

**Confronting Contemporary  
Educational Challenges  
Through Research**

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## Teaching modern sculpture to primary school students: Implementation and evaluation of an intervention using virtual museums

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### ABSTRACT

*The study presents the results of a pilot project in which the main objective was to teach concepts related to modern sculpture through virtual museums. For that matter, the three main representatives of modern sculpture, namely Brancusi, Modigliani, and Tziakometti, were selected. The target group was 50 sixth-grade primary school students, divided into an experimental and a control group. In the experimental group, students developed their own virtual museums, without the guidance of their teacher, by means of a friendly-to-use on-line application. In the control group, conventional learning material were used and the teaching method was also conventional. Data were collected by means of evaluation sheets, pre- and delayed post-tests and a questionnaire. Results indicated that students in the experimental group outperformed students in the control group in all the evaluation sheets and in the delayed post-test. Finally, the implications of the findings for education are also discussed.*

**Keywords:** Arts education, Artsteps, Virtual museums

### INTRODUCTION

In recent years, efforts have been made to improve the quality of education by creating new and attractive learning environments with the use of ICT applications, including virtual museums. However, in Greece, the educational reality is essentially delineated within a digital divide. On one hand, the integration of ICT into education is very slow. On the other, the new generation of students is accustomed to thinking and learning in digital environments that are highly interactive and fast paced. This dichotomy emphasizes the need to radically change the established teaching/learning framework and to reshape the whole educational process.

With regard to the course of Arts Education, it can be argued that it is particularly degraded although art, as a highly creative and expressive activity, signifies the human experience (Vaos, 2008). Given its uniqueness and the fact that it is addressed to particular functions of the human mind, this course cannot be easily substituted with any other subject (Eisner, 2002). According to the Greek curriculum for primary education, the general purpose of Art Education is to acquaint the students with all forms of art, so as to become critical viewers of art as well as creators of art. However, the knowledge that is offered is mainly of a technical nature, which is enriched with minimal to nonexistent information from the history of art (Alter, Hays, & O'Hara, 2009). As a result, the Arts Education is transformed into nothing more than a skill training lesson. This fact reduces the pedagogical value and shrinks its impact, leading to marginalization (Vaos, 2008).

On the other hand, Arts Education and ICT have common elements in both their philosophy and the benefits they provide to children (Kim, Coluntino, Martin, Silka, & Yanco, 2007). So, finding ways so as ICT can be integrated into the teaching of Arts Education is an interesting research field, since they share common learning theories and, in both, hands-on experiences are quite important (Savvaidou-Kampouroupoulou, 2007). In other countries, greater emphasis is placed on an interdisciplinary approach to art and technology. In Greece, however, such comprehensive proposals are generally scarce (Kim et al., 2007). Nevertheless, some interesting implementations do exist that had interesting results (Grosdos, Makarantzis, & Andreadou, 2010). It has been found that the combination of art and ICT effectively enhances learning in an experiential, holistic manner, but also strengthens students' critical thinking (Grosdos et al., 2010). The use of virtual museums, in particular, presents an interesting case, since the learning outcomes are promising when combined with students' teamwork (Papachristou, Vorvi, & Kokkinou, 2016).

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Taking the above into consideration, the question that arises is whether, through the development of virtual museums, by the students, it is possible to achieve better learning outcomes when teaching elements from the arts' course and in particular the history of art, in relation to other conventional teaching methods. For examining the above, a short pilot project was designed and implemented. Its rationale, methodology, and results are presented in the coming sections.

### **VIRTUAL MUSEUMS**

A virtual museum can be defined as a collection of digitized objects and views through a service, such as the Internet, where visitors can access using an electronic device (Fragaki, 2010). It can include a wide variety of elements, such as information and three-dimensional objects, providing rich experiences to users (Moldoveanu, Moldoveanu, Soceanu, & Asavei, 2008). So, if the designing of a virtual museum is based on certain learning principles, it functions as a catalyst for: (a) the dissemination of information (Glitsi, Zafeirakou, Kakourou-Chroni, & Pipikopoulou-Tsolaki, 2002), (b) learning in relation to what is experienced and known through contrast or comparison, motivation, and interest (Shouten, 1983), and (c) the interaction with the exhibits, which have the potential to inform visitors (Hooper-Greenhill, 1996).

