



Origami in the science classroom environment and students' performance in senior Secondary School in Rivers State.

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Abstract

The study examined origami in the science classroom environment and students' performance in senior secondary schools in Rivers State. Three objectives and one hypothesis were used for the study. The population used were all junior secondary school students in Community Secondary school, Rumuolumeni, Port Harcourt. A sample of 190 students were randomly selected from three classes. Simple random sampling techniques was used for the study and the instrument used to collect data was a structured questionnaire titled Origami in a science classroom and students' performance in senior secondary school in Rivers State (OSCPSSRS) with 30 items. Mean score, and t-test were the statistical tools used for the study. The instrument designed by the researcher was given to experts in the field of science education to test the validity of the instrument. Test retest was used and the reliability coefficient of 0.72 was obtained. It was found that origami is used to make animals, birds, shapes and toys using colored sheet and simple folding. Origami also gets students engaged in a classroom environment. It is recommended that all teachers are recommended to incorporate technology into their classroom, also teachers should encourage cooperative learning and use mathematics manipulatives in their mathematics for all students.

Keywords: Origami, science, classroom, paper folding & skills.

Introduction

The ancient skill of paper folding known as origami is making a resurgence. While some of the first examples of origami can be discovered in ancient China, and its deepest roots can be found in ancient Japan, origami may also have a positive impact on education today. This style of art fascinates kids while also subtly improving their skills, such as spatial vision and logical and sequential reasoning. Researchers have discovered a variety of ways that origami may make lessons more engaging while also teaching pupils important skills (Ainissa, 2015). Origami can be used in a physics or scientific classroom to improve a variety of skills, according to Ainissa (2015).

Origami helps children to understand the importance of cooperative thinking. Develops mathematics skills which is an art form that helps children to develop their mathematics skills. Transforming a flat piece of paper into a three-dimensional figure is a unique exercise that develops special reasoning in children. Origami excites other modalities of learning. It has been shown to improve spatial visualization skills using hands-on learning. Such skills allow children to comprehend, characterize, and construct their own vernacular for the world around them (Ainissa, 2015).

Origami promotes various skills in an individual. For instance, good eye-hand coordination, attention to detail and focus, patience, sequencing ability, processing ability, mathematical reasoning etc. the involvement of these skills boosts the mind and thinking ability to a great extent. The reason for this is the stimulation of the entire brain (Varsha, 2018).

Geometry was one of the poor areas among pupils in 2003, according to the National Center for Education Statistics. Origami has been discovered to help students learn mathematical ideas, formulas, and labels by bringing them to life. Students will learn key vocabulary and strategies to define a shape by naming an origami structure with length, breadth, and height. By applying a formula to a real-world structure, origami can be used to calculate the area.

Other learning modalities are stimulated by origami's thinking skills. Hands-on learning has been found to increase spatial visualization skills. Children can understand, characterize, and develop their own vernacular for the world around them with these talents. A teacher can find origami or geometric shapes in nature and describe them using geometric language in the classroom.

Fractions: For many children, the concept of fractions is frightening. Paper folding can be used to illustrate fractions in a tactile method. By folding paper and asking how many folds and pupils would need to construct a given design, origami can be used in the classroom to

demonstrate the ideas of one-half, one-third, or one-fourth. Folding the paper in half and then in half again, and so on, can be used to show the concept of infinity.

In many assignments, there is just one correct answer and only one route to get there. Children can use origami to overcome problems that are not intended for them, and they can make friends with failure (i.e. trial and error). A teacher can present a shape to students and ask them to figure out how to make it. They may be able to find a solution through a variety of methods.

Fun science: explaining physics principles with origami is a lot of fun. A thin piece of paper is not particularly sturdy, but when folded into an accordion, it becomes quite strong. This is how bridges are built. Also, explaining chemicals with origami is a lot of fun. Tetrahedrons and other polyhedral shapes are found in many molecules.

