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Hands-on and digital origami "trip": the case of a visual arts workshop in Higher Education

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Abstract: The present study refers to an origami workshop of visual arts activities and interdisciplinary research, implemented during COVID-19 pandemics in online distance education in Higher Education. The aim of the workshop was to engage pre-service preschool teachers in origami activities which should then be used and implemented in activities mainly in early childhood and primary education. The paper presents: a. the structure and the content of the workshop with activities by hand and in digital form, and b. the students' responses regarding their experience and perceptions about origami based on quantitative data. The results revealed that the interplay of physical and digital art and space composed an inter-media origami experience with various potential implementations in education.

Keywords: Origami, Visual arts, Digital technologies, Interdisciplinary research.

1. Introduction

Origami (折り紙, Japanese word from ori, oru, which means "fold" + kami which is "paper") is a paper folding technique which produces two-dimensional and three-dimensional decorative geometric shapes in the form of animals, plants, figures, objects, geometrical compositions etc. Origami's origin is obscure and there are many beliefs about the first paper folds in human history as well as about the first origami. According to Nishida (2019) paper and paper-folding were imported from China to Japan in the 7th century and since then they have become integral parts of Japanese history and culture. The Japanese origami origin is associated, although with no clear evidence, with folded noshi as well as with ocho and mecho butterflies used for bottle decoration in feasts. The samurai warriors' tradition is also connected with origami as folded wrapping paper for samurai's gifts. (Hatori, 2011) There were also Japanese zig-zag origami creations, named gohei, and origami in the form of human figures, called katashiro, which were put in Shinto temples for sacred reasons (Lang, 1989).

Western origami's origin is traced in the square paper folds by Friedrich Fröbel or Froebel. Fröbel was also the inventor of the idea of the kindergarten as a place for activities and play for preschoolers (Best, 2016, Fröbel, 1887). He introduced folding paper techniques in his kindergarten in Germany (Shashi, 1992). His folding paper crafts took his name as Fröbel

shapes. The Basic Fröbel Shape is used for the construction of medallions, stars and other ornaments with crosses and symmetries. (Täubner, 2012).

This paper presents an origami workshop of visual arts activities and interdisciplinary research, which took place during COVID-19 pandemics in online distance education settings. The aim of this workshop was to offer knowledge and skills to undergraduate pre-service preschool teachers about origami which should then be used and implemented in activities mainly in early childhood and primary education.

2. Methods

2.1. The structure and content of the origami workshop

The origami workshop was developed in three consecutive courses in an Early Childhood Education department of a University in Greece. Most of the participants were second-year students, but there were also third-year students and fourth-year students (graduands). The workshop was developed in three phases: a. introduction to the history, art and applications of origami, b. hands-on and digital origami creative experience and c. reflection and feedback on the creations, evaluation of the workshops.

2.2. Preliminary activities

The **flipped classroom** training methodology was preliminarily put into place for the origami workshop. The students had been informed through the asynchronous platform about the subject of the workshops and they were asked to research in advance of the synchronous virtual class (Tucker, 2012: 82) the history of origami as well as origami constructions. Instructions in videos and written text along with a list of indicative links were provided beforehand by the author/instructor/facilitator and students could choose to make their own origami constructions.

Thus, many students had already been informed on origami history and technique before the implementation of the workshop. In this way learning was extended out of the classroom which, in turn, was turned upside down, and this led to gain quality time (Milman, 2014: 9) in the synchronous virtual classroom where the author/facilitator could immediately delve deeply into origami technique and its interdisciplinary potential.

2.3. Origami workshop – Introduction

The workshop was initiated with an origami "trip" by Mooser's Rigid Train starting from Japan (origami's most recognised country of origin) and ending in Greece (the country of the workshop's implementation) on Google Maps (Figures 1 and 2). Other "stations" of this "trip" involved: China, the country where paper was invented; Germany, where Fröbel introduced symmetrical origami shapes; and Switzerland, which is where Emmanuel Mooser's origami train diagrams were made (Nolan & Mooser, 2013). By seeing the Mooser's train as an example of origami construction, as well as its "trip" from Japan to Greece with other countries as intermediate "stations", students were better introduced to the history and the possibilities of origami. Furthermore, students got familiar with Geography through Geospatial Technologies (GSTs).

