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Research Article

The Role Of Using Origami In Improving Geometric Skills Among Students With Learning Disabilities In The Elementary Stage

Dr. Mohamad Ahmad Saleem Khasawneh*

*Assistant Professor, Special Education Department, King Khalid University, Saudi Arabia, mkhasawneh@kku.edu.sa. https://orcid.org/0000-0002-1390-3765

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ARTICLE INFO	ABSTRACT

This study explored the impact of using origami-based activities on developing geometry skills and knowledge among students with learning disabilities in the elementary stage. The study used the qualitative-descriptive approach and relied on three instruments, a test of geometry knowledge for fifth-grade students, activities for the intervention period (origami activities and iconic-symbolic activities), and semi-structured interviews. Six students with learning disabilities from Irbid City, Jordan, were selected to be part of this investigation. the students showed high effectiveness in overcoming challenges in some basic engineering concepts, and they prominently demonstrated the role of folding activities in developing this knowledge, such as symmetry, diagonals, angles, and opposite sides. The students themselves had positive opinions about the folding activities, which were reflections on the intervention experience in general. The results of the study showed the improvement of the students in understanding some geometric concepts using the origami-based activities.

Keywords: Geometry skills and concepts, origami, students with learning disabilities,

1. Introduction

Geometry is one of the fields of mathematics that has been known since a very ancient time. The Babylonians (3000 BC) dealt with it from a standard perspective to measure specific areas such as the area of a rectangle, a triangle, or the circumference of a circle (Klemer & Rapoport, 2020). As for the ancient Egyptians, they used it to divide the land into various geometric shapes after a river flood. Geometry developed in the time of the Greeks to rely on logical thinking for proof, so Euclidean and non-Euclidean geometry appeared, to be followed in the nineteenth century by other theories in which geometry was considered as the study of geometric shapes and their properties up until the modern usage of geometry (Kögce, 2020). Historically, geometry has played a very productive role in the development of mathematics, and geometric techniques and visual images remain essential tools and sources of inspiration for mathematicians. By ignoring visualization, curricula not only fail to engage a powerful part of students' minds in serving their mathematical thinking but also fail to develop students' skills in visual exploration and argumentation (Fathyipor et al., 2023).

Accordingly, geometry was included as one of the principles and standards that should be covered in school according to the National Council of Teachers of Mathematics (NCTM), where students learn about geometric shapes and how to analyze their properties and relationships, construct and manipulate representations of two- and three-dimensional shapes, and perceive them from different points of view (Kamalodeen et al., 2021). It is an important aspect of engineering thinking, and engineering is considered a natural place for developing students' thinking and justification skills and developing mathematical arguments about geometric relationships (Huang et al., 2023). Distinguishing geometric shapes, knowing their properties, the relationship between them, and finding their area is one of the basic skills, as adopted in the basic skills adopted by the Ministry of Education for the elementary level, its principles and standards in learning mathematics curriculum, developing an in-depth understanding of their mathematical ideas, and being presented in an exploratory manner to motivate learners and achieve enjoyment (UYGUN, 2019). This requires a gradual transition from the tangible to the semi-tangible, then the abstract to build and develop concepts in general.

When students create new mathematical knowledge, by thinking about their physical and mental actions, moving from the concrete to the abstract, it is often derived from Bruner's descriptive theory of representational modes of knowledge, where Bruner believes that learning through discovery involves the internal reorganization of known ideas (Muhammad, 2021). Previously, it was suggested that students move through three styles or levels of representation as they learn. Bruner's proposal achieves one of the endeavours and efforts made to reform education and bring about a qualitative shift, as here lies the challenge facing teachers. The learner becomes a participant in his teaching and learning, and not just a recipient, in providing a "thinking" curriculum and creative educational methods that help students realize the importance of active participation in their learning (Widayati et al., 2019). This depends mainly on the constructivist theory, which emphasizes the "construction" that occurs in the brain during learning. Here the role of the teacher is highlighted, which is rooted in the social and cognitive perspective of learning, and to facilitate and prepare the appropriate mechanism. Students need to explore and build an intuitive understanding of mathematical concepts, which makes mathematics - as a learning subject, interesting (Colliot & Boucheix, 2023). Students need to explore mental pleasure in learning it, and giving them a feeling for it, as it is not an abstract subject as it is viewed.