Origami techniques

The origami includes a variety of folding techniques, including simple ones like the Mountain and Valley Folds, intermediate ones like the Rabbit Ear Fold and Petal Fold, and more sophisticated ones like the Unsink and Closed Unsink. For creating multiple and unique forms, several procedures could be combined.

Origami's applications have expanded over time for entertainment and education, but there was a quantum leap in its application in the middle of the twentieth century that embraced various scientific domains (Asiel, 2017). origami uses several folding techniques, which could be basic as the Mountain Fold and the Valley Fold, intermediate as the Rabbit Ear Fold and the Petal Fold, or more complex as the Unsink and the Closed Unsink. Several techniques could be merged for making multiple and unique forms.

The applications of origami evolved over the years for entertainment and educational purposes, yet, in the middle of the last century, there has been a quantum jump in its application that i Traditionally, origami was used for adornment. Colored sheets and basic folding techniques, for example, were used to embellish letters and gifts, as well as to build animals and bird shapes and toys. Origami's applications at the time were simple and solely for entertainment. On the other hand, origami has recently been used in a variety of fields (Asiel, 2017) included several scientific fields (Asiel, 2017).

Origami Application in the Past

In the past, origami was used in decoration. For example, it was used to decorate letters and gifts, and to make animals and bird shapes, and toys using colored sheet and simple folding techniques. The applications of origami in that period was simple and was only for

entertainment. On the other hand, origami in the recent time is applied in several areas (Asiel, 2017)

Origami Application in the Present Time

- **Architecture and Civil Engineering:** Miniature models of bridges and stadiums are made out of origami.
- **Medicine:** paper folding techniques are utilized to simulate DNA samples and to embody the cell membrane and protein.
- **Mechanical Engineering:** Japanese high-speed trains' pipes were made using origami techniques. To absorb the excess pressure, in-pipe supports were employed, lowering the chance of an accident.
- **Mathematics:** some teachers are now using origami as a teaching tool to assist students understand geometry, fractions, and problem solving.
- **Orbit technology:** plans are in the works to send an origami-style aircraft into space (Asiel, 2017).

Educational benefits of Origami

Origami is beneficial because it promotes the development of: • Eye-hand coordination • Sequencing abilities • Mathematics reasoning • Spatial skills • Memory, as well as patience and attention skills • Origami allows for the development of fine motor skills and mental concentration

• Collaborative learning • teaching each other and • taking pride in one's work • community building • sense of accomplishment (2018, Redted art)

Origami is a skill that may be learned at any age. Origami is a form of mathematics, and it has numerous mathematical features, including: • Symmetry (the majority of origami patterns require symmetrical work)

• Geometry • 3D comprehension • Sequencing • Problem solving • Measurement, fractions, and proportions (Hiroo, 2017)

- **Mathematical reasoning ability:** helps enhance mathematical logical thinking
- **Understanding of geometry:** strengthens the knowledge of geometric concepts and formulae
- **Problem solving:** improves problem-solving skills by helping individuals figure out more than one solution to a problem

- Behavioral skills: the ability to create or recreate an artwork through origami helps increase focus, energy and confidence.
- Thinking ability: improves thinking skills by boosting visualization and imagination specific abilities
- Flexibility: origami helps adapting to new situations or needs by promoting flexibility in order to improvise or strategize problem-solving skills.

With a variety of ways, origami aids in the study of mathematics and science. Anyone can easily become a scientific experimenter by using origami. Kruskai (2002) discovered that origami is easier to design and apply than most scientific theories. With his experience handling a variety of issues ranging from creating a folding telescope called Eyeglass that can be readily deployed in space to the delicate folding of an air bag to safeguard passengers, he is uniquely qualified. Robert (2002) explains how to solve a wide range of origami folding problems using a basic geometric notion. In terms of science, this advancement could lead to the development of medical devices that can be activated to fold while within the body. The procedure is similar to collapsing a crease pattern into the finished origami shape in terms of origami.