Then a **lecture** was given by the author with regards to origami history and applications in various fields including art and education. A **discussion** followed about the interdisciplinary character of origami.

2.4. Hands-on origami experience

In the online classroom the author/instructor/facilitator made a **demonstration** of the steps to make an origami butterfly. Students were plunged into a **hands-on origami experience** and made their own butterflies by following the instructions. Except for the butterfly, they could also choose to make their own origami constructions.

Figure 1 Anastasia Zoi Souliotou, 2021, origami "trip" at the beginning of the workshop by Mooser's Rigid Train on Google Maps starting from Japan.

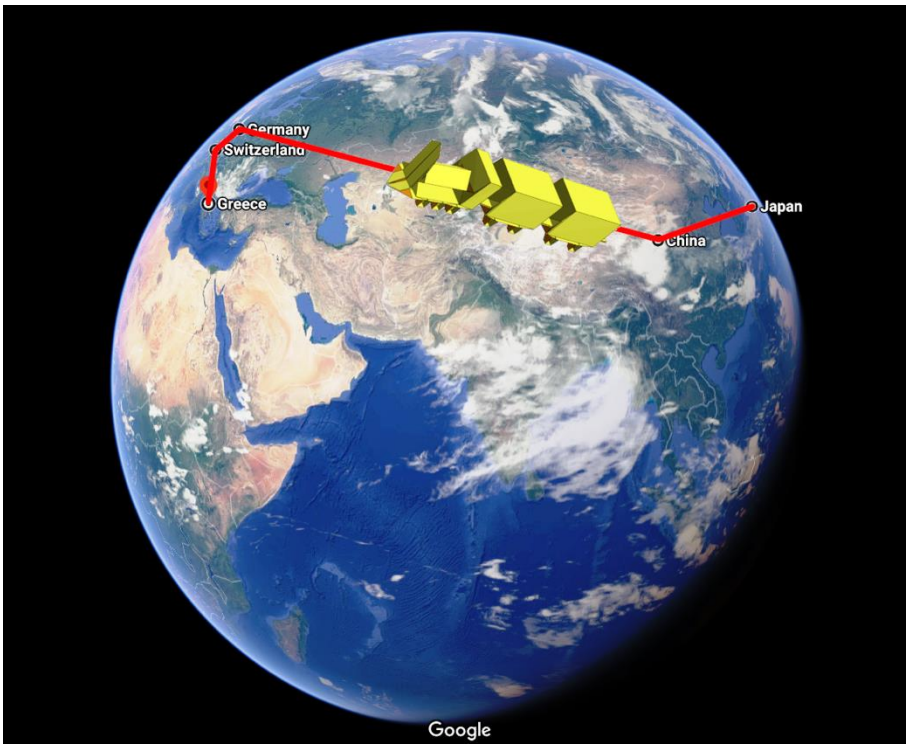

Figure 2 Anastasia Zoi Souliotou, 2021, an origami "trip" by Mooser's Rigid Train on Google Maps from Japan to Greece with the intermediate "stations" China, Germany and Switzerland.

In this way a more **student-centered approach** was adopted letting, thus, students make their own choices. **Experiential learning** and **learning by doing** were at the core of origami workshops.

2.5. Digital origami experience

The **digital origami experience** involved the making of animated pictures in the form of Graphic Interchange Formats (GIFs), as well as stop-motion animation with students' handmade constructions. Furthermore, students became acquainted with the origami animations by Shigeru Okada, as well as the

origamisimulator.org (Ghassaei, Demaine & Gershenfeld, 2018) digital tool and its possibilities for manipulation and creation of origami digital animations.

