

## Art integration applications in middle school 5<sup>th</sup> class science lesson

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Article Info	Abstract
<p>Research Article</p> <p>Received: 26 February 2021 Revised: 11 April 2021 Accepted: 23 April 2021</p> <p><b>Keywords:</b> Arts integration, Art education, Science education, Science-arts collaboration, Education through art</p>	<p>The purpose of the study is to determine the effect of the use of artistic practices in different curriculum areas on learning skills. For this reason, a plan for the art integration method has been created to be applied in the subjects determined in the science course. The research was conducted with fifth-grade students studying at a public secondary school in Samsun. Consisting of 40 students, the study group was divided into two halves as the experimental and the control group, each containing 20 persons. Research data was collected by a Science Achievement Test prepared by the researcher accompanied by an expert opinion. The findings show that using the art integration method in science course increases student success. Compared to the posttest of the experimental and control groups, it was found that the success rate of the experimental group was significantly higher than that of the control group. The research findings indicate that; art integration have a potential to contribute teaching other subjects. Besides some other suggestions were made in relation with curriculum design and policy making.</p>

### 1. Introduction

The removal of interdisciplinary boundaries by combining arts with other subject areas in the curriculum has been a remarkable approach recently observed in many countries. Art integration emerges as an educational method proving the importance of art in this transformation with its ability to develop learners' cooperation, communication, creative and critical thinking skills. This method, whose foundations date back to the 20th century, has been developed on the basis of theories of constructivism, interdisciplinary teaching and multiple intelligence. Studies in the field of art integration revealed that it increases student motivation and ensures the subsistence of what have been learnt.

The most common difficulties faced by teachers in education and training processes are to attract students' attention, to ensure their active participation in the lessons, and to keep up their attention alive throughout the learning time. So, educators and administrators seek creative alternatives to deal with these challenges in a constructive way. Art has the potential to shape and transform the learning experience for students. However, most educators are not familiar to the integration of art into other subject areas.

From this point of view, it is necessary to develop higher-order thinking skills in students in order to obtain and use information. It is stated in the statutory curriculum prepared by the Ministry of National Education for all school subjects that the aim of the schooling is to raise individuals who can produce the information/knowledge, use it effectively in life, take her/his own decisions, solve problems, think critically, be initiative, have communication skills, empathize and be ready to contribute to society and culture. Art integration as a teaching method that has been practiced and studied various places and has received appropriate feedback in return. However, it is not widely practiced in educational institutions in Turkey. Henceforth, the current study aims to draw attention to art integration and to provide detailed information about its practice in real teaching/learning settings.

Art integration is a teaching and learning method that aims to provide real and creative lessons that help students to connect and transfer knowledge between multiple concepts and subject areas, including various forms of art

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(Burnaford, Aprill and Weiss, 2001). Arts integration practices aim to facilitate arts and other subject areas to achieve their goals together. In fact, practitioners may use arts integration to reach the two subject areas (arts and others) and their educational goals simultaneously, or they can use art as a tool to achieve the educational goals of other subject areas. In this study, the effect of using art integration method in science course on student success was investigated. Science achievement test which was designed by researcher was used to measure cognitive achievement.

## 2. Literature

Art has been featured in school programs on different reasons at different times in many parts of the world. Both popular causes and social needs have been decisive here and shaped art education (Kırıçoğlu, 2009). As those who support the arts continue to offer strong evidence between art education and student achievement educators continue to develop instructional strategies to integrate art into the entire school curriculum (Holcomb, 2007). Because visual arts are recognized to develop mental processes related to language, imagination, perception and planning. These processes cover elements such as knowing, remembering, judging, problem solving, and meta-cognition. It is also thought that being engaged in art provides a deeper conceptual understanding and has effects that enhance some mental function (Blatt-Gross, 2010; Duggan, 2007; Land, 2013).

In addition, art supports the social development of the individuals. It forms the basis for developing skills to adapt to society, to work collaboratively and to communicate effectively. Many studies show that there is a positive relationship between participation in artistic processes and academic achievement (Deasy, 2002; Hetland and Winner, 2001; Catterall, 2009; Catterall et al., 2012). A research study published by the National Association for Arts Education, shows that the integration of art into the school curriculum helps students understand different perspectives, take risks safely, express their feelings freely and make connections between art and other core subject areas. In this context, it has been concluded that the art integration method increases academic success (Lynch, 2007).