Origami tessellations were related to the production of cosmic structures from dark matter by Neyrinck and Miguel (2012). Dark matter is defined as a flat sheet that is folded by gravity in the same way as paper is folded in origami. Dark-matter folds tessellate into stream areas that can be visualized using origami tessellations.

According to Ramirez (2015), the following reasons origami improve students' skills include:

1. Thinking skills: Origami excites other modalities of learning. It has been shown to improve spatial visualization skills using hands-on learning. Such skills allow children to comprehend, characterize, and construct their own vernacular for the world around them.
2. Fractions: The concept of fractions is scary to lots of students. Folding paper can demonstrate the fractions in a tactile way. In the classroom, origami can be used to illustrate the concepts of one-half, one-third, or one fourth by folding paper and asking how many folds students would need to make a certain shape. The act of folding the paper in half and in half again and so on can also be used to demonstrate the concept of infinity.
3. Problem solving: Origami provides children an opportunity to solve something that is not prescribed and gives them a chance to make friends with failure (that is trial and

error). It is advisable to show students a shape and ask the students to come up with a way to make it. They may get the solution from various approaches.

4. Fun science: Origami is a fun way to explain science concepts. Students learn best when they can make connections between discipline (Landry, 2022).

Origami is good as it develops in the following ways:

1. Eye hand co-ordination
2. Sequencing skills
3. Mathematics reasoning
4. Spatial skills
5. Memory, but also patience and attention skills
6. Origami allows for motor skills and
7. Mental concentration (RedTedArt, 2022).

Statement of the Problem

Parents and educators are constantly looking for new and innovative ways to teach and enhance basic reading and math abilities, stimulate critical thinking and problem solving, build cooperation and socializing, and expose our children to diverse cultures. An ideal lesson would attempt to meet all of these objectives while also presenting itself in such a way that students of all ages are motivated to learn. Children enjoy origami, and learning by doing keeps pupils engaged since they naturally want to play with and investigate materials. Children find learning more meaningful when they make and dismantle paper manipulatives, activate prior information, and experience it firsthand. Folding tasks help kids apply mathematical principles and expand vocabulary in real ways, retain material for longer periods of time, and bridge the gap between words and their meaning. Understanding is necessary for students to solve the new types of difficulties they will certainly encounter in the future.

Aim and Objectives of the study

The study is to examine Origami in a science classroom environment. Specifically, the study intends to:

1. Identify the use of origami as a teaching strategy in a science classroom environment
2. Examine the benefits of origami in a science classroom environment
3. Determine the importance of origami in a science classroom environment

Research Questions

1. What is the use of origami in a science classroom environment?
2. How is origami beneficial in a science classroom environment?
3. What is the importance of origami in a science classroom environment?

Hypothesis

1. There is no significant difference in the male and female score in science test.

Methodology

The study is a descriptive survey research design to examine origami in a science classroom and students' performance in Senior Secondary Schools in Rivers State. The population of the study comprises all secondary schools in obio-akpor local government area in Rivers State, Port Harcourt. A sample of 190 students were used for the study. Simple random sampling techniques was used for the study. The instrument used to collect data is a structured questionnaire titled Origami in a science classroom and students' performance in senior secondary school in Rivers State (OSCPSSRS) with 30 items. To ensure validity, the instrument designed by the researcher was given to experts in the field of science education. Test retest was used and the reliability coefficient of 0.72 was obtained. Data was analyzed using mean, standard deviation and t-test.