In a museum's environment, when are students visiting it, there is the potential to build new cognitive schemes based on past experiences and perceptions, by exploring and interacting with a variety of objects in a collaborative and relaxed learning environment (Anderson, Piscitelli, Weier, Everett, & Tayler, 2002). Falk and Dierking (2000) argue that visiting a virtual museum is an experience as complex as a tour in a real museum since both choices are related to the free will of the visitor. The environment of a digital museum provides learning experiences to students, develops their skills and competencies, provides knowledge and information and is based on the learners' free will for learning (Kisiel, 2003).

In general, the use of virtual environments in education is based on the theories of constructivism and sensory ergonomics, focusing on the experiential acquisition of knowledge and enhancing the student's experiences (Mikropoulos & Natsis, 2011). Relevant studies have shown that virtual environments stimulate imagination and lead to knowledge-building. This is because these environments are imposed on the real ones and overcome the limitations of the natural environment (Martin, Diaz, Sancristobal, Gil, Castro, & Peire, 2011). The presentation of the content using multimedia elements and the virtual museum's ability to interconnect the object with the information seems to overcome the traditional methods of communication and interaction and responds in a better way to the needs and interests of the users (Martin, et. al., 2011).

The ArtSteps (<http://www.artsteps.com/>) is of great interest among the many art programs that are available for building virtual museums. It provides a three-dimensional environment, in which the user can configure and add his/her own data and information. The fact that it is in Greek and especially simple to use allows its use from students of younger ages. Research has shown that it enables the implementation of complex activities in a playful way and promotes the unified knowledge (with cross-curricular activities) that are difficult to implement by conventional means (Bouboureka, 2013). As a guided discovery and exploration software, it contributes significantly in designing interesting and innovative activities within the framework of the theoretical model of constructivism and the principles of exploratory, experiential, interactive, and collaborative learning (Κόμης, 2004; Kress, 2003). In a relevant research for evaluating Artsteps in the learning process, the results were particularly encouraging; the development of information processing and not just the memorization of the learning subject was observed (Papachristou et al., 2016).

### **METHODOLOGY, ORGANIZATION AND IMPLEMENTATION OF THE PROJECT**

As it has been shown from the previous section, linking Art Education with virtual learning environments can benefit the learning process. Thus, it was quite logical to wonder what the learning outcomes might be if virtual museums were used for teaching art's history to primary school students. In order to examine this, a short pilot project was designed and implemented. The teaching/learning subject that was selected was modern sculpture. Accordingly, the following research questions were formed:

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- H1: Students who develop their own virtual museums perform better compared to students who are taught conventionally.
- H2: The sustainability of knowledge is also better.
- H3: Students develop positive attitudes and perceptions regarding the use of virtual museums in their teaching.

For the purpose of the research, an educational intervention was carried out in two groups, one experimental and one control group. The experimental group used ArtSteps in order to develop virtual museums. The control group was taught conventionally. Sixth-grade primary school students (ages 11-12) were the target group. The initial sample size was 56 students coming from two neighboring schools in Rhodes, Greece. Each teaching method was assigned randomly to the classes that were involved. Before the beginning of the interventions, students' parents were informed for the purposes of the study and they provided their written consent for the participation of their children. Also, teachers were informed not to teach the modules included in the project in no other way than the one that was envisaged to each group.

