Vol. 2, Issue 4, 2022 (October– December)

ISSN 2710-4532 (Online) *ISSN 2710-4524 (Print)* *ISSN 2710-4540 (ISSN-L)*

Journal of Educational Research & Social Sciences Review (JERSSR)

The Effect of ORI-geometry on Visual Spatial Skills of Elementary Level Students

1. **Muneer Ahmed** (Corresponding Author)
PhD Scholar, Northern University Nowshera
2. **Dr. Muhammad Naeemullah** Assistant Professor, Northern University Nowshera
3. **Dr. Rabia Tabassum** Professor, Northern University Nowshera

Abstract

The purpose of the study was to determine how ori-geometry affected class 3 kids' basic math visual spatial skills. The study's goal was to evaluate how ori-geometry affected primary school children' visual spatial abilities. The null hypothesis that there is no discernible difference in the efficiency of ori-geometry on visual spatial abilities in Mathematics was evaluated to achieve the aforementioned goal. A total of 40 third-grade pupils were use as the study's sample. The investigation was conducted using an experimental equivalent group pretest-posttest research design. The development of pre-test and post-test for data collecting. The acquired data were analyzed using statistical techniques including the mean, standard deviation, and t-test to gauge the student's performance. The study's findings indicated that ori-geometry had a considerable impact on pupils' academic achievement. The outcomes showed that the experimental group's pupils outperformed the control group's kids in terms of performance. Every elementary-level student, teacher, researcher, and curriculum creator should be aware of this study.

Keywords: Visual Spatial Skills, Origami, Geometry, Elementary Level

Introduction

Education is necessary for the socialization of an individual. It clearly defines how the people think, feel, believe and do. For every nation, education is the basis for the empowerment and progress. A vital role in understanding and participating in day to day activities of today's world is played by education. To get ready people, for adaptation the fluctuating situations in future life, attainment of knowledge, producing sound rational and teaching education is the act of providing in this context. The procedure by which the nation with determination spreads its composed facts, philosophies and expertise from group to group and from person to person is education. Thus education is necessary for future development of human beings(Rizwan, 2011).

For societal development, at the fundamental of many successful lives and successful careers, mathematics is predominantly in the perspective of significant and speed up change. In truth, the majority of individuals—and students in particular—hate math as well. Mathematics to be the most challenging subject is believed by the majority of secondary school pupils, abstract, tiresome, dangerous, and uninteresting subject, according to a survey of academic research. Additionally, research demonstrates that although primary school kids appreciate the topic of mathematics, their interest in it drops as they progress to senior school. Man's first approach to understanding nature was descriptive, and mathematics was initiated by nature, but as time passed, man used basic concepts in varied directions and tried to understand nature from different angles. The numbers assume new forms over time, although mathematics is taking place with simple counting. There have been new branches of mathematics. Some of them from these divisions may seem far away from nature and abstract. Only mathematicians can understand some equations and theorems in mathematics that are applicable to these fields. Only abstract concepts in mathematics were helpful in the discovery of new equations that made abstract concepts understandable (Noreen, 2019).

In the mathematical aspects, the study of different shapes is described in geometry. Geometry shapes, students' effective thinking into abstracts and also develops their cognitive abilities. To helps students and equips them with the tools that they can apply in other areas of mathematics are analyzing and interpreting the world. One of the hardest subjects for students is geometry. For pupils to perceive, describe, and draw a figure, they must have a basic understanding of many types of figures (Riastuti, 2017).