Data Presentation

1. What is the use of origami in a science classroom as a teaching strategy?

Table 1.1: uses of origami in a science classroom

S/N	ITEMS Uses of Origami	MEAN	SD
1.	Origami is used for educational purposes	3.01	0.63
2.	It is used to help clarify geometry	3.03	0.69
3.	It is used to explain fraction in mathematics	3.03	0.65
4.	Origami is used in solving problems	3.09	0.63
5.	It is used to decorate letters and gifts	3.09	0.62
6.	It is used to make animals, bird, shapes, and toys using colored sheets and simple folding	3.21	0.60
7.	Origami is used to help students verbalize what they are learning to each other	3.16	0.64
8.	It is used to explore 3D objects through paper folding	3.20	0.64
9.	Origami is used to learn a skill from another culture	3.20	0.64
10.	It gets students engaged in a classroom environment	3.21	0.64
	Average Mean	3.12	0.63

Entries in table 1.1 shows that students accepted all the items as the uses of origami in a science classroom as a teaching strategy. This is because all the mean was above the criterion

mean of 2.50. Therefore, the study found that origami is used to make animals, birds, shapes and toys using colored sheet and simple folding. Origami also gets students engaged in a classroom environment.

2. How is origami beneficial in a science classroom as a teaching strategy?

Table 1.2: Importance of Origami

S/N	ITEMS Importance of Origami	MEAN	SD
1.	Origami excites other modalities of learning	3.31	0.60
2.	It improves spatial visualization skills using hands on learning	3.25	0.60
3.	Origami skills allows students to comprehend, characterize and construct their own vernacular for the world around them	3.25	0.64
4.	Folding paper can demonstrate the fractions in a tactile way	3.30	0.59
5.	Origami provides opportunity to solve problems that is not prescribes and gives students a chance to make friends with trial and error	3.13	0.67
6.	It is a fun way to explain science concepts	3.16	0.65
7.	Origami principle help fit large objects into smaller shape after which they can expand again	3.13	0.62
8.	It helps sharpen students' memory and imagination	3.12	0.66
9.	It channels creativity, critical thinking and collaboration	3.25	0.60
10.	It develops the ability to follow instructions	3.03	0.67
	Average Mean	3.19	0.63

Entries in table 1.2 shows that students accepted all the items as the importance of origami in a science classroom as a teaching strategy. This is because all the items mean was above the criterion mean of 2.50. Therefore, the study found that folding paper can demonstrate the fraction in a mathematical problem in a tactile way. Origami excites other modalities of learning and it channels creativity, critical thinking and collaboration.

3. What are the benefits of origami in a science classroom as a teaching strategy?

Table 1.3: benefits of origami in a physics classroom as a teaching strategy

S/N	ITEMS Benefits of Origami	MEAN	SD
1.	It helps with eye hand coordination	3.01	0.65
2.	It improves sequencing skills	3.14	0.65
3.	It improves mathematical reasoning	3.18	0.63
4.	It improves memory	3.19	0.65
5.	It takes pride in work in classroom assignment	3.20	0.65
6.	It helps students teach each other	3.22	0.71
7.	It helps students to work together	3.13	0.67
8.	It improves mental concentration	3.21	0.66

9	Origami improves spatial skills	3.20	0.65
10	Origami improves memory	3.86	0.55
	Average Mean	3.23	0.64

Entries in table 1.2 shows that students accepted all the items as the benefits of origami in a physics classroom as a teaching strategy. This is because all the items mean was above the criterion mean of 2.50. Therefore, the study found that origami improves memory, it helps students teach each other and improves spatial skills.

Hypothesis

1. There is no significant difference in male and female performance in science test.

Table 1.1: t- test analysis of differences between male and female students' performance in science test.

Group	Mean	Sum of squared	N	Df	Standard Error	t(cal)	t(tab)
Male	16.66	1008.6	12	22	3.42	1.90	2.074
Female	23.16	507.6	12				

$P < 0.05$; significant @ 0.05 levels

Entries from table 1.1 shows mean of 16.66 for male respondents while mean score for female respondents is 23.16. The t(cal) value of 1.90 while is less than the t(tab) value of 2.074 suggests that there is no significant difference between male and female scores in the science test using origami as a teaching strategy.

