mutual trust (Streubert & Carpenter, 2011).

In order for the research to be replicated under different conditions and by different researchers, the conclusions drawn from the experimental process have been reported carefully and clearly (Kaptan, 1982). Two experimental and control groups were determined and the diversity of students and teachers was increased; in this way, transferability is increased (Merriam, 2009).

Through the use of ISAA and "Scenarios," interviews were conducted with the aim of reducing potential biases, ensuring objectivity, and examining—via data-based triangulation technique—whether the obtained results support each other (Greene et al., 1989).

Process

Data collection tools have been prepared with the necessary expert opinions and ethics committee approval. In the groups of the study, measurements were made with the scenarios developed by the researcher before and after the experimental procedure. In one of the experimental groups, the application of ISAA was carried out by the researcher, while in the other, it was conducted by the classroom teacher. Quantitative data were collected with scenarios used at the beginning and end of the implementation. The existing education and instruction process continued in the control groups.

With ISAA, it is aimed to enable students to look at some examples from real life from different perspectives, to question, to seek solutions and to reach the main goals while trying to solve them (Keski & Aykaç, 2014) and to test the development of their high-level skills (Titterington, 2007).

Smile at Yourself, Patterns of Nature, My Wishes and Resources, and Explorer activities took place over the course of 28 class hours. ISAA was implemented separately in two experimental groups.

Courses integrated into ISAA;

- Smile at Yourself Activity; is an activity that integrates Turkish and visual arts (8 course hours, 4 weeks), activity is the first activity of BBSE and is designed to develop creative thinking skills. Based on the premise that every child can generate creative ideas, the activity aims to design an appropriate teaching–learning process and demonstrate how these ideas can be transformed into concrete products.
- Nature's Patterns Activity; is an activity that integrates mathematics, visual arts and Turkish course (8 lesson hours, 4 weeks), This is the second activity of the research. This activity aims to support students in developing an inquisitive perspective on their surroundings. It is an activity designed to develop problem-solving skills. Students are encouraged to notice the geometric shapes and letters within architectural structures. The primary goal of this activity is to help students perceive that art emerges as part of nature. In addition, by noticing the shapes and letters in nature, students are expected to establish a connection with architecture. Students are encouraged to recognize that mathematics and number science are part of life.
- My Requests and Resources Activity; is an activity that integrates social sciences, Turkish, visual arts (6 lesson hours, 3 weeks), This is the third activity of the research. The activity is structured to highlight the connection between saving, wants, and needs in real life contexts. It is an activity aimed at developing creative thinking skills. Participants are asked to write an original drama script to increase their awareness of savings, desires, and needs. The goal of this activity is to integrate the artistic awareness developed in previous activities with the topic of savings, desires, and needs

- Explorer Activity: An activity that integrates science and music lessons (6 lessons, 3 weeks), An activity that integrates science and music lessons (6 lessons, 3 weeks) This activity aims to further develop the artistic awareness established in previous activities through the topic of planets. It is an activity designed to develop creative thinking skills. At the end of the activity, in the evaluation section, students are asked to prepare an original 'Concept Map'. Making analogies for creativity and finding connections between concepts is an important indicator. The relationships, analogies, and connections found in the concept map are examined. Making analogies and visualizing connections between concepts, if any, develops higher-level thinking skills.

Four scenarios have been prepared in accordance with the criteria for measuring each of the ISAA activities named Smile at Yourself, Patterns of Nature, My Desires and Resources, and Explorer. In the Smile at Yourself activity, fluency, flexibility, detail, and originality were used; in the My Desires and Resources activity, fluency, detail, and originality were used; and in the Patterns of Nature and Explorer activity, problem identification, suggesting possible solutions, and reaching a conclusion by selecting the most appropriate path were used as criteria.

RESULTS

To convey the results of the study in a meaningful and coherent manner, quantitative and qualitative findings have been presented together and in a way that answers the research questions.

Examination of ISAA Post-Test Scores in Terms of Creative Thinking and Problem-solving Skills

The results of the analysis regarding creative thinking skills based on the post-test total scores obtained from Scenario I and III, which measure creative thinking skills in the experimental and control groups, are presented in Table 3.

Table 3. Comparison of Post-test Scores Obtained from Scenarios Measuring Groups' Creative Thinking Skills

Groups	N	X̄	ss	Sd	t	p
Control	40	16.175	2,87239	83	-23,122	.000
Experiment	45	34,9111	4,50163			

*p<0.05

According to the independent sample t-test, there was a significant difference [$t_{(83)}$ =-23.122, p<0.05] between the post-test average scores of the control group students' creative thinking skills (x̄=16.175) and the post-test average scores of the experimental group students (x̄=34,9111). According to these results, it can be said that ISAA has an effect on the development of creative thinking skills. It was examined whether there is a difference between the post-test total scores obtained from Scenario II and IV, which measure problem-solving skills in the experimental and control groups, in terms of problem-solving skills, and the results of the analysis are presented in Table 4.