Figure 3 Origami flapping bird on top of Kasimir Malevich's *Black Square* (1915), snapshot from student's digital origami animation, 2021.

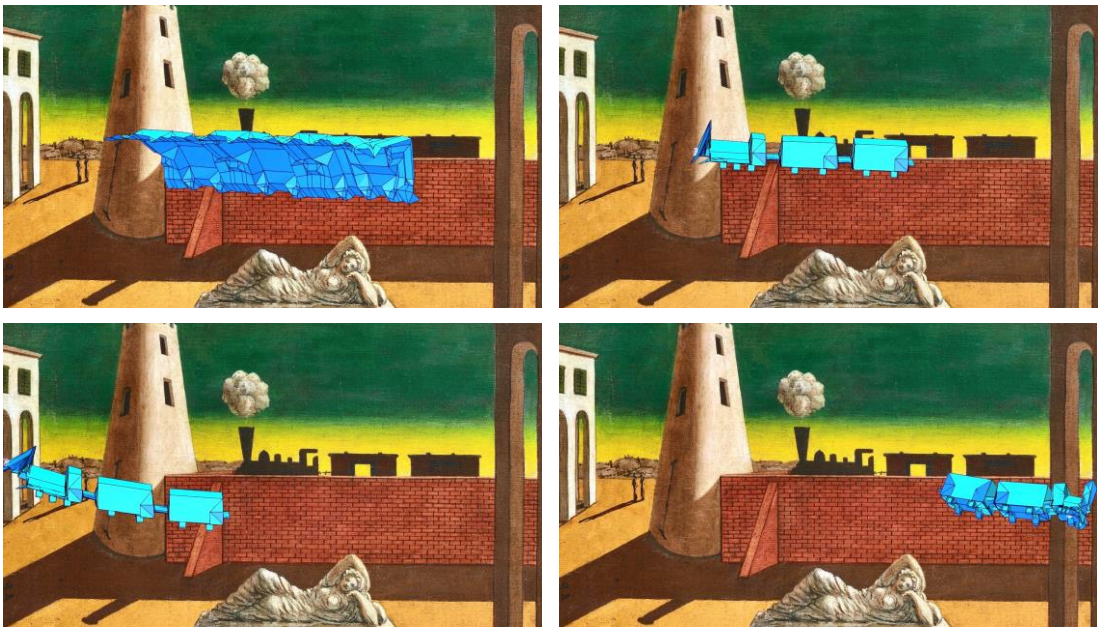

Figure 4 Anastasia Zoi Souliotou's origami animation with Mooser's Rigid Train on top of Giorgio De Chirico's painting *Piazza d'Italia*..

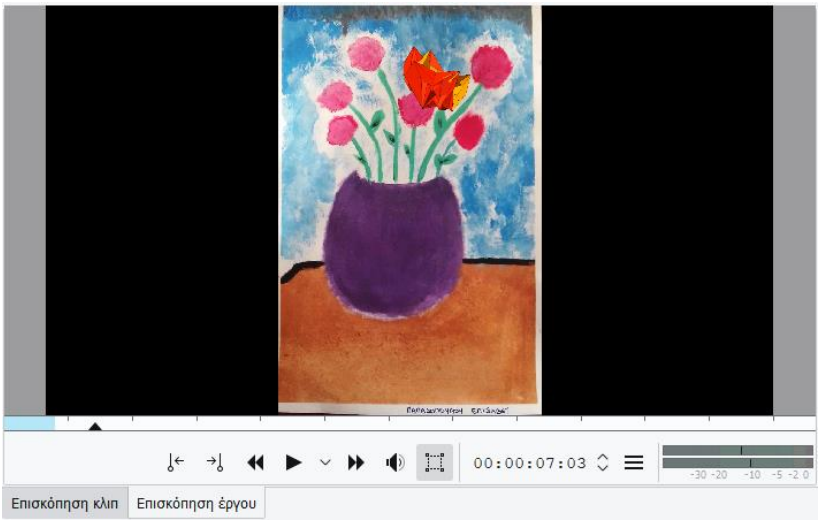

Figure 5 Digital experiment with origami flower on top of a student's painting.