To read maps, follow dance moves and solve some math problems children use visual-spatial handling skills. To make sense of letters and numbers they also prerequisite these skills. Visual-spatial processing skills also have a need for additional visual processing skills that are involved in most of the tasks. Creating pictures in your mind as you read is visualization. You can think of it as making a movie based on the writing. It can help with our reading comprehension so visualization is very important to make you feel more linked to the material, and construct a more personal experience. In everyday tasks visual spatial relationships are also important. . Spatial ability as "the capacity to create and manipulate mental representations in the mind". It was described as the skill in demonstrating, altering, creating, and eliciting symbolic, non-linguistic information. The term "spatial aptitude" was regularly used to refer to skills involving space around. The intellectual handling of things and their components in 2D and 3D space, according to his general definition of spatial ability. In other words, although the same term has been defined in many literary works, we may say that the perception of spatial ability is one of picture manipulation in the mind (Cakmak, 2009).

Objective of the Study

Major objective of this study was as under:

- To study the effect of ori-geometry on visual spatial skills in Mathematics at elementary level.

Hypothesis of the Study

The following null hypotheses was tested to achieve the objective of the study:

H01 There is no significant effect of ori-geometry on visuospatial skills in Mathematics at the elementary level.

Significance of the Study

Origami is a new art for Pakistani students and Mathematics teachers. They mostly used a traditional method of teaching to teach Geometry to students. Students, especially in rural schools mostly used to learn Geometry through pen, pencil, and by drawing shapes. They did not have much deep conceptual knowledge due to reason; they learn geometry with traditional methods only. So, to build their concepts, and to improve their skills in the Mathematics field required to change the traditional method to the modern method of teaching geometry, that is Origami (a paper folding method used by Japanese and Chines teachers in their classroom). So, this method will be equally helpful for teachers, students and researchers as well. This study tried to explain the importance of ori-geometry for the improvement of visualization among students in their daily life.

Literature Review

"Education shall be dedicated to the complete development of the human personality and the strengthening of protection of human rights and fundamental freedoms," states Article 26(2) of the Universal Declaration of Human Rights. It will strengthen the UN's efforts to maintain peace by encouraging respect and companionship considerate, patience among all people, irrespective of religion or race. "The right to education belongs to everybody. Education at the fundamental and primary levels must be free. First grade needs to be finished. All people must have access to professional and technical education, and admission to higher education must be based only on merit. (Article 26 (1) of Universal Declaration of Human Rights)

In 2005, Kayhan stated that one of the most significant subjects, which is necessary for both daily living and academic achievement, is mathematics. As a result, studying mathematics is essential for developing life skills. Because mathematics is so important to educators and teachers, how to help kids develop their fundamental intellectual capabilities has long been a pressing concern. Instead of only teaching mathematics, one of the desired recommendations is to effectively emphasize growing fundamental skills like spatial awareness. Spatial ability is one of the fundamental skills that stand out as being particularly important when learning and practicing mathematics. Numerous studies have shown that spatial abilities are in a straight line associated to the performance in mathematical techniques. In order to be effective tools for thinking carefully and solving mathematical problems, spatial talentsare required (Kayhan, 2005).

In her article, Noreen focused on how mathematics has been man's uncomplicated ally and helper since the beginning of his existence on our planet. To answer questions like "How many? How much? How big? etc., a man, developed arithmetic. To simplify arithmetical calculations, algebra was used by the mathematicians. Geometry was designed for measurement and shape. Geometry and arithmetic research, like any other, is beneficial in today's world. As an advanced science,

mathematics has been used extensively. The earliest men were also concerned about this piece of information (Noreen, 2019).

Japanese used a method to solve the geometrical concepts through ancient time the art of Origami". Origami is a term used frequently in Japanese that combines the words "ori" (to fold) and "kami" (paper). The Japanese paper folding technique The art of origami is well known. The more accurate description was created by origami designer Joseph Wu in 1999. According to his definition, origami is a "type of graphic or sculptural portrayal specifically determined mostly by the fold over of the standard, generally paper." Both paper folding and origami are used interchangeably in literature. According to Cakmak, "the ability to create mental images and alter these forms in the mind" is the definition of spatial ability. The ability to represent, modify, produce, and recall symbolic, non-linguistic information was defined as this ability (Cakmak ,2009).

The term ‘spatial ability was frequently used to refer to skills involving space.