Table 4. Comparison of Post-test Scores Obtained from Scenarios Measuring Groups' Creative Thinking Skills

Groups	N	X̄	ss	Sd	t	p
Control	40	9,0500	2,71699	83	-16,049	,000
Experiment	45	17,2444	1,96741			

*p<0.05

According to the independent sample t-test, the problem-solving skills of the control group students were significantly higher than the mean score of the post-test (x̄=9,0500), the post-test mean score of the experimental group students (x̄=17,2444A significant difference was found

between [$t_{(83)}$ =-16,049, p<0,05]. According to these results, it can be said that ISAA has an effect on the development of problem-solving skills. With the results of the analysis obtained, it is revealed that ISAA is significantly higher on creative thinking and problem-solving skills in the experimental groups. When looking at the impact of ISAA, it has been found to have a significant effect.

Primary School 3rd Grade Teachers' Opinions and Suggestions on Integrated Science and Art Activities

When examining the findings obtained from individual interviews conducted with all third-grade teachers at the elementary school where the research was conducted, it was observed that there was a significant similarity in the responses, including the additional questions asked to the teachers in the experimental groups. For this reason, data were analyzed together up to the questions that were appropriate for teachers in the experimental groups to answer. Further explanations have been provided regarding the teachers in the experimental groups. The themes and codes obtained from the interviews with teachers are presented below.

Table 5. Themes and Codes Related to Primary School 3rd Grade Teachers' Opinions and Suggestions on Integrated Science and Art Activities

Theme	Codes
Publications followed by teachers	Novel, TÜBİTAK Children's Magazine, Literature Magazine, Science Children's Magazine, Enthusiastic, Reading A Lot, Not Reading At All
Participation and Practice in science and art activities	Participation fee, positive attitude, physical conditions of the school, class sizes, economic difficulties
The effect of art lessons on creative thinking skills	Feeling of inadequacy, field expert support, insufficient class time, patience, awareness, contributing to each other, related activities
The effect of art classes on problem-solving skills	Feeling of inadequacy, field expert support, insufficient class time, belief in contribution, material shortage

In the study, themes and codes were identified and analyzed in the light of the responses of 3rd - grade teachers.

Publications Followed by Teachers

When asked whether they follow any publications in science, art, or other fields, according to the classroom teachers who took part in the interviews that they find it difficult to follow any publications and that they prefer to follow certain publications for their own children. In the theme of publications followed by teachers; novel, Tübitak Children's Magazine, Literature Magazine, Science Children's Magazine, Enthusiastic, Reading A Lot, Not Reading At All codes have been determined. Some examples of teacher comments are provided below:

"... I hesitated to say I'm not following you. I used to do it, but unfortunately I don't have the money for it anymore..." (S3)

"...Maybe if there was a teacher discount, but with these prices, it's impossible. I also had to stop following the ones I followed..." (S8)

Classroom teachers stated that they were unable to follow publications in the fields of science and art due to economic difficulties.

Participation and Practice of Science and Art Activities

Classroom teachers have demonstrated a positive attitude toward participating in and practicing activities that combine science and art, but they have again linked participation and application to their economic circumstances. Some examples of teacher comments are provided below:

"...I started choosing where I would go. If it's very important, I can plan and go, but I can only go to one because I don't have enough money..." (S3)

"...The number of places offering discounts for teachers should be increased or made permanent. I have to choose among books, concerts, trips, theater. After all, who wouldn't want to go there... (S4)

All classroom teachers expressed positive views about participating in and practicing science and art-related activities, but also indicated that economic difficulties prevented them from doing so.

The Impact of Art Classes on Creative Thinking and Problem-solving Skills

Classroom teachers talk more about how creative thinking and problem-solving skills can be developed when visual arts and music lessons are structured, rather than about the content of these lessons. It is thought that the teachers' statements indirectly emphasize that they do not find the current implementation of the lessons appropriate. Therefore, the codes obtained in response to this question have also been in this direction. Within the theme of the impact of art classes on creative thinking and problem-solving skills, the following codes were identified: sense of inadequacy, support from subject-matter experts, limited class hours, patience, awareness, mutual contribution, related activities, belief in its contribution, and lack of materials. Some examples of teacher comments are provided below:

"...I try to get the student to find the answer to the question I ask. I teach all my classes this way. I am asking patiently and offering him this opportunity patiently. Students who find the answer once believe that they can find other answers and try to do so. (S3)

"...It greatly contributes to students helping each other. When they do related activities, communication between them also increases. Creative thinkers and problem solvers should do this..." (S4)

"...I think art and music are the two most suitable subjects for other subjects. I don't understand why the implementation has become so ridiculous..." (S7)

Findings revealed that participants believed these activities enhanced creative thinking and problem-solving skills, and that they should be structured in a way that allows students to explore, engage their interest, and direct their attention during visual arts and music classes.