1.1. Problem statement

The reason for the low achievement of students with disabilities in geometry in particular is due to several reasons, including the teacher, the curriculum, the students, and others. In the current study, the researcher will highlight students, who often show modest knowledge of the properties of shapes and the relationships between them, and for whom learning geometric concepts seems to be rote memorization rather than their construction. Diagnosing the nature of concepts and errors among students enables the teacher to develop specific teaching strategies that address such problems and enhance understanding of concepts. Therefore, when an appropriate teaching strategy is used, it will help to accurately understand students and reduce their misconceptions. When looking at the challenges of students in geometry, students do not show the same levels of thinking in all the areas included in the curriculum. Sometimes their levels of thinking appear low for some topics in geometry, for example: they do not recognize squares as rectangles. In addition, Van Hiele's theory shows that one of the reasons students have difficulty with higher-order cognitive processes, which are the key to success (the evidence needed for success) in high school engineering, is that they are taught at a higher Van Hiele level than they are or are prepared for. It is necessary to pay attention to the language used, which takes into account the levels of engineering thinking among students, as the difference in language may constitute a linguistic barrier that prevents the delivery of the information that the teacher wants to convey to the students, and this may explain the general weakness in geometry.

1.2. Question of the study

The study sought to answer the following main question:
What is the impact of using origami-based activities on developing geometry skills and knowledge among students with learning disabilities in the elementary stage?

1.3. Significance of the study

The study emanates from the recommendations of researchers who called for conducting qualitative studies to investigate students' learning while practising origami activities, its benefits in different school environments, recording them, and their perceptions of them. The study delves deeper into details and previous learning behaviours in search of a generalization of the importance of origami as a teaching method. Qualitative studies on origami are almost few and do not delve into engineering knowledge in detail. In addition, the importance of the study lies in the fact that it provides a detailed narrative description of the development of geometry knowledge among elementary students with learning disabilities through the use of origami folding activities, which is a study that is not widely used locally or in the Arab world. Folding (origami) is used in some private schools as a form of art and entertainment, so this is an opportunity to adopt it as an educational method. The study presents the origami tool as an educational method that can help students overcome the engineering challenges they have acquired (previously) or develop or build engineering knowledge. Pre-service and in-service teachers can benefit from it and use it as a method of presenting various engineering topics - and mathematics topics - that in turn, generally help students on three levels and in different aspects (cognitive, emotional, motor).

1.4. Study limitations

The traditional and simple origami lessons are designed so that all students can feel a sense of accomplishment, as no previous origami experience restricted the lessons chosen. From the practical side, the researcher adhered to a period not exceeding six consecutive days. The current study was limited to the participation of six fifth-grade students, who are studying in one of the government schools (Ministry of Education) of Irbid City in the school year (2023-2024). The geometry concepts contained in the "Geometry and Measurement" unit were applied to the class.

2. Literature Review

Bruner was interested in learning theory, the teaching process, and the philosophy of education, and wrote many books and articles about them. Later, Bruner presented his book “Towards a Theory of Teaching,” like his book The Teaching Process, in which he reviews his point of view on the nature of mental development, discusses six characteristics of it, and suggests four important aspects of teaching theory (Husniati et al., 2020). Enactive representation is known to represent past events/knowledge through motor responses, such as actions taken directly by students. Students learn about a specific concept or knowledge through their direct work with tools from the environment. Students at this level do not need a picture or explanation of the required knowledge in words; rather, they learn knowledge through their actions only (Boakes, 2020). Iconic representation transforms the knowledge that students learned from their manipulation of the tools into an image, which symbolizes the object/knowledge depicted. Whereas in iconic representation, students move to what resembles visual materials, but they do not need to manipulate (Feil, 2019).

Van Hiele’s theory of levels of geometric thinking goes back to two Dutch mathematics teachers, Diana Van Hiele & Pierre Van Hiele, who formed the basis for curriculum design in Russian scholarship and geometric teaching methods. There is consistency and similarity between Van Hiele's levels of geometric thinking and origami activities, as students move between three of Van Hiele's five levels while practicing folding activities (Lusyana & Lestari, 2022). This transition is not a sudden jump from one level to another, but rather there is a gradual shift in focus from one level to another. At the first level, students learn about geometric shapes from their apparent shape, where a shape is judged by its visual appearance. It is said, “It is a rectangle because it resembles a box.” Students do not see the whole part of the shape, its properties, or the relationship between geometric shapes (Galicha & Lazaro, 2022). In origami, as they fold their models, students are exposed to several terms and concepts for basic geometric shapes, such as sides, angles, squares, rectangles, and triangles. In each origami activity these terms and shapes are repeated, so that basic understanding is reinforced.