A study conducted by Cohen and Johnson, which examined the effect of drawing on understanding topics and concepts, reached positive conclusions. By means of this quasi-experimental study, researchers obtained evidence that scientific concepts and words can be significantly learned permanently through drawing. The authors concluded that what is important is not to make the best drawing, but to be involved in that process (Johnson & Cohen, 2013). Besides this, various studies on the principles of the brain's operation support the presentation of information in various contexts through concrete experiences, as it increases coding variability (Custers, 2010, Degen 2014, Rinne et al., 2011). Studies has shown that the motor cortex is activated when the brain is engaged in problem solving, which comprises cognitive components such as memory, emotion, language and active learning (Hardiman, 2010).

### 2.1. Art integration method

Studies on the working principles of the mind, have been revealed that those teaching techniques addressing multiple senses help learners' processes and store more information in their long-term memories (instead of short-term) and potentially alter the structure of neurons (Smilian, 2004; Latham, 2017; Sparks, 2013; Sousa and Pilecki, 2013; Bolotta, 2017; Marollo, 2014; Dorminey, 2015; Maneen, 2016; Gobert and Clement, 1999; Roth, Bowen and McGinn, 1999). All these means that the art integration method allows different disciplinary areas in school curricula to come together in a common practice process.

Although there is no universally accepted definition of the concept of art integration, it can be seen that the sources mention a multidisciplinary curriculum, interdisciplinary studies and integrated learning in relatively interchangeable terms. Silverstein and Layne (2010) describe arts integration as an approach to teaching in which students construct and demonstrate understanding through an art form. The main driving force behind integrated teaching and learning is the belief that students begin to see meaningful connections between subjects when themes, subjects or projects are combined.

In generally, the integration process is a rigorous intellectual and creative activity in which artists and teachers are actively engaged (Botstein, 1998). Before applying art integration, it is necessary to plan the following steps (Burnaford et al., 2001):

- Build a team and vision,
- Learn from each other,
- Try new skills,
- Find problems and ask questions,

- Brainstorming and planning together,
- Find and use access points.

There may be several reasons for integrating art into other subject areas. The art integration method can be used in order to achieve the goals of both fields or to benefit from the characteristics of the nature of art while achieving the goal of the other curriculum areas. It is the educators who will make the decision. The evaluation to be made at the end of the process will also be shaped accordingly.

## 2.2. Art and science integration

Although art and science seem to be two completely different fields, they actually share many common concepts and goals. In both disciplines, we stand to study nature closely, visualize our observations, and record and express what we have discovered. Harvey Seifter, an expert on art-based learning, suggests that art has the sparks to transform science education (Robelen, 2011). Greene, on the other hand, says that the student will see, feel, and understand information or object better thanks to its features such as animating the imagination, creating dialogue, and introducing multifaceted perspectives (Greene, 2014). The value of the integration of art and science is based on the power of visual symbols in scientific communication, documented through the ages since Da Vinci. This relationship between two fields has continued across history and global boundaries, from African bronze and smelting practices to early Renaissance pigment experiments (Jerez, Dambekalns & Middleton, 2012). Yenawine, on the relationship between art and science "...art feeds us in a unique way because it combines ideas, knowledge and emotions. I think that when our minds and hearts work together, it nourishes the soul" (Feldman, 2003: 47). The fact that those interested in science and having an artistically creative imagination may be able to develop new ways of thinking and to be innovative (Rosen-O'leary, 2018).

Recently, educators in the teaching of Arts and Sciences have been using these two disciplines for similar purposes. Many studies (Chessin and Zander 2006; Shaw, Baggett, Daughenbaugh et al. 2005) have concluded that by integrating art into the science course, students will be able to experience and develop communication and problem-solving skills, feeling within the identity of a scientist or artist. In addition, this collaboration also supports the creativity of students and a better understanding of scientific concepts (Eisenkraft et al., 2006). Because learning can occur not only orally and in writing, but also in different ways, such as visual and auditory. Also, visual presentations improve the cognitive aspects of what students learn in points such as "long-term memory and recollection" (Peeck, 1993). In addition, students with advanced problem-solving abilities in the literature, experience, and there are studies that have identified that easily integrate new information with previous information (Gobert and Clement, 1999; Roth, Bowen, and McGinn, 1999). However, there are a limited number of resources and implementation studies related to this method in Turkey. From this point of view, our research is important to be a reference to the practices that can be done in Turkey.

Consequently, the purpose of this research study is to determine the effect and effectiveness of teaching two subjects selected from the 5<sup>th</sup> grade middle school science course curriculum through plans and practices prepared in accordance with the art integration method, in transferring the related attainment targets to students. In this context, the current study aims to answer the following questions:

- 1) Does the teaching the topics of biodiversity and electrical circuit elements through the art integration method make a significant difference on the academic achievements between the experimental and control groups?
- a) Did the study conducted in the biodiversity unit create a significant difference between the experimental-control groups in the pre-test-post-test scores?
- b) Did the study conducted in the Electrical Circuit Elements unit make a significant difference between the experimental-control groups' pre-test and post-test scores?