Additional Opinions of Teachers in the Experimental Groups

The teachers in the experimental group were asked three more questions concerning ISAA. This has made it possible for us to acquire more in-depth data on the research. The identified themes and codes are presented below.

Table 6. Teachers' Views on Integrated Science and Art Activities in Experimental Groups Regarding Creative Thinking and Problem-solving Skills Theme and Codes

Theme	**Codes**
ISAA's Contribution to Creative Thinking Skills	Curiosity, talent, awareness of art, desires and needs, different areas of interest
The Contribution of ISAA to Students' Problem-solving Skills	Tolerance, willingness to speak, perseverance-effort-determination, desire and needs, curiosity, self-confidence
ISAA's Contribution to Teachers' Development	Recognizing their skills, increased interest, enthusiasm and desire to apply, prioritization, engaging in practical activities, asking detailed questions
Recommendations for the Development of the ISAA	Economic barriers, feelings of inadequacy, in-service training, awareness of the arts, planning, scheduling lesson

Within the theme of ISAA's contribution to creative thinking skills, the following codes were identified: curiosity, talent, art awareness, needs and desires, and diverse areas of interest. Within the theme of ISAA's contribution to students' problem-solving skills, the identified codes were: tolerance, willingness to speak, perseverance-effort-determination, needs and desires, curiosity,andself-confidence.

Within the theme of ISAA's contribution to teachers' professional development, the following

codes emerged: awareness of their own skills, increased interest, enthusiasm and willingness to implement, prioritization, conducting practical activities, and asking detailed questions. Wthin the theme of suggestions for the development of ISAA, the identified codes included: financial barriers, sense of inadequacy, in-service training, art awareness, planning, and organizing class hours.

It was stated that, through the conducted activities, student's sense of exploration was activated and their negative perspectives changed in a positive direction. They underlined that it raised awareness necessary for the development of student's skills. They stated that the activities which required them to concentrate their attention particularly provided support in terms of creative thinking. Some examples of teacher comments are provided below:

"…I think artistic activities have broadened my perspective. I don't think any single activity is sufficient on its own. I don't think creative, hard-working people are judgmental. I believe they are understanding and tolerant..." (S7)

Some of the teachers' responses related to the theme of ISAA's contribution to problem-solving skills are presented below:

"… Children in general want to explore them all. They constantly try to find answers by asking questions. Sometimes they find answers, sometimes they don't. The best part of the activities you conducted was that they were able to find their own answers. Every child is curious and wants to explore. "It guided them, broadened their horizons, in my opinion…" (T7)

"…The children saw what they could accomplish when they carried out a task step by step." I think their belief in themselves has increased..." (S8)

"…I personally witnessed that the activities supported the students and gradually helped them build self-confidence…" (T7)

Classroom teachers stated that the students were curious and excited about the activities, experienced a sense of mental satisfaction, and that their self-confidence increased. They emphasized the importance of keeping student's attention actively engaged at all times. Teachers reported that the students were happy with the activities and that their belief in their ability to succeed had increased. Some examples of teacher comments are provided below:

"…The children were quite happy." They eagerly looked forward to the day you would come for the activity. Maybe because they were able to touch and engage with it themselves, they were very enthusiastic. There wasn't a single child who couldn't do it, nor did anyone say, "I can't do this." "They want these activities to continue…" (T7)

"…I did not observe any anxiety in my students about whether they might not be able to do it." They all participated with the belief that they were quite successful. I find this very important. They were very peaceful hours during which the students were not anxious at all… (T8)

Classroom teachers stated that their student's anxiety about failure decreased in other subjects as well, that they focused more on the process, and that, as a result, they were able to construct their own learning. They stated that all of these factors contributed to maintaining students' excitement and enthusiasm at a high level, helped them reach the necessary level of self-confidence, and led them to exhibit determined and perseverant behaviors.

When the teachers in the experimental group were asked about the contribution of the ISAA implemented in their classrooms to their teaching practice, they stated that it had contributed more than they had expected. The teachers stated that, thanks to ISAA, their individual awareness had increased and the topic had begun to capture their attention; they started to believe that they could overcome the challenges and obstacles they previously perceived as barriers, and they began to question the interrelation between different subjects.