They, then, expressed their need to put these animations on top of other images or videos to create stories or allegories.

For the above digital activities a series of **demonstrations** were made by the author/instructor/facilitator in order for students to learn the digital tools (video editing software, animated pictures, converters and origami simulator) and make digital origami animations.

Figures 3 and 4 are examples of digital origami animations with appropriation/adaptation of famous paintings. In Figure 3 a greenish origami flapping bird appears on top of Kasimir Malevich's *Black Square* (1915) which is considered as the "zero point" in the painterly history (El Lissitzky, 1977: 25 as cited in Forgács, 2003: 56). The power of the piece lies on the coexistence of contradictory forces in terms of media and abstraction: the handmade painterly with the digital; the black background in contrast with the greenish luminous bird; the inanimate black square in contrast with the animated origami bird.

Figure 5 is a digital experiment in video-editing software in the synchronous virtual classroom with an animated origami flower on top of a student's painting. Figure 4 shows author's digital collage and animation of a Mooser's Rigid Train on top of Giorgio De Chirico's painting *Piazza d'Italia.* The train in De Chirico's paintings appears behind a wall (De Chirico, Munck, 2009) as the only, or one of a few signs of life. It is exactly this sense of life that the origami digital animation augments by moving along the canvas.

Thus, the origami animation on top of paintings or other images (e.g. photos) augments the reality (re)presented in the image and endows the background image with the digital aesthetics of folding and unfolding colourful digital origami geometry.

3. Results

During the workshops implementation discussions were made about origami in Greek education. Many students declared verbally in the synchronous virtual classroom that they had never been taught origami before entering the Higher Education.

After the implementation of the visual arts origami workshops, some students declared verbally that they were inspired by origami workshops and carried out origami activities in their neighborhoods with children in the stage of early childhood.

Beyond these discussions, an electronic questionnaire about origami workshops was given to students. 25 students participated by giving their responses. The code system P1, ..., P25 (Participant 1, Participant 2,..... Participant 24, Participant 25) was used for the data analysis. The completion of the questionnaire was anonymous and optional and it was made clear to students that it would not at all relate to their evaluation in the course.

The questionnaire consisted of : 2 dichotomous Yes/No questions (Q1. and Q2.); 2 open-ended questions (Q3. and Q13.); 1 multiple-answer multiple choice question (Q12.); 8 Likert scale questions (Q4., Q5., Q6., Q7., Q8., Q9., Q10. and Q11.).

The participants' answers in "*Q1. Did you know the origami technique before the origami workshop?*" [Yes or No] indicate that more than the 2/3 (68%, N = 17/25) knew origami before the origami workshop implementation. The answers to the second question (*Q2. Had you ever created origami before the workshop?* [Yes or No]) show that slightly more than half (52%, N = 13/25) of the participants had made origami constructions before the origami workshops presented in this paper. The answers to the third question (*Q3. If you answered "yes" in the previous question (Q2), can you mention what origami you made and on what occasion?*) were given only from the 13 participants who answered "Yes" in Q2. Five of

them (5/13) declared that they had made a paper boat without mentioning any other origami construction and there was one more participant who answered that they had made paper boat, airplane and Pikachu. Thus, nearly half (6/13) of the participants who had made origami before the visual arts origami workshop had made paper boat. From the rest of the participants who answered "Yes" in Q2, five of them declared that they had made origami animals (e.g. frog, birds, dog and dragons) and two of them said that they were creating origami flowers. As far as the framework or occasion of origami creation is concerned, six out of the thirteen participants who answered "Yes" in Q2. gave relevant information. More analytically: one of the participants declared that their origami creation took place in a camp for kids; another participant declared creating an origami in their free time when watching a video in social media; another participant watched and created origami from YouTube; two participants mentioned making origami at school (the one of them mentioned Elementary School) and one more participant made origami in their free time. Thus, **2/13 (in total 8%, N=2/25) participants who answered "Yes" in Q2 made origami in formal education, 1/13 (in total 4%, N=1/25) made origami in nonformal education (camp activity) and 3/13 (in total 12%, N=3/25) made origami in their free time**.