Discussion of findings

Research Question 1: What is the use of origami in a science classroom as a teaching strategy?

The result reveals that origami is used to make animals, birds, shapes and toys using colored sheet and simple folding. Origami also gets students engaged in a classroom environment.

The findings of the present study are in agreement with those of Liu (2019) who found that all teachers should incorporate technology, encourage cooperative learning and use mathematics manipulatives in their mathematics lessons for all levels of students, and this is to engage students in classroom.

Furthermore, the present study is also in agreement with those of Dilek, Zeynep & Zuhail (2017) who found that students who have an opportunity to learn the origami activities himself or herself can visualize the models that he/she makes them himself/ herself and touches them as he/her mind in easier way in the necessary case.

Research Question 2: How is origami beneficial in a physics classroom as a teaching strategy?

The result reveals that folding paper can demonstrate the fraction in a mathematical problem in a tactile way. Origami excites other modalities of learning and it channels creativity, critical thinking and collaboration.

The findings of the present study are in agreement with those of Lee (2017) who found that origami helped students increase their understanding and confidence in writing.

Research Question 3: What are the benefits of origami in a physics classroom as a teaching strategy?

The result reveals that origami improves memory, it helps students teach each other and improves spatial skills.

The finding of the present study is in agreement with those of Wei (2016) who found that origami helps train students mind and enhance spatial skills.

Conclusions

The following conclusions were made by the researchers:

1. The study found that origami is used to make animals, birds, shapes and toys using colored sheet and simple folding. Origami also get students engaged in a classroom environment.
2. folding paper can demonstrate the fraction in a mathematical problem in a tactile way. Origami excites other modalities of learning and it channels creativity, critical thinking and collaboration.
3. origami improves memory, it helps students teach each other and improves spatial skills.

Recommendations

Based on the conclusion, the following recommendations were made by the researcher:

1. All teachers are recommended to incorporate technology into their classroom
2. Teachers should encourage cooperative learning
3. Teachers should use mathematics manipulatives in their mathematics for all students.

References

- Ainissa, R., (2015). 5 reasons why origami improves students' skills. Retrieved from <https://www.edutopia.org>blog>w...>
- Asiel, F., (2018). SCIplanet- origami applications in the past and present. Retrieved from <https://www.bibalex.org>details...>
- Dilek, C., Zeynep, A., & Zuhail, U., (2017). The use of origami in the science education. 2nd international conference contemporary educational research congress 2017.
- Hiroo, J., (2017). What are the benefits of origami? How can the art style be performed successfully? Retrieved from <https://www.gymboglobal.jp.com>.
- Kruskai, L.L., (2002). Scientific toy with origami as a solution. *American physical society journal*. 11 (8), 56-61.
- Landry, R., (2022). Incorporating coding in STEM Classes. Retrieved from <https://www.edutopia.org>blog...>
- Lee, K.F., (2017). Teaching the non-chinese speaking students origami to improve their interest and concentration in learning Chinese language. Open access journal. Retrieved from <https://www.davidpublisher.org>Art...>
- Liu, Y., (2019). A comparison study of using origami as a teaching tool in middle school mathematics class in North America and China. <https://www.scholar.uwindsor.ca...>
- Neyrinck, M.C., & Miguel, A., (2012). Origami: delineating halos using phase-space folds. *The Astrophysical journal*. 5(2), 1-11.
- Redted (2018). Educational benefits of origami- Red ted art-make crafting with kids easy and fun. Retrieved from <https://www.redted.com.educati...>
- Robert, J.L., (2002). Origami helps scientists solve problems. Retrieved from <https://www.sciencedaily.com>2002...>
- Varsha, P., (2018). How does origami educationally benefit you and improve your skill set. <https://www.careerindia.com...>
- Wei, M., (2016). 5 ways origami boost mindfulness. Retrieved from <https://www.psychologytoday.com...>