Within the theme of suggestions for the improvement of ISAA, teachers once again expressed concerns about financial barriers and time constraints. Classroom teachers emphasized that music and visual arts classes, which are categorized as art courses, were left to the discretion and preference of the teacher. Sample statements from teacher's responses are presented below:

"…Class sizes are the biggest problem; in crowded classrooms, everything becomes an obstacle…" (T7)

"…It is important to have a budget for these activities in schools, because in cases where the technological infrastructure or materials are insufficient, we cannot find a solution…" (T8)

Another issue highlighted by the teachers is the sense of inadequacy. They stated that they wished to receive support and requested that professional training be offered to help them improve in the areas where they felt inadequate. However, they emphasized that these trainings must be practical and of high quality. Sample statements from teacher's responses are presented below:

"…Artistic and scientific content-based trainings should be prepared for us. There are a lot of people who are competent in this regard. It would be beneficial to make use of them. Sometimes an idea pops into our heads, but it's hard to put it into practice. I mean, whether it's technique, integration, or a new perspective. These things are important, in my opinion…" (S7)

Classroom teachers have listed the necessary points for increasing the variety of activities, facilitating their practicality, and ensuring their effective implementation. There are no negative opinions regarding the activities, such as they cannot be held, carried out, or implemented. On the contrary, they have adopted a positive approach, recognizing that it supports creative thinking and problem-solving skills. They have also made it clear that they will not refrain from implementing these activities when they are planned, structured and some materials are provided in advance.

Opinions and Suggestions of Primary School 3rd Grade Students

In addition to the questions asked to the students in the experimental groups, two more questions were asked to the third-grade students in the elementary school where the research was carried out. The most popular ISAA and ISAA contribution themes obtained from these two additional questions are presented together with the other themes. The themes and codes obtained from the student interviews regarding the ISAA are presented below:

Table 7. Primary School 3rd Grade Students' Opinions on Integrated Science and Art Activities

Theme	Codes
Participation and Practice of Science and Art Activities	Exciting, relaxing, fun, confidence-boosting, freedom,
What the Concepts of Science and Art Mean	learning, everything, pictures, tests, and inventions/inventors
The Process for Solving a Problem	learning, striving, self-confidence, and not giving up
Their Thoughts on Art Classes	feeling good, loving, beautiful, comforting, and important
Characteristics of a Creative Thinker	determined, happy, intelligent, relaxed, inquisitive, curious
Most popular ISAA	natural dye application, drawing, geometric shapes, poems, painting, feeling successful, self-confidence
Contribution of ISAA	success, influence, creativity, relaxation, love, and intelligence development

In light of student interviews, the themes of participation and practice in science and art activities were identified as exciting, relaxing, fun, confidence-building, and freedom; the theme of learning what science and art concepts mean was identified as everything, learning, picture, testing, and

invention/inventor codes; the approach followed in solving a problem has been identified as learning, perseverance, self-confidence, and not giving up. In the theme of what they think about art classes, the codes of feeling good, loving, beautiful, relaxing, and important were identified. Within the theme of the most enjoyed ISAA activities, the identified codes included: natural dye application, drawing pictures, geometric shapes, poems, painting, feeling successful, and self-confidence. Within the theme of ISAA's contribution, the following codes were identified: success, impressiveness, creativity, relaxation, enjoyment, and intelligence development.

Students in the control groups, when expressing their thoughts about participating in science and art activities, stated that they found participation enjoyable, that they liked it, and that it was fun. Students in the experimental groups expressed the contributions of participating in the activities using longer and more descriptive sentences. Students in the experimental group stated that they enjoyed participating in the activities, felt successful, and found them relaxing. While expressing their views on participating in these activities, they also provided examples from the science and art activities, and were able to give detailed, nuanced, and explanatory answers to the questions asked. When asked what the concepts of science and art meant to them as the second question, the control groups were unable to answer by considering the concepts of science and art together.

Students in the experimental groups, unlike those in the control groups, were able to perceive the concepts of science and art in a holistic manner and used expressions reflecting this understanding. Sample statements from students in the experimental groups expressing their thoughts about science and art are presented below:

"…When I think of the word 'art,' almost everything comes to mind…" (G6)

When I think of science and art, almost everything I have learned comes to mind. There is mathematics, there is art in the color of the sky. And I'm always singing in my head..."(G9)

It is believed that the students in the experimental groups showed a high degree of awareness regarding the concepts of science and art, and that this awareness was fostered through the ISAA activities conducted with the experimental groups. In addition to these responses, students associated various activities with science and art, such as knitting, participating in exams, attending summer school, entering drawing competitions, building model rockets, and playing with mini toys they made themselves from materials like paper and cardboard.

When the students in the control groups were asked what they did when faced with a problem, they were initially unable to respond. In order to obtain responses from the students regarding the question, it was necessary to provide additional explanations and examples. For the students in the experimental groups, such a need did not arise; they were able to clearly and thoroughly express what they did when faced with a problem.

"…I'm not sure if I can solve the problem, but when I trust myself, it becomes easier." I learned to trust myself. Then I relax and figure it out...." (G7)

"... I keep trying the solutions that come to my mind. Then the solution seems easier. I don't give up, then it happens..."(G9)

Their statements suggest that students in the experimental groups demonstrated a more determined attitude toward identifying and solving a problem. They stated that they did not avoid trying and researching, and that they were solution-oriented.