At the analysis/descriptive level, students begin to judge shapes based on the properties they possess, not by the apparent shape “because it resembles...” but because it has certain properties. For example, an equilateral triangle has three sides, all of its sides are equal and the angles are equal, etc (Mjenda et al., 2023). Language at this level is important for describing shapes, however, at the descriptive level, the properties are not yet logically arranged, so at this level, it is not inferred that an equilateral triangle is isosceles either. In the process of origami, many geometric shapes emerge, such as the rectangle, which appears in several different spaces and positions. Here, students discuss why the shape is a rectangle by learning about its characteristics and highlighting them (Hibi, 2022).

At the order/informal deduction level, properties are arranged logically, they can use them to formulate definitions, and students can infer some of them. For example, why all squares are rectangles can be explained and justified through relationships (Yahya et al., 2022). However, at this level, the essential meaning of a formal deduction or proof is not understood, i.e. the role of axioms, definitions, and theorems in it, nor are their conversations understood. In origami, while folding the model, students experience the properties of geometric shapes in different contexts, learning to explain and identify similar shapes, such as similar and isosceles triangles, parallelograms, and rhombuses (Nur, et al., 2022). This atmosphere is characterized by continuous analysis of the origami paper throughout the process of folding the model. To highlight this level, for example, some students show a great ability to see two triangles and a square from an isosceles trapezoid.

At the deduction level, students realize the importance of deduction as a means of constructing and developing engineering theories and also realize the importance of using axioms and postulates and their role in deduction (Klemer & Rapoport, 2020). Students can write a formal proof and have an understanding of it. The rigour level is the highest level of geometric thinking. Students at this level can perform more rigorous and abstract proofs and can understand non-Euclidean geometry (Fathyipor et al., 2023). Origami methods vary, including traditional ones in which simplicity is maintained by using a single, square origami sheet, which is formed into several models that imitate nature and are known to people without cutting it or using rigid origami, which relies on using a single origami sheet that folds easily without bending the areas between its wrinkles. This idea was adopted in replacing unbent lines with joints and solid panels, which has great meaning (Kamalodeen et al., 2021; Khasawneh, M. A. S. (2023).

It is noteworthy that origami and learning mathematics and science are closely linked. These connections between origami and the various sciences (mathematics, science, and technology), and education in particular, make them topics of interest, as researchers sought to show the links between these fields through a series of conferences to explore those links. Origami is closely related to mathematics (Huang et al., 2023). Through it, many mathematical concepts can be explained in various fields of mathematics, such as geometry, algebra, calculus, and others. Origami activities can be useful for students and are key to understanding many concepts in mathematics due to their tangible and practical nature (Widayati et al., 2019). There is much evidence that origami is linked to different areas of mathematics, and this is what I will try to show in this section, as well as in operations, for example, in teaching fractions such as multiplying numbers.

Previous studies

Amanda and Hidayat (2024) explored how well children with intellectual impairments' social skills fare after participating in origami play therapy. In February of 2023, the research was carried out. Research design based on a one-group pretest-posttest paradigm. There are eighty-nine pupils in all. The data was analyzed using the Wilcoxon test, and 30 samples were gathered using the purposive sampling strategy. According to studies on social skills, the majority of participants had poor social skills before treatment (n=19, or 63.3% of the total), however after therapy, participants' social skills improved (n=13, or 43.3% of the total). The statistical test yielded a ρ value of 0.000, indicating that the social skills level of children with intellectual impairments at Special Education School C Tulungagung was impacted by origami play therapy. The social skills of children may be enhanced via group origami play therapy sessions by encouraging them to engage with their classmates. Educators are advised to include regular play therapy in their lesson plans to help youngsters improve their social skills.

Budinski et al. (2020) investigated opportunities for teaching formal geometric definitions to fifth-grade primary school kids (11-12 years old) via the use of origami and technology, namely GeoGebra. It is now well acknowledged that incorporating origami into mathematics lectures may greatly enhance students' understanding of the subject. The study sought to see whether our origami and tech-based math exercises for high school students would be effective in elementary school after developing them for that level of education in earlier research. Because of this, the study decided to make a flat origami crane model and use it to teach kids about fundamental geometric concepts like lines, points, intersections, and angles. Using GeoGebra, a mathematical program, we supplemented the mathematical concepts students learned via paper folding with new concepts and expanded their mathematical toolboxes. However, students would need some familiarity with geometric terminology before they could use the program, and it's obvious that the software helps pupils retain more information.