In Q4., Q5., Q6., Q7., Q8., Q9., Q10. and Q11. a Likert-type scale was used with clear explanation of each value from 1 (minimum value, i.e. "Not at all") to 5 (maximum value, i.e. "Very Much" or "Absolutely").

In the histogram of the responses for *Q4. To what degree the hands-on origami creation was interesting?* the distribution is unimodal and negatively skewed, i.e. skewed left, which means that most of the participants find hands-on origami activities interesting. More analytically: 48% (N=12/25) responded that hands-on origami experience is "*absolutely interesting*", 20% (N=5/25) stated that it is "very interesting", 20% (N=5/25) stated that it is "interesting enough", 8% (N=2/25) found it "a little interesting" and 4% (1/25) did not find it interesting. Thus, in total **88% (N=22/25) of the participants found hands-on origami experience interesting**.

In the histogram of the responses for *Q5. To what degree the creation of animated images (Graphic Interchange Format images – GIFs) with the photos of handmade origami was interesting?* the distribution is also unimodal and negatively skewed, i.e. skewed left, which means that most of the participants find the creation of GIFs with the photos of handmade origami interesting. More analytically: 40% (N=10/25) responded that the creation of GIFs with the photos of handmade origami is "*absolutely interesting*", 20% (N=5/25) stated that it is "very interesting", 20% (N=5/25) stated that it is "interesting enough", 12% (N=3/25) found it "a little interesting" and 8% (N=2/25) did not find it interesting. Thus, in total **80% (N=20/25) of the participants found hands-on origami experience interesting**.

In contrast with the unimodal distribution of Q4. and Q5., *Q6. To what degree origami manipulation in origamisimulator.org digital space was interesting?* presents a bimodal (double-peaked) and more random distribution. The two clear peaks of this distribution are found in the values 5, i.e. "absolutely interesting", and 3, i.e. "interesting enough". The most frequent value is 5, i.e. "absolutely interesting", while the value 3, i.e. "interesting enough", presents a local maximum. More analytically: 28% (N=7/25) responded that origami manipulation in origamisimulator.org digital space is "absolutely interesting", 16% (N=4/25) found it "very interesting", 24% (N=6/25) found it "interesting enough", 20% (N=5/25) found it "a little interesting" and 12% (3/25) did not find it interesting at all. Thus, totally **68% (N=15/25) found origami manipulation in**

origamisimulator.org digital space interesting.

Q7. To what degree the creation of digital origami animation was interesting? responses present a unimodal negatively skewed, i.e. left-skewed, distribution with a maximum in value 4, i.e. "very interesting". More analytically, 20% (N=5/25) found the creation of digital origami animation "absolutely interesting", 28% (N=7/25) "very interesting", 24% (N=6/25) "interesting enough", while 20% (N=5/25) found it "a little interesting" and 8% (N=2/25) "Not at all interesting". Thus, **72% (N=18/25) in total found the creation of digital origami animation interesting**.

The responses to the question *Q8. To what degree the origami digital animation with a painting or another image as a background was interesting?* form a unimodal negatively skewed, i.e. left-skewed, distribution with the maximum score of 32% (N=8/25) for "absolutely interesting". For the 28% (N=7/25) the origami animation with a painting or image background was "very interesting", for 24% (N=6/25) of the participants it was "interesting enough", for 8% (N=2/25) it was "a little interesting" and the same score 8% (N=2/25) found it "Not at all" interesting. Thus, in total **84% (N=21/25) of the participants found the origami digital animation with a painting or other image background interesting**.