Students in the control groups refer to visual arts class as the drawing class. They were unable to provide an explanation regarding the value and importance of music and visual arts classes. Students in the experimental groups were able to explain the importance and value of visual arts and music classes more effectively compared to those in the control groups. Sample statements from students in the experimental groups are presented below:

"…I relax and feel happy in art and music class; it is good for me. It's not like they're lessons..." (G7)

"… I feel so good when I sing. My teacher also really likes my voice and always tells me to sing a song..." (G8)

The experimental group's students had the opportunity to comment and provide explanations regarding the meaning, importance, and value of art classes, as well as what they gained from them.

When students were asked about the characteristics a creative individual should possess, many students in the control groups specifically expressed the view that individuals who study their lessons are creative. Students in the experimental groups, in addition to establishing a connection between success and creativity, stated that creative individuals are relaxed, happy, cheerful, and energetic people. They identified persistence, inquisitiveness, asking questions, courage, and determination as characteristics of creative individuals.

Students in the experimental group were asked which activity in the ISAA most impressed them and which they liked the most, and the following codes were identified: natural dye application, drawing pictures, geometric shapes, poems, painting, feeling successful, and self-confidence. Findings indicate that they were more impressed by and enjoyed the activities involving nature observation and natural dye production.

"…I felt another power inside me, as if I was lucky and would succeed…" (G7)

"... I will never forget anything you taught us. You taught us all so many wonderful things. I'll never forget them..." (G9)

An analysis of the responses from students in the experimental groups revealed findings indicating that they internalized the activities and teaching-learning experiences, and structured their own learning processes accordingly. For example, students did not directly state phrases such as "my creative thinking skills improved" or "my problem-solving skills increased," but they were able to express the characteristics and situations necessary for creative thinking and problem-solving skills. Nevertheless, in response to questions about the contributions of ISAA to them, they provided significant explanations regarding their own development and impressions. Students in the experimental group, when discussing the contributions of ISAA, emphasized features such as success, impressiveness, creativity, relaxation, enjoyment, and intelligence development.

Students stated that they greatly enjoyed the activities, were deeply influenced by them, began to appreciate music and visual arts classes more, felt mentally relaxed, and were introduced to poetry through this process. Some sample statements from students in the experimental groups are presented below:

"… I think artists are very smart. I think when you make art, you live happily..." (G7)

"… I feel relieved in music class. It's like I'm getting smarter..." (G8)

"… I love it when I listen to music while painting. I feel different inside. You played music for us too. I feel more successful..." (G7)

Students not only remembered the activities that were carried out, but also spoke about the impact of the activity that influenced them the most and the feelings they still experienced as a result. During the interview process, it was noted that students in the experimental groups responded to the questions with great enthusiasm and eagerness.

It has been observed that the responses of students in the control and experimental groups did not exhibit the same level of clarity, coherence, and quality. Results show that once the ISAA was implemented, students in the experimental group not only became more aware of, but also demonstrated development in their creative thinking and problem-solving skills. Findings revealed that, as a result of learning experiences in which both skills were utilized, students also showed development in areas such as identifying problems and proposing not only a single solution but also alternative solutions.

CONCLUSION and DISCUSSION

The findings of the research were tried to be interpreted by evaluating quantitative and qualitative information together in accordance with the order of the research questions focusing on creative thinking skills and problem-solving skills.

Interpretation and Discussion of ISAA in Terms of Creative Thinking and Problem-solving Skills Based on Pre-Test and Post-Test Scores

Analyses based on the pre-test and post-test total scores indicated that, following the fourteen (14) weeks of activities, students showed improvement in their creative thinking and problem-solving skills.

In the literature, science and art have been addressed as separate phenomena, or activities have been developed in which they are brought together. The disciplines of science and art have been considered within the scope of interdisciplinary studies; within art courses, subjects such as music and visual arts have been identified, while within science courses, subjects such as mathematics, science, and social studies have been included. This study goes beyond a course-based perspective on the disciplines of science and art and is an elementary-level study that focuses on integrating these disciplines Turkish, mathematics, life sciences, and science courses were all considered as science subjects, while visual arts and music courses were treated as art subjects, within a holistic perspective. The study aimed to approach science and art from a holistic and broad perspective. In this way, the content was diversified and structured to support the multidimensional development of the mind.

Each activity within ISAA possesses a spiral and holistic structure in itself. At the same time, each activity serves both as a complement to and a component of the activity that follows it. Gestalt, which maintains that "the whole is greater than the sum of its parts," served as the foundation for the design of the ISAA operations whereby students organize pieces of information in their own minds to construct their own meaningful wholes.

The tests used for assessment before and after the ISAA implementation were designed in the form of scenarios. Of these mini-scenarios used as pre-test and post-test, two were designed to measure creative thinking skills and two to assess problem-solving skills. At their core, the activities aim to develop the learner's potential, provide external stimuli that activate intrinsic motivation, and ultimately support awareness of the self, the environment, and the society in which they live. Efforts were made to stimulate the learner through activities designed to enhance creative thinking and problem-solving skills.