The three main exponents of modern sculpture, namely Brancusi, Modigliani, and Giacometti were selected as the teaching/learning subject. It should be noted that modern sculpture was selected as it constitutes a very small part of the curriculum in primary education (indicatively in the sixth-grade there are no corresponding sections in the school textbook). The choice of teaching these three artists, apart from the fact that there were important representatives of modern sculpture, was based on the fact that Giacometti was already been taught in the fourth grade. As already mentioned, the target group was sixth-grade students. This is because, at this age, students are able to engage in complex artistic activities that enable them to broaden their artistic and spiritual horizons. On the other hand, students of this age often encounter difficulties in understanding concepts related to art and even more in the field of sculpture, but also have the inability to express an opinion and to adopt scientific knowledge (Eisner, 2002).

For each session (one introductory and one for each artist), two teaching hours were allocated so as students to have enough time to create their virtual museums. Regarding the way that students worked, the collaborative teaching method was applied. That is because collaborative pedagogical activities that take place in a digital environment and combine self-action, communication, interaction, feedback, and interdisciplinarity, tend to maximize the benefits of technology in the classroom (Chapman & Cope, 2004). Thus, students were divided into groups of four (with the exception of a group with five members) having a common computer at their disposal.

The purpose of all these was, through the gradual development of virtual museums, students, under the guidance of their teacher, to acquire an overall view of modern sculpture, as well as to get to know the three artists, their works, the characteristics of their techniques, and, finally, to be in a position to compare these artists with each other. In order to achieve this, the development of the virtual museums was done in four stages. In the first, students chose the structure of the virtual museums' rooms and the colors. They placed a portrait of each artist downloaded from the Internet, accompanied by information, which was also downloaded from the Internet, in a central spot in each of the three rooms. In next three courses, in each room, students chose representative works of each artist, they placed the relevant images on the walls and added information for each one of them (technique, influences, etc.) that were also able to find on the Internet.

The implementation of the experimental process did not require the installation of the application as it is an online program. During the course, students were able to browse the program and use it as they wished. Even more importantly, the selection of the works and the relevant information were purely their own, acquiring the control of the museum's layout and the presentation of the artists' works. It should be noted that during the creation of virtual museums the teacher had a consultative role in order to allow students to have more autonomy (Lampert, 1990). In addition, it has been found that students rarely accept something ready without evaluating it, especially when it is not theirs or when the outcome seems to be

wrong and not close to their own expectations (Sakonidis, Kaldrimidou, & Tzekaki, 2002). At the end of the last session, each team was invited to present their virtual museums to the rest of the class.

Since there are no sections in the school textbook regarding the three artists, it was necessary to develop the relevant material for the control group. Thus, a booklet was written having four modules with the following themes: (a) Modern art and sculpture, (b) Knowing Brancusi, (c) Knowing Modigliani, and (d) Knowing Giacometti. In the group that was taught conventionally, the teacher presented the modules and students studied from the booklet. In this group, the duration of each teaching was also two hours. Students worked in groups and they were able to discuss and cooperate.

For the collection of the research data, the following were used:

- Pre-test, in order to trace the students' prior knowledge of modern art and sculpture.
- Course evaluation sheets, given after the end of each session to check whether students assimilated everything they were taught. They included multiple choice, matching questions, but also questions where students had to express an opinion, as well as compare the works of the artists that were taught.
- Delayed post-test, given fifteen days after the completion of the courses, to check the sustainability of students' knowledge. Its configuration was the same as the evaluation sheets, but it included questions from all the modules.
- Evaluation questionnaire. At the end of teaching, a short questionnaire (15 Likert-type questions) was administered to students in the experimental group to investigate their views and opinions regarding the whole process.

## RESULTS

A number of students had to be excluded from the study because they were absent in one or more teaching sessions. Thus, the final sample size was 50 students, divided into 2 groups of 25. Group0 represents the team that was taught conventionally, while Group1 represents the group of students that was taught using the virtual museums. For the analysis of the results in evaluation sheets (including pre- and delayed post-tests), these were scored on the basis of their correct answers. The mean scores for each group of participants and per evaluation sheet are presented in Table 1.