His broad definition of spatial aptitude includes the ability to mentally manipulate objects and observe how they behave in two- and three-dimensional space. The notion of spatial ability was developing, as can be observed from the literature, according to academics. In other words the same phrase had multiple definitions in the literature, but we could concludes that spatial ability is interpreted in different ways (Cakmak, 2009).

Spatial ability is an important talent for kids to possess. Educators must acknowledge that all children need to develop a variety of spatial skills for both academic or professional achievement and everyday competence. The mathematics behind this subject includes abilities like estimation, map-reading, and elementary drawing. To excel in subjects like geometry, volume, and measurement, students need to have good spatial abilities. Students may also be aware that this talent is necessary for careers in engineering, dentistry, and architecture as well as for success in math, physics, and geography (Risma, 2013).

Spatial Ability in Mathematics

Students must acquire the important skill of spatial reasoning. Teachers must recognize that all children need to develop a variety of spatial abilities in order to succeed in school or in their careers as well as in daily life. Mathematical concepts underlying this subject include prediction, geometry, measurement, map-reading, and elementary drawing. Given the importance of this element, it is no longer viable to ignore how students' spatial abilities are developing. In the current study, we suggest an instructional activity flow that combines spatial visualisation and spatial orientation exercises to help students build their spatial cognition (Risma, 2013).

The word "geometry" is the origin of the earth's measure. For agriculture and construction purposes, geometry was used first. The Pythagorean theorem was initially applied by the Egyptians to find a field's square corner or the pyramid base. The body of language from the sixth to the fourth BC was rationally ordered by Greek intellectuals using empirical and quantitative geometry. Knowing the definitions and characteristics of geometrical ideas is only one part of learning geometry; students must also be able to analyze the characteristics of two-dimensional (2D) and three dimensional (3D) geometric shapes and develop their spatial skills. Mathematics debates the use of symmetry, conceptualization, spatial reasoning, and geometric modelling in problem solving, as well as the specification of places and geographic relationships, the application of conversions, and the usage of these techniques (Özerem, 2012).

Spatial Ability

The idea of "spatial ability" is not well defined since, in general, spatial skills entail visual difficulties or activities that need people to estimate, assess, or forecast the connections among figures or objects in different perspectives. The ability to explore the visual field, more precisely the ability to comprehend systems, shapes, and generate mental pictures of those systems, shapes, and locations of things as visually observed, and the ability to mentally manipulate such symbols, is what is meant by "spatial skills." The capacity to think and reason via mental images rather than words also involves spatial abilities. Numerous researches have shown that the choice and effectiveness of a strategy are related to the degree of an individual's talents. People with greater skill and a propensity for problem solving use more spatial processes, while others attempt to use more logical methods (Zhu, 2007). The category of spatial skills often includes visual challenges or activities that require estimation, prediction, or assessment of the connections among figures or objects in diverse situations. For solving mathematical problems, they are regarded as an essential component of mathematical

cognition. There are spatial components in some mathematical concepts, while others have seen and documented connections between mathematical concepts and visual spatial abilities. People with poor spatial abilities gravitate more toward the semantic content. If the semantic contents of the crossover point is minimal, those with good spatial abilities do better than people with poor spatial abilities. Individuals with poor spatial abilities gain more from the development of additional non-spatial semantic data under these circumstances. Rather than just teaching mathematics, one of the preferred recommendations for developing mathematical skills is to appropriately highlight and build fundamental talents like spatial skills (Bishop, 1980).

Research Methodology

Population of the Study

The population of the research consisted of all 591717 boys in grade three at the public school in Punjab. (SIS. Punjab, 2019).

Sample of the study

By using convenient sampling method, one school was chosen from the government rural school boys, Government Boys High School Shakardra, Attock. From the school 40 students (Boys) of grade three was chosen as a subject of the study.