When students experience knowledge that they can apply in the objective world, their desire to learn increases along with their intrinsic motivation. Experiences such as conducting nature observations, conveying observations using associations and analogies, and interpreting an imaginary situation have significantly contributed to the development of students' creative thinking and problem-solving skills. This contribution has been particularly evident through practices such as note-taking, which can be considered one of the objective world skills, and simulation through nature observation. Note taking about their own observations enables students to establish meaningful connections between information and their experiences and to apply what they have learned more effectively in their daily lives (Akman & Senemoğlu, 2023; Burgin, 2020; Darling-Hammond et al., 2021). A student who makes an effort to learn in a free learning environment will also develop in terms of higher-order thinking skills. This is one of the reasons why associationalism—recognized among problem-solving theories (Bentham, 2006)—was incorporated into the activities.

The aim of ISAA is to broaden the individual's potential and to enable its effective use when needed. In this way, students who benefited from the activities stated that they felt excited, that they learned, and that they wanted to share their experiences with those around them (Eş, et al., 2015).

It is believed that one of the reasons why ISAA had such a significant impact on the development of creative thinking and problem-solving skills is its holistic approach to art education. Through this holistic perspective, it is important that students experience activities that enrich their cognitive structures, encourage them to put forth greater effort to succeed (Elliott, Kratochwill, Littlefield & Travers, 1996), and enable them to generate diverse and original ideas that stimulate their desire to explore.

Interpretation and Discussion of 3rd Grade Teachers' Opinions and Suggestions Regarding Integrated Science and Art Activities

Teachers who hold positive views of integrated science and art activities have particularly emphasized financial problems as a major constraint. International research similarly indicates that low-income levels and salary dissatisfaction limit teachers' participation in professional, social, and cultural activities, including attending artistic events and subscribing to academic and cultural publications (OECD, 2020; UNESCO, 2021). Likewise, Cantürk (2020) and Çakır İlhan (2003) reported that, due to these financial constraints and related challenges, teachers are unable to participate in many activities they wish to engage in. They explicitly expressed that, due to insufficient income, they were unable to actively engage in matters that could be considered social needs, such as attending an artistic event or subscribing to a publication. Teachers' expressions of dissatisfaction with their salaries and their inability to allocate money for social and cultural needs have also been documented in various other studies (Cantürk, 2020; Eğitim Sen, 2020; Özbek, 2020). Multifaced strategies that make teaching more appealing must be put into practice. Teachers' pay must be significantly increased to reflect inflation and the cost of living in order to remedy this (Yılmaz Yıldız, et al., 2025).

In order to expect a teacher to foster students' higher-order thinking skills, it is first necessary to examine what the teacher has done to develop these skills in themselves. A teacher who nourishes and develops themselves through various perspectives and disciplines can effectively meet the needs of their students. Scientific and artistic activities possess content and structure that encompass nearly all aspects of life. Therefore, when teachers are engaged in such activities, their imagination will first be enhanced, and this imagination will then serve as a catalyst for the development of their other skills. Aspects such as increased adaptability and the development of an aesthetic perspective are among other elements that support and stimulate higher-order thinking skills, and it is important for teachers to possess these qualities (IKSV, 2014).

Teachers expressed that they felt inadequate in the preparation and implementing of ISAA. Although ISAA, with its enriched and deepened structure, serves as an important tool for fostering a holistic perspective, teachers said that they felt inadequate in terms of both time and skills during the implementation phase, as well as in terms of allocating time for preparation. Tarı (2011) and İğci (2023) stated that teachers experience difficulties in areas such as structuring the learning and teaching process, determining and preparing the learning environment, and teaching art courses. Similar challenges have been widely reported in international studies, which indicate that many teachers feel insufficiently prepared to organize learner-centered instruction, create supportive learning environments, and effectively integrate arts education into their teaching practices (Eisner, 2002; Alter, Hays, & O'Hara, 2009). The investments made in teachers have a direct impact on the quality of the educational system. Enhancing and enhancing teacher education is essential in nations like Turkey (Yılmaz et al., 2025).

They stated that the activities in art classes cannot be completed within a single class hour, that artistic activities require time, and that they should also have a flexible structure. They emphasized that they avoid carrying out many activities due to the insufficiency of class hours (Çakmak & Türkcan, 2019; Gürdal, 2007; Yarımca, 2010). It is considered that the class hours allocated to music and visual arts, which are regarded as art courses, need to be reorganized. International studies indicate that teachers require additional instructional and planning time to design and implement activities that meaningfully integrate visual arts and music, as interdisciplinary and arts-based teaching involves complex preparation processes and workload

demands, particularly when aligning curriculum standards across subjects (Liow, et al., 2025; Wang et al., 2025; Winner, et al., 2013). Teachers stated that they need additional time to prepare activities that integrate visual arts and music, emphasizing that planning and preparation require a significant amount of time. It is known that teachers frequently use interdisciplinary activities by integrating different subjects in their lessons. However, transforming subjects into activities that foster higher-order thinking skills through a holistic perspective can only be achieved with sufficient time, appropriate materials, and knowledge of how to implement them.