In *Q9. To what degree the origami animation with image, sound and words was interesting?* The responses form a unimodal negatively skewed, i.e. left-skewed, distribution with the maximum score of 36% (N=9/25) for "absolutely interesting". The 24% (N=6/25) of the participants found the origami animation "very interesting", the 20% (N=5/25) found it "interesting enough", the 12% (N=3/25) found it "a little interesting" and 8% (N=2) found it "not at all interesting". Thus, a total of **80% (N=20/25) found interesting the creation of the origami animation with image, sound and words**.

The responses in *Q10. To what extent do you believe that hands-on origami creation should be beneficial for preschoolers?* also present a unimodal skewed-left, i.e. negatively skewed, distribution with an outlier on the far left of the histogram where one participant, i.e. 4% (N=1/25) believes that origami creation with the hands would be "not at all beneficial" for preschoolers. Except for this participant, all other participants, with a percentage of **96% (N=24/25), believe that the hands-on origami creation should be beneficial for preschoolers**. More analytically, 48% (N=12/25) believe that origami hands-on experience should be "absolutely beneficial", 28% (N=7/25) believe that it should be "very beneficial" and 20% (N=5/25) believe that it should be "beneficial enough" for preschoolers. In the *Q11. To what extent do you believe that origami digital manipulation should be beneficial for preschoolers?* the responses present a more random bimodal negatively skewed, i.e. skewed-left, distribution with a maximum of 36% (N=9/25) who find origami digital manipulation "very beneficial" for preschoolers and another local maximum of 20% (N=5/25) who find it "a little beneficial" for preschoolers. From the rest of the participants, 20% (N=5/25) find origami digital manipulation "absolutely beneficial" for preschoolers, 12% (N=3/25) find it "beneficial enough" and another 12% (N=3/25) "not at all beneficial". Thus, totally **68% (N=17/25) find origami digital manipulation beneficial for preschoolers**.

Q10. and Q11. responses indicate that there is a significant difference between the total score **96% (N=24/25)** of participants who find that hands-on origami experience should be beneficial for preschoolers and the total number **68% (N=17/25)** of participants who find that digital origami experience should be beneficial for preschoolers.

In Q12. multiple-answer multiple choice question students were asked to mention disciplines with which origami relates (*Q12.*

With which disciplines do you believe that origami relates?), except for the visual arts, since they participated in visual arts origami workshops. Students' responses reveal a wide range of sixteen disciplines with which origami relates, as shown in the graph in Table 1.