Bornasal and Sulatra (2021) explored how teaching geometry using paper folding (origami) affected student performance. A total of eighty-six (86) eighth graders were divided into an experimental group and a control group at random. A quasi-experimental pre- and post-test approach was used in this investigation. While one group learned how to fold paper, the other group received non-paper folding training. The results showed that both groups performed better after receiving training in both paper-folding and non-paper-folding techniques. However, when comparing the two groups' mathematical abilities, the experimental group came out on top. As a result, students learned geometry more effectively via paper-folding teaching. Students' geometry scores, math educators' pedagogical practices, and the work of academics in the future might all benefit from the data and conclusions drawn from this study.

Respitawulan and Afrianti (2019) conducted a restricted trial of the hypothesized origami construction-based learning technique for early childhood mathematical ideas. Seventeen instructors of preschool and kindergarten in Bandung and the neighbouring regions received instruction in the method using the training tools developed for the pilot study. Teachers' understanding of how to use origami to teach mathematics to young children improved based on the results of the trial's pre-and post-tests. Using a t-paired test, it was shown that the improvement was statistically significant. The majority of participants have only a high school diploma and no formal education in mathematics for young children; this, combined with origami's traditional use for the development of fine motor skills, may explain the observed improvement. So, origami creation might be a great way for kids to grasp arithmetic concepts at a young age.

Tella and Sulaimon (2022) examined the relationship between gender and students' performance in fractions in Oyo State, Nigeria, as well as the impact of an inquiry-based teaching technique that included origami activities. Utilizing a 2x2 factorial matrix, the research embraced a quasi-experimental design with a control group that underwent testing before and after intervention. Two public elementary schools were chosen at random to provide the sample group, which included 55 males and 33 females. The experimental group and the control group were each given two complete courses at random. Students' fraction achievement tests and instructors' lesson plans served as the tools for this study. The researchers used the estimated marginal mean and analysis of covariance to look at the data. No substantial main effect was found for gender; however, treatment did have a notable impact on students' fractional success. Students' performance was unaffected by the interplay between treatment and gender. An inquiry-based educational technique that incorporates origami activities was suggested for mathematics teachers.

3. Methods

The study methodology is considered qualitative-descriptive, and a case study was chosen that delves into describing the development of geometry knowledge using folding activities among fifth-grade students with learning disabilities. The case study provides a detailed and precise examination and provides the collection of data that cannot be collected through surveys or (Cohen et al., 2018) for a small sample (experimental research), and this methodology also suits the goal of the study.

3.1.Sampling

The study included six students from one school in Irbid City, Jordan, for the academic year 2023. The students were selected using purposive sampling, which is one of the non-probability sampling methods (Cohen et al., 2018), and which is compatible with qualitative research, specifically case studies. Several conditions were met, such as academic achievement in mathematics (excellent, good, acceptable) and being close to the teaching place. The following table presents the characteristics of the study participants.

Table 1. Characteristics of the study participants

Student	Average	Level in mathematics	notes
Student A	Very good	Excellent	The students are all 11 years old. The students are enrolled in a mixed government school. All students did not receive any education - whether face-to-face or remotely - in the geometry unit using the origami technique.
Student B	Very good	Excellent	
Student C	Very good	Good	
Student D	Good	Good	
Student E	Poor	Poor	
Student F	Poor	Poor	

3.2. Instruments of the study

This study relied on three instruments, a test of geometry knowledge for fifth-grade students, activities for the intervention period (origami activities and iconic-symbolic activities), and semi-structured interviews. Through these instruments, the details of developing geometry knowledge using origami activities were delved into as deeply as possible.

3.2.1. The geometry test

The test aimed to examine the challenges of fifth-grade students in their geometry knowledge/basic concepts contained in the "Geometry and Measurement" unit in the engineering part of the first three lessons in the unit. It was designed based on the specifications table after determining the objectives and content of the lessons. The test consists of two sections: the first section contains an objective question consisting of 10 various items, based on cognitive and inferential objectives (8 cognitive items, 2 inferential items), and each item has four alternatives. The second section consists of five essay questions on applied and inferential objectives. To achieve validity in the written test, the test was sent to five expert arbitrators specializing in mathematics, who are professors at the Faculty of Education at the University of Jordan, and seven school teachers specializing in mathematics and special education with varying experience (between one and 35 years). Most of them agreed that the test is consistent with the principles of measurement and evaluation in preparing tests, and achieves the goals it seeks to achieve. They suggested several observations that I took into consideration, such as increasing the test time and clarifying some phrases to make them easier to understand and read.