Through their active participation in cognitive and social activities, students are able to construct knowledge more effectively (Türkoğuz, 2008). For this reason, teachers need to provide students with a learning environment that fosters the development of a sense of responsibility for their own learning processes (Baylor et al., 1996; Busbea, 2006). The inability to implement scientific and artistic activities should not be attributed solely to teachers. Teachers stated that they are tired of receiving poorly prepared training programs and that they wish to receive well-designed, high-quality in-service training; otherwise, they feel devalued and believe that the training fails to achieve its intended purpose (Akdeniz, 2021; Usal, 2021). It is important that teachers' needs and requests are not overlooked when designing in-service training programs. Ultimately, training that is not sufficiently well structured and does not take into account the teacher's views and suggestions can be a waste of time for the teacher.

During the interviews, classroom teachers were asked to provide examples of activities integrating science and art, but they struggled to answer this question. Before answering the question, they felt the need to consult with other teachers in the interview group. Once they exchanged ideas with one another, they began to list examples. In a similar study, Fleming (2007) stated that when teachers discussed and gained knowledge about fields such as science and art—which are strongly interconnected—their attitudes, perceptions, and learning regarding these seemingly separate concepts improved significantly, along with their sense of self-efficacy.

Classroom teachers have stated that the curriculum is intense and that having to complete it makes them feel "mechanized." The flexible and spiral structure of the curriculum should be strengthened in order to support teachers who structure the teaching-learning process according to the classroom and school climate, rather than becoming "mechanized." By eliminating the limitations stemming from the curriculum, content and practices that better meet students' needs should be prioritized and supported (Alanazi, 2020).

One of the implicit objectives of this study was to increase the teacher's awareness so that they can recognize their own potential and structure activities, particularly in classroom practices where the teacher tends to become objectified. This is because, particularly at the primary level, the classroom teacher is in a position to integrate art courses with all other subjects and, by using other disciplines more effectively, can further enhance the value of learning for students (Fleming, 2007; Immordino-Yang, 2008). For example, enabling a student who learns about the components of an electric circuit in a science lesson to write an essay on electricity generation and green energy in a Turkish lesson, and subsequently create a three-dimensional project, will also support the student in regulating their own learning. Research shows that such interdisciplinary and project-based learning experiences allow students to engage in meaningful problem-solving, influence change, and promote sustainable practices such as recycling (Aydın & Zümrüt, 2013; Hmelo-Silver, 2004). In addition, teachers' competencies in analyzing problems, using problem-solving models, identifying alternative solutions, and reflecting on the results of their solutions also increase (Arslan & Şahin, 2025). Moreover, by drawing on art's capacity to enhance intrinsic motivation, studies indicate that artistic engagement positively influences ethical awareness, value education, and learners' enthusiasm and prosocial behavior, thereby serving as a powerful tool for fostering creativity and intrinsic motivation in interdisciplinary learning contexts (Winner, et al., 2013; Eisner, 2002; Hetland et al., 2013).

Interpretation and Discussion of 3rd Grade Students' Opinions and Suggestions on Integrated Science and Art Activities

Students were asked about an activity they had participated in related to science and art, and they responded by mentioning activities at school for which they had to pay to participate. They did not provide any examples from outside of school. Economic difficulties pose a barrier to participation in activities for students and teachers at the primary, secondary, and higher education levels (Çakır İlhan, 2003; Yazar, et al., 2014). Eliminating this barrier would be a significant step in favor of supporting students' development.

It is observed that, following the experimental intervention, students in the experimental group developed an increased awareness of science and art. The same level of development cannot be observed in the students of the control group. Students in the experimental group were able to define science and art, express their feelings about the content. Şahin and Alakuş (2014) found that art classes that actively engage students enhance their motivation to learn and academic achievement, contribute positively to the development of aesthetic and critical thinking skills, support creativity, and foster self-confidence and positive career expectations. International research confirms these findings and shows that art education and integrated arts instruction can increase students' motivation to learn; enhance their cognitive engagement, creativity, and academic outcomes; and develop the emotional and motivational aspects of learning (Robyn, et al., 2014; Gerber, et al., 2024; Yarmakeev, et al., 2021).

It is evident from the responses of students in the experimental groups that they have internalized the stages of problem-solving. Students were able to understand the nature of the problem, propose solutions, list alternative solutions, consider the feasibility of their suggestions, and evaluate the appropriateness of the proposed solutions. Various studies have also demonstrated that, through integrated activities, students can be more easily motivated to engage with the lesson, their interest and attention increase, they begin to develop a positive attitude toward learning, and they enhance their higher-order thinking skills (Elliot, 1999; Smith, 1999; San, 2019).