## 3. Methodology

### 3.1. Research design

In this study, which uses quantitative research method, the science achievement test was used. Creswell defines quantitative research as "the process of collecting, analyzing, interpreting, and writing the results of a study" (Creswell, 2002: 9). There are several reasons why the quantitative research method was chosen in this study. These are the ability to achieve objective results, to achieve statistical clear data, and to compare between experimental-control groups. It is important that we obtain statistical data to measure the impact of the art integration method

on student achievement in order to achieve a clearer result. The study is an experimental study, as it is planned to measure the impact of the art integration method on student success. Designed as a quantitative method study, this research aims to examine the impact of art integration practices on the academic achievements of middle school 5th graders in Science class. Data obtained from the pretest and posttest applied to the experimental and control groups constitute the of the research. After the pretest, the determined subjects were taught with art integration method in the experimental group, while it was taught in usual or conventional teaching-learning method in the control group. After then, the posttest was applied to the experimental and control groups.

### 3.2. Research sample

The research was conducted with 5<sup>th</sup> grade students and lasted in seven weeks. The experimental study was carried out in a class comprising of 20 students in the spring semester of the 2018-2019 academic year. There were also 20 students in the control group who were also taught by the same science teacher. Both groups were selected in accordance with the accessible case sampling technique.

### 3.3. Research instruments and procedures

As a data collection tool, The Science Achievement Test prepared by the researcher with expert opinions was used. A pilot study was conducted for the validity and reliability of the scientific success Test prepared by the researcher. After the validity - reliability study, questions with low reliability were removed. It was then applied to experimental and control groups as pretest and posttest.

### 3.4. Process of art integration method

The art integration process was designed and carried out by the researchers, who were supported by two science education specialists. It included these steps:

Study units	
Biodiversity	Electrical circuit elements
<ul style="list-style-type: none"> <li>• Providing background information about the study unit</li> <li>• Dividing students into groups</li> <li>• Subject teacher informing students about question and answer method</li> <li>• The teacher giving students a research assignment on the subject</li> <li>• Students choose which theme to work on</li> <li>• Starting to design biotope using design elements with bandmate</li> <li>• Make model studies with what they have learned about biodiversity</li> <li>• Making a presentation to introduce their works at the end of the process</li> </ul>	<ul style="list-style-type: none"> <li>• Providing background information about the study unit</li> <li>• Visual overview of electrical circuit elements</li> <li>• Explaining the principle of light bulb combustion and informing about the art of 'led-art'</li> <li>• Students using their imagination to draw a Picture on the theme 'garden of your dreams'</li> <li>• Designing invitation cards for an imaginative party that will be given in their school garden</li> <li>• Students drawing their pictures using design elements</li> <li>• Drawings are combined with electrical circuit elements</li> <li>• Making a presentation to introduce their works at the end of the process</li> </ul>

### 3.5. Data analysis

Item analysis were made to examine the validity and reliability of the achievement test for the analysis of quantitative data. The test shaped according to the results of the analysis applied to the experimental and control groups. Within this process, two-way analysis of variance (ANOVA) test was used, which enables the comparison of the results of two measurements made intermittently (repeated) in the experimental and control groups. The assumptions of the analysis method were examined before performing the analysis of variance. Accordingly, Shapiro-Wilk test showed the normality of the assumption, Box's M test covariances and Levene test showed that variances were homogeneous. ITEMAN 3 and SPSS 23 software were used for analysis.

### 3.6. Validity and reliability

Item analyses were conducted to examine the validity and reliability of the 43-question Success test created in accordance with the relevant curriculum and expert opinions. For this reason, the developed test was applied to 144 students who attending 6th class selected from secondary school random. According to the results of the item analysis, questions which item discrimination less than 0.30 were excluded from the test (6, 8, 19, 20, 12, 15, 17, 22, 40). Although questions with a substance distinction between 0.20 and 0.30 can be corrected and the test can be taken, these substances were also removed from the analysis because there are enough questions that sample the subject in the test. The analysis was repeated with the remaining 34 items.

In the last case, the arithmetic mean of the test was calculated as  $25.125 \pm 5.616$ . The reliability coefficient of the test was 0.836. In the field of social science, it seems that our test is a reliable measurement tool, since the reliability of a test is 0.70, which is seen as a sufficient level of reliability for that test. The average difficulty of the test is 0.739 indicating that the test is easy, while the level of differentiation is 0.571, which indicates that the test is sufficient to distinguish between successful students and unsuccessful students.