**Table 1.** Presentation of the results in the evaluation sheets

	Group0		Group1	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pre-test	15.85	2.24	15.04	2.68
Evaluation sheet 1	12.46	3.15	16.14	3.56
Evaluation sheet 2	14.19	3.33	17.20	2.95
Evaluation sheet 3	13.55	2.29	16.78	3.05
Evaluation sheet 4	11.98	4.55	15.05	3.12
Delayed post-test	15.85	3.89	19.46	3.14

One-way ANOVA tests were to be conducted to compare the scores of the two groups in all tests, in order to determine if they had any significant differences. Prior to conducting these tests, it was checked whether the assumptions of ANOVA testing were violated. It was found that: (a) all groups had the same number of participants ( $N = 25$ ), (b) there were no outliers, (c) the data was normally distributed in all tests, as assessed by Q-Q plots and Shapiro-Wilk test, and (d) the homogeneity of variance was not violated in all tests, as assessed by Levene's Test of Homogeneity of Variance. Since all assumptions for ANOVA testing were met, the analysis was conducted. It was found that:

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- Pre-test. The mean score of Group0 ( $M = 15.85, SD = 2.25$ ), was not statistically significantly different than that of Group1 ( $M = 15.04, SD = 2.68$ ) [ $F(1, 48) = 1.34, p = .252$ ].
- Evaluation sheet 1. The mean score of Group0 ( $M = 12.46, SD = 3.15$ ), was statistically significantly different than that of Group1 ( $M = 16.14, SD = 3.56$ ) [ $F(1, 48) = 14.98, p < .001$ ].
- Evaluation sheet 2. The mean score of Group0 ( $M = 14.19, SD = 3.33$ ), was statistically significantly different than that of Group1 ( $M = 17.20, SD = 2.95$ ) [ $F(1, 48) = 11.44, p = .0014$ ].
- Evaluation sheet 3. The mean score of Group0 ( $M = 13.55, SD = 2.29$ ), was statistically significantly different than that of Group1 ( $M = 16.78, SD = 3.05$ ) [ $F(1, 48) = 17.93, p < .001$ ].
- Evaluation sheet 4. The mean score of Group0 ( $M = 11.98, SD = 4.55$ ), was statistically significantly different than that of Group1 ( $M = 15.05, SD = 3.12$ ) [ $F(1, 48) = 7.74, p = .008$ ].
- Delayed post-test. The mean score of Group0 ( $M = 15.85, SD = 3.89$ ), was statistically significantly different than that of Group1 ( $M = 19.46, SD = 3.14$ ) [ $F(1, 48) = 13.04, p < .001$ ].

Taken together, these results suggested that:

- Both groups had the same knowledge level prior to conducting the research since they did not have statistically significant differences in the pre-test. As groups had the same initial starting point, any differences observed in the participants' knowledge acquisition after the interventions, can be attributed to the different teaching methods that were followed.
- Students who developed virtual museums outperformed students in the other group in all cases, including the delayed post-test.

As a result of the above, H1 and H2 were confirmed.

Students made positive remarks regarding their experiences while developing their virtual museums. More specifically:

- They learned quite easily to use the application ( $M = 4.16, SD = 0.92$ ).
- They learned quite easily to navigate into the 3D space ( $M = 4.29, SD = 1.17$ ).
- They considered the application fun to use ( $M = 4.25, SD = 1.24$ ).
- They liked that they worked in groups ( $M = 4.05, SD = 1.44$ ).
- They stated that they learned a lot ( $M = 3.88, SD = 1.15$ ) and quite easily ( $M = 4.01, SD = 1.25$ ).
- They would like more subjects to be taught using virtual museums ( $M = 3.90, SD = 1.50$ ).
- They faced no significant problems ( $M = 2.15, SD = 1.06$ ).
- They faced no significant problems regarding their collaboration with their fellow students ( $M = 1.56, SD = 1.39$ ).