Research Design

The goal of the research project was to determine how ori-geometry affected class 3 pupils' ability to visualize spatial relationships in mathematics at the primary level. The goal of the research project was to determine how ori-geometry affected class 3 pupils' ability to visualize spatial relationships in mathematics at the primary level. research question. A single group pre-test/post-test design was utilised for the quantitative portion.

A pretest posttest equivalent group design was employed for this, and its symbolic representation is as follows:

R	E	= O1	T	O2
R	C	= O3		O4

dRE	= O2	-	O1

dRC	= O4	-	O3

D	= dRE	-	dRC

This approach involved giving one group a pre-test before randomly splitting it into two groups with pre-test mean scores that were virtually equal for both groups. Following the pretest, two groups— experimental and control group—were formed. Upon completion of the therapy period, a post-test was given. Both group was provided the same learning material. The control was taught with traditional method in the classroom according to teacher's lesson plan. The experimental group was treated with different activities of paper folding (Farooq, R.A 2017).

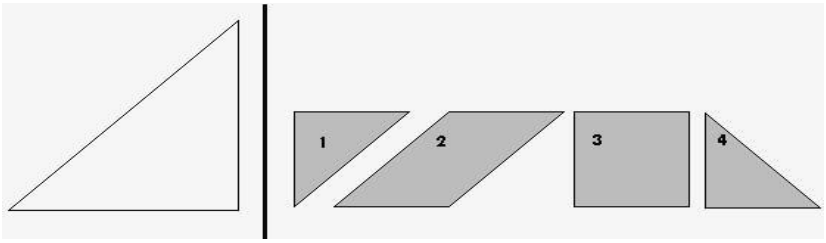
Research Instrument

A pretest and posttest constructed by teachers were used as research tool. In order to split the class 3 pupils into the experimental and control groups, a pre-test was given to them. While the control group received standard instruction, the experimental group received the therapy (Paper-pencil technique). The experimental group received therapy for six weeks, and both the experimental and control group's subjects underwent a post-test. This study sought to determine how ori-geometry affected students' mathematical visual spatial ability. The tests that came next were carried out to collect the data.

Spatial Ability Test

Students' capacity to cognitively manipulate things and the parts of those items in two and three dimensions was assessed using the Spatial Ability Test (SAT). The Spatial Visualization test in 2D Geometry (TSV) and the "Paper Folding Test" were combined to create the 20-item SAT utilized in this study (PFT).

Which of the grey forms should we use to cover the left-hand shape?



A) 1, 3 and 4

B) 1 and 3

(Cakmak, 20009)

Procedure of the study

Students were taught in different pattern of teaching. The traditional method was followed by the teacher nominated for the control group. The ori-geometry method was applied by the teacher selected for experimental group. The first data was collected from the students before the treatment through Pre-Test. A control group and an experimental group were created for the students depending on the outcomes of the pre-test. The geometric forms were intended for the pretest. Over the duration of the unit, the experimental group got training from their usual classroom teacher along with a lesson in mathematics provided by the researcher using origami. Five days a week, these lessons were held. The origami models utilised ranged from simple designs (basic boats, planes) to more sophisticated designs that got harder with each visit. Ten lectures in all were imparted during the period of time. Students took part in a geometry concept exam and spatial visualisation after finishing the geometry lesson. The pupils underwent a post-test after receiving the medication for six weeks. A post-test was administered to see how well the therapy worked. The difference between the Pre- and Post-test results was seen as evidence of the study's efficacy**.**

Data Collection

Two tutors with the identical title, credentials, and teaching skills were selected to instruct the two groups for a six-week period. The experimental group received instruction in origami geometry for six weeks, for a total of 40 minutes per session, in order to assess their abilities in visual spatial skills, visualization, and problem solving. Their instructional approach stayed the same, while the control group continued to learn geometry using the conventional methods (pencil, geometry box, etc.). Experimental group was treated with origami (paper-folding methods) to teach them geometrical shapes of Triangle, Quadrilaterals (Rectangle, Square), Circle, two- dimensional objects 2D- Objects, 3D- objects (Cubes, cuboids and pyramids) and Angles shapes. Two tests were given by the researcher in order to gather data (Pre and Post test). First, both group underwent a pre-test, and then, following the completion of therapy, both groups completed a post-test.