#### 4. Results

The findings of this study are presented to find out answers for the research questions stated above.

- 1) The first sub-problem of the study includes testing whether the teaching of secondary school 5th grade science and visual arts lessons through art integration method creates a significant difference between groups (experimental-control). For this purpose, each unit were analyzed separately.
  - a) Did the study conducted in the biodiversity unit create a significant difference between the experimental-control groups in the pre-test-post-test scores?

In order to answer this question, a two-way analysis of variance test was used for mixed measurements, which allowed the differences between the results of two measurements made intermittently (repeated) in two different groups to be compared with each other according to the experimental and control groups. In order for this test to be used, there should be no significant difference between the covariances of the groups for pairwise combinations of measurement groups. Box's M test results showed that this assumption was met ( $p > 0.05$ ). Secondly, the variances of the pre-test and post-test results in the experimental and control groups should be homogeneous. Levene test results showed that the equality of variances was achieved in both groups ( $p > 0.05$ ). Another important assumption of the analysis is the normal distribution of the pretest and posttest measurements of the variables for the experimental and control groups. According to the results of the Shapiro-Wilk test, it was seen that this assumption was provided for the pretest scores ( $p > 0.05$ ) but not for the posttest scores ( $p < 0.05$ ). When the posttest scores were examined, it was seen that the mean and median values were close to each other. Beside this, the average and the average values trimmed from the 5% ends are also very close to each other. In addition to this situation, two-way ANOVA for mixed measurements, besides being a powerful parametric analysis method, gives correct results even when the data show deviations from the normal (Green and Salkind, 2005). For these reasons, it was decided to use the analysis and the results in Table-1 were obtained.

Table 1. Two-Way ANOVA test results for mixed measures for biodiversity unit

	Type 3 Error Sum of Squares	Degree of Freedom	Mean of Squares	F	p
Within-Group					
Measurement	125.000	1	125.000	63.716	.000
Measurement * Group	8.450	1	8.450	4.307	.045
Error (Measurement)	74.550	38	1.962		
Between Groups					
Intersection	7220.000	1	7220.000	705.749	.000
Group	11.250	1	11.250	1.100	.301
Fault	388.750	38	10.230		

According to Table 1, when the 20 people in the class in which the art integration method was used and the other 20 people in the class where the same subjects were conventionally taught were taken as a whole group, it was seen that the average posttest scores of all students were higher than the pretest scores [ $F(1-38)=63.716$ ,  $p < 0.01$ ]. It was seen that being in the class, where art integration was applied, made a significant contribution to the students' scores [ $F(1-38)=4.307$ ,  $p < 0.05$ ]. There is no significant difference between the total pre-test and post-test scores of the experimental group and the control group's pre-test and post-test scores ( $F(1-38) = 1.100$ ,  $p > 0.05$ ). The test findings obtained as a result of art integration method in comparison with the control group given in Table 2.

Table 2. Descriptive statistics for biodiversity unit

	Pre-test			Post-test		
	N	$\bar{X}$	S	N	$\bar{X}$	S
Control	20	8.20	2.38	20	10.05	2.52
Experiment	20	8.30	2.56	20	11.45	2.42

According to table 2, the preliminary scores of the experimental group ( $x=8.20\pm 2.38$ ) were after application ( $x=10.05\pm 2.52$ ), while the preliminary scores of the control group ( $x=8.30\pm 2.56$ ) were after application ( $x=11.45\pm 2.42$ ). As a result, the use of the art integration method in the course has a significant effect on students' success in learning the topic of biodiversity. This increase is graphically have shown in Figure 1.

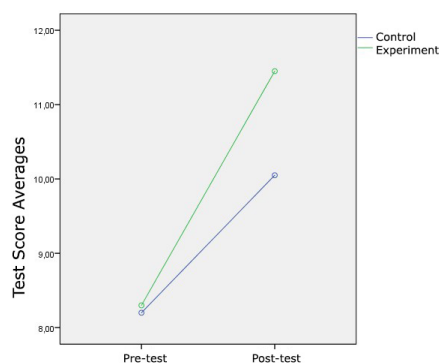


Figure 1. Changing scores of experimental and control groups for biodiversity unit

When Figure 1 analyzed, it is seen that the art integration method is more effective on the success level of biodiversity than the conventional teaching/learning applications.

- b) Did the study conducted in the Electrical Circuit Elements unit make a significant difference between the experimental-control groups' pre-test and post-test scores?