3.2.2. The origami activities

The idea of developing the fifth-grade geometry unit activities is based on Bruner's three representations so that geometric mathematical concepts are presented to students in three ways: practical, iconic, and symbolic. The idea of developing the "Geometry and Measurement Unit" lessons for fifth-grade students in Part 2 came after reviewing it. From this standpoint and after considering the literature, the three lessons were developed to adopt Bruner's three levels and were divided as follows: The first day of each lesson is devoted to practical activities (folding activities). The second day is devoted to iconic-symbolic activities. The 11 folding activities (letter envelope lesson, ship lesson, and swan lesson) are a reflection of the concepts of the three lessons in order. The focus is on geometric concepts practically as students explore them with folding by asking purposeful questions that spark discussion and dialogue. They are given enough time and space to explore the concepts, then justify them, and finally present them in their language.

The qualitative part (the symbolic-iconic folding and interviewing activities) was dealt with according to the qualitative approach. To achieve this, the study built the symbolic-iconic folding and interviewing activities based on the theoretical framework, specifically Bruner's representations. All the tools depend on each other, which gives the tools confidence in them. Therefore, the reliability of my tools depends on four principles of the qualitative approach, which are the specifications table, the tools that build them on each other, and the theoretical framework, and their results depend on each other, which gives them confidence.

3.2.3. semi-structured interviews

The interview somewhat performs the function of reading the students' progress compared to the test and the intervention period for some challenges, as it is not possible to cover all the students' challenges that were monitored during the intervention period. It is expected that the students will exceed some of them, and there will be differences among them. The interview depends primarily on the student's performance during the intervention period, so it was built and designed accordingly, taking into account the challenges that the students demonstrated in the test. It is also concerned with delving deeper into the development of their engineering knowledge in some challenges. In designing the interview, the study relied mainly on the challenges students faced during the test and the iconic and symbolic folding activities. The focus was on two main challenges: knowing the angles of a quadrilateral by folding paper without using a protractor and identifying and defining some geometric shapes.

4. Results and discussion

4.1. The test

To achieve the objective of the study, the student's results were transcribed in the written test, which resulted in several challenges that the study took into consideration in the folding and iconic-symbolic activities. During the intervention period, the study focused on those challenges and the objectives of the first three lessons in the geometry unit for the fifth grade, which include the quadrilateral, the square, and the rectangle, the characteristics of the rhombus, and after completing the intervention period and transcribing a large portion of their data into it, respectively. Each student was interviewed individually, and all of the data was transcribed. In the end, the study repeated the test after the end-of-work test, and the resulting data was transcribed. The students passed the test with various levels as shown in the following table.

Table 2. The student's results in the written post-test

Student	Score (out of 10)	Level
Student A	9	High
Student B	9	High
Student C	7	Medium
Student D	7	Medium
Student E	6	Low
Student F	6	Low

In the written test, students showed general challenges. Some of these challenges were overcome by all students and demonstrated an improvement in engineering knowledge. In other words, there was a high effectiveness of the folding activities on these levels. As for some of the other challenges, there was a variation in the effectiveness of the folding activities with the students challenges that exist for all students. All students demonstrated a challenge in identifying shapes that have one line of symmetry. They expressed this in writing by answering incorrectly and verbally during the test where they said, "What does line of symmetry mean?

4.2. The origami-based activities and the semi-structured interviews

The origami activities showed great effectiveness in overcoming this challenge. Some students demonstrated a high level of understanding and grasping this knowledge, and some of them were content with just finding it. In addition, it appears from the students' performance that the folding activity was effective for all academic levels. This made them equal in knowledge, and the difference was in the ability to express the concept. The method of constructing knowledge for students with a high academic level was more profound, and they had a special definition of the concept, sometimes with linguistic precision, as appears in Student A's conversation with Student C when she corrected "two shapes like each other" to "meaning similar." Student A needed to point (using fingers) to express her understanding of the line of symmetry.