Data Analysis

The collected data was analyzed by using the following tools:

- The marks' mean and standard deviations were computed.
- T-test was applied for the calculation of significant level of visual spatial skills of the elementary level students.

Ho1: There is no discernible difference in the average values of the experimental and the control group on the pre-test for mathematical visual spatial skills.

Table 1: Significance of the difference in mean scores between the experimental and control groups on the pre-test for visual spatial abilities in mathematics.

Group	N	Mean	SD	df	t-value	Significance	Effect
Control Group	20	3.15	1.46	38	0.22	0.83	Insignificant
ExperimentalGroup	20	3.25	1.41				

Table 1 , the pre-test results for pupils' visual spatial abilities are shown in the table 1. The mean score for the control group was 3.15, as per the pre-test findings. This pre-test had a mean score of 3.25 for the experimental group. In this instance, the two groups' average scores were very equal. As opposed to the experimental group's S.D. of 1.41, the control group's S.D was 1.46. It was 0.22 for the t-score. When compared to the pre-test, the significance was very low. At the pre-test, visual spatial

skills had a significance of 0.83. The required significance, which is 0.05, is exceeded by this ratio. This implies that the test had no significance. The absence of significance in the test suggests that the researcher must acknowledge the null hypothesis, which states that there's no significance in the difference in the mean of the control group with experimental groups' visual spatial ability in mathematics for the pre-test.

Ho2: There is no discernible change in the mean scores in between control and the experimental groups group on the post-test for mathematical visual spatial skills.

Table 2: Significance of the difference between the experimental group's and the control group's mean scores on the post-test for visual spatial abilities in mathematics.

Group	N	Mean	SD	df	t-value	Significance	Effect
Control Group	20	5.2	3.35				
				38	11.97	0.000	Significant
ExperimentalGroup	20	15.65	2.01				

The outcomes of the post-test on mathematical visual spatial abilities for the experimental and control groups are displayed in Table 2. The control group's mean score, as determined by the post-test findings, was 5.2. The experimental group scored an average of 15.65 on the post-test. Although the S.D. In the test group, it was 2.01, and 3.35 in the group under control. The t-score was 11.97. At the post-test, visual spatial skills showed a significance level of.0001. This ratio exceeds the 0.05 level of significance that is necessary. It illustrates the importance of the test. The test's findings show that its null hypothesis, according to which there is no discernible difference between the experimental with control groups' mean scores on mathematical visual spatial skills, must be disproved.

Ho3: The results of the retention test for mathematical visual spatial abilities reveal no appreciable difference between the means of the experimental and control groups.

Table 3: Differences between experimental and control groups' visual spatial abilities in mathematics on the retention test and their significance.

Group	**N**	**Mean**	**SD**	**df**	**t-value**	**Significance**	**Effect**
Control Group	20	5.1	1.58				
				38	26.00	0.000	Significant
ExperimentalGroup	20	17.35	1.38				

table value of *t* at 0.05= 2.093 * significant

Table 3 the results of the post-test on students in the experimental and control groups' mathematical visual spatial skills are shown in table 3. The control group's mean score, as determined by the post-test, was 5.1. The experimental group's mean score on this post-test was 17.35. In the experimental group, the S.D. was 1.38 while it was 1.58 in the control group. 26.00 was the t-score. At the retention test, the significance for visual spatial skills was.0001. This ratio is higher than the 0.05 level of significance necessary. It demonstrates the test's importance. The null hypothesis, which contends that there's significance in the differences in between mean scores of both the experimental with control groups for visual spatial abilities in mathematics, must be rejected in light of the test's significance.