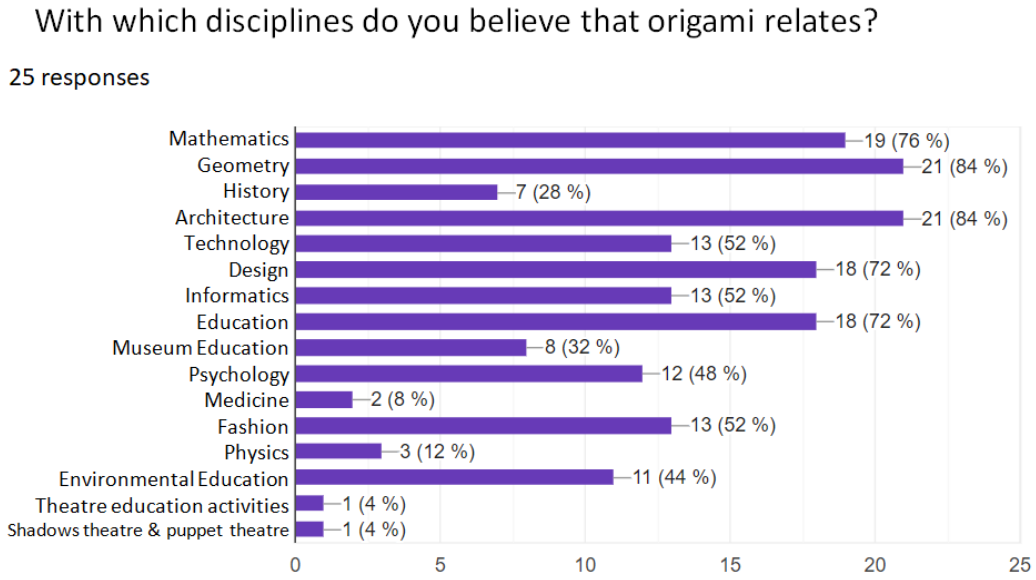

Table 1 Graph with participants' Q12. answers about disciplines, other than visual arts, with which origami relates.

Despite the implementation of the flipped classroom, despite distance education and demonstrations of digital origami software, a participant (P7) wrote "It would be more interesting to make more origami with the instructor.." in Q13. This indicates that there is a need for hands-on origami experience demonstrated by the instructor in the physical classroom and not necessarily from other digital sources, as for example YouTube videos. Another Q13. comment by P23 also supported handmade origami experience with instructor's demonstration in the physical classroom over digital resources and distance education: "Of course, it would be very interesting if we created even more handmade origami with you (the instructor), for sure this would be done in the live (in the physical classroom) courses, the distance was a considerable obstacle."

Some other comments indicate that origami constructions were difficult for some students: P12 "I had difficulty in making another origami beyond the butterfly that we created with the instructor."; P19 "They seemed to me very difficult the origami constructions, especially through the applications that we should work on."; P22 "Even though it was an interesting activity they seem to me difficult".

For other students origami workshops were inspirational and creative: P18 "They (the origami workshops) were very creative and inspirational"; P21 "[...]. If it is (possible) to take a piece of paper, something so simple and make something so beautiful, then surely the art of origami is magic."

Other students in Q13. stressed the benefits that origami constructions should have for preschoolers. P15 stated "Interesting workshop, it reinforces fine motor skills, puts children to think about how they (the origami)

are created!!". Similarly for P13 the origami workshop was a "Nice activity for children of early childhood that develop fine motor skills [...]" For P25 "it was a wonderful experience to participate in all these origami workshops, I wish also in future to share this with the children." According to P23 "[...]. The origami lessons were very creative and I would like in future to use them with many children of early childhood so that they get to know from an early age the internal satisfaction that one feels when they make something wonderful from a simple, blank, small, white paper. [...]."

Other students' opinions connect origami workshops, not only with arts and education, but also with other disciplines: P13 "[…].Very interesting also the workshops of the course, as ideas were given for the exploitation of this (origami) technique in combination with other disciplines and new technologies."; P24 "Origami as an activity was very interesting because you learn new techniques but it also helps you in the psychological part, as it helps you forget any problem that you face. It also contributes to the cultivation of imagination, but also to the development of the thinking process."

P23 expressed their view on the digital software which was used for digital origami animation: "The workshops were very pleasant and useful. For the applications that we used I confess that I did not know any of them and I am very happy that I learnt (how to use) them and of course I would like to study more as there are more other choices."

Conclusion

Origami is a paper folding technique with interdisciplinary research interest and applications in many fields. Furthermore, the origami history and geography proves that it is a technique with long-term international recognition and impact. The case of the origami workshop –implemented in a University department in Greece and presented in this paper– shows not only the physical (handmade), but also the digital potential of origami. However, the hands-on experience with experiential learning and making of origami with the instructor's demonstration was interesting and vital for a high percentage of students. Most importantly, a considerably higher percentage of students consider the hands-on origami experience beneficial for preschoolers comparing to the percentage for the digital origami. After the implementation of the visual arts origami workshops, some students declared verbally that they were very much inspired and that they carried out origami activities in their neighborhoods with children in the stage of early childhood. Furthermore, by taking into account students' previous experiences, which indicate that origami is not a very common practice in the context of Greek education, this kind of activities in formal and nonformal educational frameworks can be the subject of future research.

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