In order to find an answer to this problem, a two-way analysis of variance test was used for mixed measurements, which allowed the differences between the results of two measurements made intermittently (repeated) in two different groups to be compared with each other. In order for this test to be used, there should be no significant difference between the covariances of the groups for pairwise combinations of measurement groups. Box's M test results showed that this assumption was met ( $p > 0.05$ ). Secondly, the variances of the pre-test and post-test results in the experimental and control groups should be homogeneous. Levene test results showed that the equality of variances was achieved in both groups ( $p > 0.05$ ). Another important assumption of the analysis is the normal distribution of the pretest and posttest measurements of the variables for the experimental and control groups. According to the results of the Shapiro-Wilk test, it was seen that this assumption was provided for the pre-test and post-test scores of each group ( $p > 0.05$ ). Since all the assumptions of the analysis were provided, it was decided to use this technique and the results in Table 3 were obtained.

Table 3. Two-Way ANOVA Test results for mixed measurements for electrical circuit elements unit

	Type 3 Error sum of squares	Degree of freedom	Mean of squares	F	p
Within-Group					
Measurement	312.050	1	312.050	139.259	.000
Measurement * Group	9.800	1	9.800	4.373	.043
Fault (Measurement)	85.150	38	2.241		
Intergroup					
Intersection	11568.050	1	11568.050	802.530	.000
Group	7.200	1	7.200	.499	.484
Fault	547.750	38	14.414		

According to Table 3, the posttest scores of all students were higher than the pretest scores ( $F(1-38) = 139.259$ ,  $p < 0.01$ ). Being in the group where art integration was applied made a significant contribution to the students' scores compared to those in control group ( $F(1-38) = 4.373$ ,  $p < 0.05$ ). There is no significant difference between the total pre-test and post-test scores of the experimental group and the control group's pre-test and post-test scores ( $F(1-38) = 0.499$ ,  $p > 0.05$ ). The test results obtained have shown in Table 4.

Table 4. Descriptive statistics for electrical circuit elements unit

	Pre-test			Post-test		
	N	$\bar{X}$	S	N	$\bar{X}$	S
Control	20	10.10	2.22	20	13.35	3.47
Experiment	20	10.00	2.68	20	14.65	3.03

According to Table 4, the pretest scores of the experimental group ( $\bar{X} = 10.10 \pm 2.22$ ) increased substantially after the application ( $\bar{X} = 13.35 \pm 3.47$ ) while the pretest scores of the control group were ( $\bar{X} = 10.00 \pm 2.68$ ) were increased slightly ( $\bar{X} = 14.65 \pm 3.03$ ). As a result, it has been seen that using the art integration method in science teaching has a significant effect on students' success in learning about electrical circuit elements. This increase is graphically have shown in Figure 2.

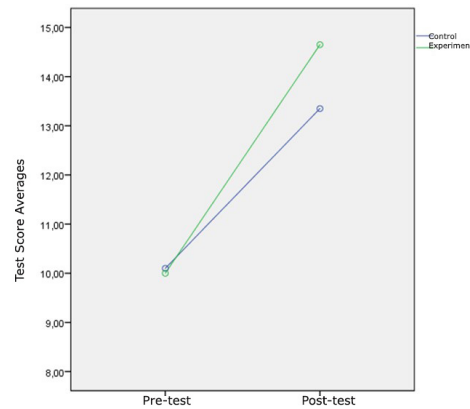


Figure 2. Changing scores of experiment and control groups for electrical circuit elements unit

Figure 2 reveals that the scores of the experimental group increased more than those of the control group. In other words, the art integration method has been more effective on the success level of the electrical circuit elements subject than the conventional mode of science teaching

## 5. Discussion and conclusion

In this study, knowledge testing was applied before and after the application in order to obtain data on whether the art integration made a significant difference in students' academic achievement in science. It was found that there was a significant difference between two groups in favor of the experimental one. A two-way variance analysis test was used for mixed measurements that allowed the differences between the results of two measurements performed intermittently in two different groups to be compared with each other according to the experimental and control groups. As a result of the two-way ANOVA test, it was found that the posttest of both groups were higher than the pretest. But the increase rate in the experimental group is significantly higher than the increase rate in the control group. Applications on biodiversity and electrical circuit elements were evaluated separately. When the subject of biodiversity was examined, being in the group used in art integration made a significant contribution to students' scores compared to those not in the other class. In other words, the art integration method has been more effective on the level of achievement in biodiversity class than normal teaching.