Art courses are referred to as key subjects in the improvement of creative thinking and problem-solving skills. From the perspective of this study, it has been demonstrated that integrating science courses with art courses yields a significant impact. There are numerous studies that have concluded art education plays a important part in the development of higher-order thinking skills and contributes to the enhancement of creative thinking and problem-solving abilities (Duman & Aybek, 2003; Gardner, 1999; Graham & Robinson, 2007; Inwood, 2013; Tavin, 2003; Wigert, 2013).

Increasing the number of class hours for art courses alone will not be a sufficient reform. Students also need to be introduced to subject-matter knowledge through which they can acquire scientific process skills. When there is a lack of sufficient subject-matter knowledge, creativity cannot be fully expressed either (Özdemir, 2012). In addition, various studies have shown that, alongside visual arts and music, courses related to play, dramatization, and theater should also be included in primary school art education, as traditional school practices alone do not yield the desired outcomes (Yazar, et al., 2014; Paek, 2020).

Human beings strive to understand and interpret the world they live in from different perspectives (Ayaydın, 2006). This search for meaning in life turns the individual inward and can give rise to the need to express, convey, reflect, or demonstrate their emotions to others by using movement, sound, line, color, or words as a medium (Karaman, 1991). This situation has moved beyond being merely an individual need and has now emerged as a necessity within the scientific community as well. This is because the value of presenting scientific data through an aesthetic and critical lens has increasingly been recognized for its unique contributions (Dambekalns, 1997). For example, the use of an aesthetic perspective plays a significant role in studies such as interpreting images obtained during space exploration or determining the underground structure of a deep cave. This need has moved beyond being merely individual and has now emerged as a

recognized necessity in educational and scientific communities, where creativity and emotional literacy are increasingly valued (Craft, 2005; Robinson, 2011). In this study, ISAA provided students with a free and open learning environment, enabling them to express their thoughts comfortably and openly without hesitation. Diversification of learning environments is vital in this context. There is an expectation that students who possess creative thinking and problem-solving skills—those capable of producing diverse, flexible, and unconventional responses—will play a significant role in shaping the structure of society (Deleuze, 1997; Yacoubian, 2022).

ISAA incorporates selected experiential moments from the student's everyday life. Students who were able to connect theoretical knowledge with real-life applications in the learning environment were thus able to take full ownership of the entire activity process (Şanlı & Somuncuoğlu Özerbaş, 2021). Students demonstrate the desired level of development when provided with a thinking environment that nurtures and encourages their intuition (Fenli Aktan, 2022; Hickey et al., 2006; Türe, 2007; Yılmaz Gündüz, 2023). Direct interaction with materials enhances students' enjoyment of and satisfaction with the activities. In the interviews, students emphasized the excitement of learning they experienced and highlighted that they were able to experiment freely while having fun. In this way, they were able to relate their own discoveries to scientific concepts without anxiety and develop their own scientific understanding (Günther Hanssen, 2020). This is because when students can physically interact with an object, they explore it guided by feelings such as familiarity, strangeness, attraction, or aversion (Boulet, 2020).

The data demonstrate that ISAA provided students with a free and innovative space in which they took ownership of their own learning, and that this led to the desired level of development in higher-order thinking skills. An additional benefit of ISAA is that it gives students the chance to compare their work with that of their peers in order to improve their own efforts and to observe the concrete outcomes of their dedication. It is believed that greater attention should be directed toward the potential of science education integrated with art education to better serve the needs of the new generation of students.

Suggestions

The integrated nature of science and art, as well as the contributions of maintaining this integration to both students and teachers, is an issue that requires further investigation. The way for teachers to gain this awareness and to learn how to structure such activities is through in-service training and guiding materials. It is believed that a material that demonstrates sample activities and contributions will facilitate the teacher's work and bring them closer to implementing integrated activities.

Another recommendation is the provision of resources that teachers may need during implementation—such as maps, experimental materials, examples of cultural elements, musical instruments, easels, paints, etc.—as this is important in terms of enhancing the contribution and impact of the activities.

It is recommended that the existing discounts offered by official institutions, such as state theaters, for science and art activities be expanded through agreements with various organizations, institutions, and private enterprises.

All educational resources that students are exposed to should—ranging from visuals and fonts to page layout—be designed in a way that supports the development of an aesthetic sensibility. Decisions that support the development of aesthetic understanding should be made and reflected in these materials.

It is recommended that specific programs and classroom activities be designed to integrate science and art, and that targeted research and development be conducted to evaluate and enhance their effectiveness.
It is recommended that ISAA be further developed using distinct research designs across different

age groups, with a focus on systematically examining its relationship with various higher-order thinking skills.

Collectively, these recommendations aim to enhance the effectiveness, accessibility, and educational impact of Integrated Science and Art Activities, fostering both students' higher-order thinking and aesthetic development while supporting teachers in implementing these practices effectively.

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