Discussion

Ori-geometry method has been widely applied in classrooms since long and from literature it is clear that nearly all the studies conducted on ori-geometry method showed positive results in all subjects' areas. This study also endured to investigate the effects of ori-geometry method in the subject of mathematics. A detailed discussion is being made which is as under:

At the start of the study, pre-tests were administered to each student. The null hypothesis H0 1 is accepted since the experimental group's findings did not significantly vary from the control group's mean scores at the significance level of (= 0.05). (Table 1). This indicates that prior to the trial, the two groups—the experimental group and the control group—were on an equal footing. However, the null hypothesis H0 2 is rejected since the two groups demonstrated a significant difference on the post-test at (= 0.05) after the therapy (Table 2). It means that ori-geometry method has positive results with respect to academic achievements as compared to traditional method.

Conclusions

The results of this investigation led to the following inferences:

- Pre-test achievement scores were examined, and it was discovered that there was no statistically significant difference between the average scores of the experimental and control

groups. Before the therapy, both groups had equal performance levels.

Findings

- The findings of this study demonstrated that students who were taught using the ori-geometry approach performed better than other learners who were not. The ori-geometry approach may be employed, like other techniques for teaching geometry at the primary level, in account of the statistical findings of the study.
- This has been advantageous for the kids who have been taught using the ori- geometry technique.

The gathered information has proven that these kids' visual spatial abilities have improved noticeably between the pre-test and post-test. As a result, the inferences made from this investigation have supported the validity of the presumption that the "ori-geometry" instructional approach for teaching helped pupils enhance their achievements in mathematics.

Recommendations

The present research was conducted to investigate the impact of ori-geometry on visual spatial abilities in Mathematics of elementary school children of Punjab. Researcher have made great effort in the field of education. Ori-geometry was a new method in Pakistan for teaching geometry in classroom. The following suggestions were made after considering all of the study's findings, analysis, and conclusion:

- The study showed that ori-geometry method can play an important role in teaching geometry.
- Results illustrated that students were eagerly involved in practicing ori-geometry activities to develop visual spatial skills in the subject of mathematics. Therefore, it is recommended that in Pakistan Mathematics teachers, curriculum experts, policy makers should take serious efforts to promote ori-geometry method as a contemporary in teaching mathematics at elementary level.
- Results revealed that student's visualization ability enhanced through ori-geometry teaching method. Thus it is recommended that ori-geometry should be practiced while teaching Mathematics to improve student's visualization ability.

References

Article 26 (1) of Universal declaration of human rights. (U.N.O).

Cakmak, S. (2009). *An investigation of the effect of origami-based instruction on elementary students' spatial ability in mathematics* (Master's thesis, Middle EastTechnical University).

Farooq, R.A. & Tabassum, R. (2017). *Understanding Research in Education.* Lahore: Majeed book Depot, lahore (Pakistan).

Kayhan, E. B. (2005). *Investigation of high school students' spatial ability* (Master's thesis, Middle East Technical University).

Noreen, R., & Rana, A. M. K. (2019). Activity-Based Teaching versus Traditional Method of Teaching in Mathematics at Elementary Level. *Bulletin of Education and Research*, *41*(2), 145-159.

Özerem, A. (2012). Misconceptions in geometry and suggested solutions for seventh grade students. *Procedia-Social and Behavioral Sciences*, *55*, 720-729.

Riastuti, N., Mardiyana, & Pramudya, I. (2017, December). Analysis of student's geometry skills viewed from spatial intelligence. In *AIP Conference Proceedings* (Vol. 1913, No. 1, p. 0200 24).

Risma, D. A. (2013). Spatial Visualization and Spatial Orientation Tasks to Support the Development of Students' Spatial Ability. *Universitas Sriwijaya*.

Rizwan. (2011). *Relationship between parental involvement and academic achievement of 2nd grade pupils in the subject of English at Murree city. Islamabad; AIOU.*