According to the results of the analysis for the subject of electrical circuit elements, the scores of the experimental group again increased more than those of the control group. Although there was no significant difference between the sum of the pre-test and final-test scores of the experimental group and the sum of the pre-test and final-test scores of the control group, it was found to be more effective in teaching subjects than formal teaching. This finding supports the results of Knight Foundation's (2011) research concluding that "participation in arts programs has a positive relationship with increased academic achievement compared to the performance of students without art education" and other studies reporting a positive relationship between participation in artistic processes and academic achievement (Deasy, 2002; Hetland and Winner, 2001; Catterall, 2009; Catterall et al., 2012).

The mental freedom, imagination and motivation expected from the student may only be formed with the correct guidance of the educators. While learning by doing provide students long lasting outcomes, education processes based on rote learning may not remain in their long-term memories (Hutzel, 2007: 34). In addition, previous research found that in educational processes including art related activities and methods, students improve problem-solving abilities and easily integrate new information with previous information (Gobert and Clement, 1999; Roth, Bowen and McGinn, 1999).

In creative thinking, the student produces a variety of ideas about possible ways to solve a problem, often by breaking it down into its components and looking for new perspectives on the problem (Sousa and Pilecki, 2013). Practices related to visual arts that students do in a science course enable them developed creative thinking skills

through intensive cognitive efforts. It can say that one of the reasons why the experimental group was more successful than the control group in the posttest is the development of these skills. Besides, the researchers suggest that it is important for students to know how they experience the world around them, and note that to support this goal, science education can be built on aesthetic and artistic pedagogical practices. DeMoss and Morris (2002) examined the effect of art education on cognitive development in their study. Their findings suggest that art may play an important role in children's learning and overall cultural attainment, providing links with academic work that may have implications for more positive and long-term learning motivation.

The findings also indicate that students enjoyed working, collaborating and communicating more closely with their friends in the processes of art integration. The project works like the one in art integration process help students achieve certain things like being patient, managing the process, expressing themselves, taking responsibilities and working cooperatively. Many studies (Baker, 2013; Rinne and et. al, 2014; Potter and Edens, 2007) examining the impact of art on cognitive development and learning reported similar results. Furthermore, these studies argue that long-term memory of knowledge is associated with art-based teaching, which overlaps the results of the current study.

One of the problems that the teachers of various subject areas are trying to solve today is to keep their students interested and be active in the learning processes. Creative thinking, producing, designing, planning, discovering new things and etc. that can commonly be seen in art related works may be some functional ways for attracting students' attention. Previous research (Davis, 2018; Lok, 2014) proves that art positively affects students, which was also highlighted in the results of this study. Likewise, Randolph's research, completed in 2016, shows that the art integration method increases student self-awareness, social interaction, self-sufficiency, communication, and empathy skills.

The art integration method is a teaching method in which creative activities are added to the educational processes involving combining one of the art areas such as music, dance, drama, painting or sculpture with other curricular areas such as mathematics, science, geography, history, literature or chemistry. The fact that the science course is one of the curriculum areas that gives the most place to visual materials and visual learning is one of the reasons why it was chosen for the art integration method in this research. This study will contribute to literature in terms of its potential to serve as an example of how the arts can collaborate with other curriculum areas. In addition, this study will contribute to literature in terms of its potential to serve as an example of how the arts can collaborate with other curriculum areas. It is a process that requires creativity and cooperation that different curriculum disciplines benefit the student through common application processes. There are not many sources in the local literature where the "art integration" method is applied in science courses and its results are analyzed. In this context, the results of our research are important for guiding researchers and practitioners.

## **6. Recommendations**

Arts integration is about a methodology and a philosophical approach to education that builds meaningful classroom activities through a creative inquiry-based teaching and learning process. The art integration method is a process in which the researcher is also a practitioner. For this reason, application and research processes developed together. In this context, the recommendations of the research are aimed at both researchers and practitioners.

Researchers, practitioners or educators who want to use this method should pay attention to these issues:

- While planning the teaching, they should take the characteristics of the students into account.
- They should explore this method in depth and start from the right point.
- They should work collaboratively with the subject teachers.
- They should remember that they are in the roles of a mentor or a guide in these processes.
- Before using the art integration method, they should analyze well how they will evaluate the lesson plan. They need agree to learn together with the students as this is journey to take together.
- They should focus on real-life problems rather than solving a designed problem, which may increase the credibility of the process.

This study also has some implementations related educational policy making and the actors of this process:

- It should be known that the educational materials that a teacher uses most in the classroom attract the student's interest and motivate them to actively involve in learning processes.
- In order to plan the inclusion of the art integration method in the curriculum, the opinions of teachers working in the relevant subject areas should also be considered.