Some indicative responses to the relevant questions were:

*It was fun because we were able to make our own Museum.*

*It was fun because we had a great time and learned a lot.*

*I really liked that we built the Museum together with my classmates because we had not done this before.*

*I learned a lot about modern art and the sculptures and would like to know more.*

*It was very nice that we did a lesson in a different way and we learnt new things that until now we did not know.*

On the basis of the above, H3 was confirmed.

## DISCUSSION-CONCLUSIONS

From the analysis of the data, interesting results regarding the performance of students were observed. It should be noted that there was a very low starting point, as shown in the pre-test, so an improvement was expected regardless of the teaching method that was used. Indeed, the progress of students in both groups was visible by naked eye after the teachings. Thus, the essential question to be answered was which of the two teaching methods had better learning outcomes. The statistical analysis demonstrated

that the use of virtual museums produced statistically better learning outcomes compared to a conventional teaching with the same content, as other researchers also noted (Chen, 2006).

The better learning outcomes can be attributed to the fact that virtual museums allowed students to be engaged in activities that encouraged active experimentation, decision making, critical thinking and creative thinking, express themselves in synergy, and build on their own knowledge (Giakoumatou, 2008). Indeed, the way the research was organized, with Artsteps, enabled students to freely select and use the works of the artists, without memorizing data as usually required, which helped them to build the new knowledge.

Also, Artsteps was used as a mental tool but also as a source of information, search, reflection, work and communication. Thus, the appropriate background was formed that enabled students to develop skills relevant to visual arts, such as locating, sorting, managing, analyzing, comparing information, and works, while helping learners get closer to the use of dynamic learning tools as other researchers had pointed out (Kinigos & Dimaraki, 2002). In addition, the learning outcomes may be due to the fact that the software that was used took into consideration parameters such as environmental veracity and interaction (Avouris, 2001). So, students were able to create their own virtual museums in their own research area after selecting a collection of exhibits from different sources (Chalatsis, 2000). This resulted in even greater flexibility and independence.

The teaching approach that followed also contributed. It is generally believed that collaborative methods achieve good cognitive results. Rahn and Kjaergaard (2014) believe that learning based on group work is more effective and there is a deeper understanding of the phenomena being studied. The significance of findings can be fully realized if we take into consideration that the teacher in Group1 has an advisory role. It seems that the increased students' autonomy led to better learning outcomes, as it has been supported by other researchers (Hong, McGee & Howard, 2000).

What should be emphasized is that in the delayed post-test Group1 significantly outperformed the other group, which leads to the conclusion that using the virtual environment offered a better retention of knowledge over time, as North and North support (2016).

Finally, from the relevant questions in the questionnaire administered to Group1, two findings emerged. First, no problems regarding the use of the application were noted. Young people are adept technology users; they can easily assimilate the use of technology and ICT applications (Beheshti 2012). Second, students stated that the lessons were enjoyable, useful, and helped them understand the subject they were learning. These views confirm the findings of numerous studies that concluded that the use of ICT tools is an enjoyable experience, that contributes to the learning outcomes (e.g., Snell & Snell-Siddle, 2013; Wojciechowski & Cellary 2013).

Although the results are considered positive, there are some limitations that need to be acknowledged. The sample size was 50 students from Rhodes, Greece. The sample, although sufficient for statistical analysis, was limited, both numerically and geographically. Thus, the generalization of the results is difficult. Teaching was limited in only three artists; the inclusion of more artists would have allowed a deeper understanding of the problem. Finally, the data collection tools that were used imposed another limitation. The use of observations and/or interviews would have allowed the recording of more accurate and detailed data.

Further studies can include more teaching subjects and/or more students in order to confirm the findings of the present study or to identify significant differences. The inclusion of younger or older students would be interesting. Future studies can have different content as regards to the choice of artists and a different teaching methodology.

In conclusion, the need to adapt and modernize the teaching of Arts Education and to unravel it from conventional approaches is unquestionable. The shift towards a systematic teaching through virtual museums that students develop by themselves is a promising alternative. By doing so, students' creative and synthetic ability can be enhanced, together with the development of social skills and positive attitudes towards all kinds of visual arts.



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