- There is no suitable ground for adding and executing the art integration method to the current school curriculum, but it should be realized that it is needed.
- In-service training activities related to art integration needs to be planned, designed and organized.

### **Author contribution statements**

N.D. Dinç and Ç.İ. Karahan contributed equally to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

### **Disclosure statement**

No potential conflict of interest was reported by the authors.

### **Ethics committee approval**

This research has ethics committee approval from Ondokuz Mayıs University with 28.03.2019 date and 2019-105 number. All responsibility belongs to the researchers. All parties were involved in the research of their own free will.

### **References**

- Baker, D. (2013). Art integration and cognitive development. *Journal for Learning Through the Arts*, 9 (1), 1-15.
- Blatt-Gross, C. (2010). Casting the conceptual net: cognitive possibilities for embracing the social and emotional richness of art education. *Studies in Art Education*, 51 (4), 353- 367.
- Bolotta, A. (2017). Exploring art and science integration in an afterschool program, department of curriculum. Unpublished Master thesis, University of Toronto, USA.
- Botstein, L. (1998). "What role for the arts?" *W.C. Ayers and J. L. Miller (eds.) in: A light in dark times: Maxine Greene and the unfinished conversation*. (s. 62–70), New York: Teachers College Press.
- Burnaford, G., Aprill, A. & Weiss, C. (2001). *Renaissance in the classroom: Arts integration and meaningful learning*. Chicago: Routledge Press.
- Catterall, J.S. (2009). *Doing well and doing good by doing art: the effects of education in the visual and performing arts on the achievements and values of young adults*. Los Angeles/London: Imagination Group/I-Group Books.
- Catterall, J.S., Dumains, S.A. & Hampden-Thompson, G. (2012). The arts and achievement in at-risk youth: findings from four longitudinal studies: Research Report. file:///C:/Users/Lenovo/Desktop/The\_Arts\_and\_Achievement\_in\_At-Risk\_Youth\_Findings.pdf Retrieved July 10, 2019.
- Chessin, D. & Zander, M.J. (2006). The nature of science and art. *Science Scope* 29(8): 42–6.
- Creswell, J. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Merrill Prentice Hall.
- Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education*. Routledge Press, New York.
- Custers, E. (2010). Long-term retention of basic science knowledge: A review study. *Advances in Health Science Education: Theory & Practice*, 15 (1), 109-128.
- Davis, R.S. (2008). *Exploring self and cultural identities through an interdisciplinary model of art education an illustrated case study and heuristic inquiry*. Unpublished PhD thesis, University Cincinnati, Ohio, USA.
- Deasy, R. J. (2002). *Critical Links: Learning in the Arts and Student Academic and Social Development*. Washington DC: Arts Education Partnership. Creative Education.
- Degen, R. (2014). *Brain-Based Learning: The neurological findings about the human brain that every teacher should know to be effective*. Portugal: Amity Global Business Review.
- DeMoss, K. & Morris, T. (2002). *How arts integration supports student learning: Students shed light on the connections*. Chicago, IL: Chicago Arts Partnerships in Education (CAPE).
- Dorminey, S. J. (2015). *Arts-integration in a middle grades social studies classroom*. Unpublished Master thesis, Georgia Southern University, Georgia.
- Duggan, T. (2007). Ways of knowing: exploring artistic representation of concepts. *SAGE Journals*, 30 (4), 56-63.
- Eisenkraft, A., Heltzel, C., Johnson, D. & Radcliffe, B. (2006). Artist as chemist. *The Science Teacher*, 73 (8), 33-35.
- Feldman, R. (2003). *Art-science integration: portrait of a residency*. Unpublished PhD thesis, University of Illinois, Chicago.
- Gobert, J. & Clement, J. (1999). Effects of student-generated diagrams versus student generated summaries on conceptual understanding of causal and dynamic knowledge in plate tectonics. *J. of Research in Science Teaching*, 36 (1), 39-53.

- Green, S. B. & Salkind, N. J. (2005). *Using SPSS for Windows and Macintosh: Analyzing and understanding data*. New Jersey: Pearson.
- Greene, M. (2014). Teaching the art of “wide-awakeness”. *Independent School*. 74 (1), 122- 126.
- Hardiman, M. (2010). “The creative-artistic brain”. D. Sousa (eds.). in: *Mind, Brain, and Education: Neuroscience Implications for the Classroom* (s. 226-246), Bloomington, IN: Solution Tree Press.
- Hetland, L. & Winner, E. (2001) The Arts and Academic Achievement: What the Evidence Shows. *Arts Education Policy Review*. 102 (5), 3-6.
- Holcomb, S. (2007). *State of the arts*. National Education Association. Retrieved February 3, 2014, from: <http://www.nea.org/home/10630.htm>
- Hutzel, K. (2007). A service-learning approach to teaching computer graphics. *Art Education*. 60(1). 33-38.
- Jerez, W.M., Dambekalns, L. & Middleton, K.V. (2012) Art and science education collaboration in a secondary teacher preparation programme. *Research in Science & Technological Education*, 30:2, 209-224.
- Johnson, K. A. & Cohen, A. B. (2013). *The relation between religious and national cultures*. V. Saroglou (eds.). in: Religion, personality, and social behavior (s. 338- 360), New York, NY: Psychology Press.
- Kırışoğlu, O. T. (2009). *Sanat kültür yaratıcılık: Görsel sanatlar ve kültür eğitimi öğretimi*. Ankara: Pegem Akademi.
- Knight Foundation (2011). *What we fund*. <https://knightfoundation.org/programs/arts/> Retrieved January 3, 2019
- Land, M.H. (2013). Full steam ahead: the benefits of integrating the arts into STEM. *Procedia Computer Science*. 20, 547-552.
- Latham, K. (2017). *Integrating art into the classroom: a necessary component of a well-rounded education*. Unpublished Honors thesis. Western Kentucky University, USA.
- Lok, M. (2014). *Integrating the visual arts into writing: effects on student learning and engagement*. Unpublished Master thesis. University of Toronto, USA.
- Lynch, P. (2007). Making meaning many ways: An exploratory look at integrating the arts with classroom curriculum. *Art Education*. 60 (4), 33-38.
- Maneen, C.A. (2016). *A case study of arts integration practices in developing the 21st century skills of critical thinking, creativity, communication, and collaboration*. Unpublished PhD thesis, Gardner-Webb University, North Carolina, USA.
- Marollo, L.A. (2014). *Integrating art + STEM: an exploratory study of three science centers*. Unpublished Master thesis, University of Washington, USA.
- Peeck, J. (1993). Increasing picture effects in learning from illustrated text. *Learning and Instruction*, 3 (3), 227-238.
- Potter, E. & Edens, K. (2007). The relationship of drawing and mathematical problem solving: "draw for math" tasks. *National Art Education Association, Studies in Art Education*. 48 (3), 282-298.
- Randolph, D. (2016). *Arts integration curriculum: building relational capacities, doctor of philosophy in the culture*. Unpublished PhD thesis, University of North Carolina, USA.
- Rinne, L., Yarmolinskaya, J. & Hardiman, M. (2011). Why arts integration improves longterm retention of content. *Mind Brain and Education*. 5 (2), 89-96.
- Robelen, E. W. (2011). *STEAM: Experts Make Case for Adding Arts to STEM*. Retrieved June 9, 2020 from: [http://www.ed-week.org/ew/articles/2011/12/01/13steam\\_ep.h31.html?r=842095516](http://www.ed-week.org/ew/articles/2011/12/01/13steam_ep.h31.html?r=842095516)
- Rosen-O’Leary, R.C. (2018). *Effect of visual art integration on long-term retention of science content*. Unpublished PhD thesis, University of Hofstra, New York, USA.
- Roth, W.-M., Bowen, G.M. & McGinn, M.K. (1999). Differences in graph-related practices between high school biology textbooks and scientific ecology. *Journal of Research in Science Teaching*. 36 (9), 977-1019.
- Shaw, E.L., Baggett, P.V. & Daughenbaugh, L.R. & Santoli, S. (2005). From boxed lunch to learning boxes: An interdisciplinary approach. *Science Activities* 42(3), 16–24.
- Silverstein, L. B., & Layne, S. (2010). What is arts integration? Chapter in Silverstein, L., Duma, A. L., and Layne. S. Arts Integration Schools: What, Why, and How (Tab 2, pp. 1-7), Washington, DC: The John F. Kennedy Center for the Performing Arts/Changing Education Through the Arts (CETA) program.
- Smilian, C.A. (2004). *The impact of art integration as an intervention to assist learners’ visual perception and concept understanding in elementary science*. Unpublished Master thesis, Florida Atlantic University, Florida, USA.
- Sousa, D.A. & Pilecki, T. (2013). *From STEM to STEAM: Using brain-compatible strategies to integrate the arts*. Thousand Oaks, CA: Sage.
- Sparks, S. (2013). *Rethinking arts integration within a 21st century high school setting*. Unpublished Master thesis, University of Florida, Florida, USA