The students demonstrated that they exceeded their challenges in the written test for some geometric concepts, as the effectiveness of folding was high, such as the line of symmetry. On the other hand, the effectiveness of folding in developing students' engineering knowledge varied, specifically in students overcoming the general challenges that they demonstrated in the test. For some students, the effectiveness of folding in developing their engineering knowledge was high (in order: Student A, then B), and this differs from their academic background before the intervention, as folding activities developed their engineering knowledge on the three cognitive levels (knowledge, application, reasoning), and their construction of new knowledge was striking. And impressive, as they transferred their knowledge directly to the deductive level and demonstrated high folding effectiveness. Some students had an average to modest level of development (in order: Student C, Student E), despite developing their engineering knowledge on the three levels, but not as good as their colleagues' performance, and building their new knowledge was average to modest. Finally, some showed a slight overcoming of their challenges at the cognitive level and were unable to transfer this knowledge to a higher level.

In this part, the students showed high effectiveness in overcoming challenges in some basic engineering concepts, and they prominently demonstrated the role of folding activities in developing this knowledge, such as symmetry, diagonals, angles, and opposite sides. It was easy for the students to deal with these geometric terms and concepts, which seem to become " "Simple" with folding paper, where the students deal with these concepts in a "practical" and tangible way, and they have a "visual" image of them, so they were able to move them to the "iconic-symbolic" stage. Some students with a high academic level were not satisfied with the cognitive level, but were able to provide a special definition of the concept, sometimes with linguistic precision, as appears in Jannat's conversation with Lamees, when she corrected "two shapes like each other" to "meaning identical."

This high effectiveness is attributed to developing students' engineering knowledge and transferring their knowledge from the tangible to the "expressive language" of folding activities. Teaching mathematics, specifically geometry, using folding activities is presented to students in a "tactile, practical way that uses the senses (hands, sight) and the brain, so students develop" "Visual images" take them to the iconic stage, where students do not deal directly with the concept, but rather reflect its image consisting of its "work" and then process it in the form of mathematical language expressed orally or in writing. In this way, information is processed with high efficiency by students when it moves from the tangible to the abstract, and this is consistent with Bruner's proposal in representing concepts and presenting them in three ways: from the practical to the iconic and then the symbolic. It appeared from the students' performance that the folding activity was effective for all academic levels. This made the students equal in knowledge, and the folding activities helped to close the knowledge gap between students with high achievement so that all students are brought to the low and high academic level similar to geometry knowledge in engineering knowledge and concepts at a second level.

The students themselves had positive opinions about the folding activities, which were in the form of reflections about the intervention experience in general. The phrases were as follows: "It was nice, I loved them." "When we fold, shapes come out, and in the end one shape." "Folding is the thing I loved the most." "The ship is the thing I loved the most; I knew how to do it." This is perhaps one of the aspects of enjoyment when A and B shared their rituals after attending the origami classes, which means "Every time after the afternoon, A, E, and B come and we make shapes together." As for the aspect Academic related to geometry, Student A expressed the activities that she learned the rhombus well, "The rhombus is a kitsch [I didn't know it], I now know it like a square." The rest of the students linked the folding activities to measuring angles, as it seems that the experience of measuring angles from the folding paper they made was a favourite for them and stuck in their minds. These results show the effectiveness of origami activities when they support concepts with other sensory tools.

5. Conclusion

The folding activities helped all the students to retain what they learned as much as possible, and this appears from their results in the post-test that took place two and a half months after the intervention period, where they showed a noticeable improvement in their geometric knowledge and some of them showed very high performance. Some of the students showed creative ideas with a creative touch and beautiful imagination. Folding activities are full of imagination and creativity, in which people exercise their hands and brains when making origami models. Student A suggested that she would make small swans to become a lake in it "the mother and her little children." On the other hand, the creative side of some of the students involved remaking models from plain paper at home and bringing them to the teacher the next day. The results of the study showed the improvement of the students in understanding some geometric concepts using origami-based activities. The origami activities have an "emotional aspect." They enhance self-esteem and increase self-efficacy among students, so they feel that this is represented in the observations that were recorded about the student's performance of achievement related to this aspect during unpacking the activities. It was observed that students helped each other when forming some parts, as Student E is with Student F. This is what makes Student E, who has a low academic level, feel accomplished for his ability to help Student F, as well, which is what the student C expressed when she said that she was able to create a model of the ship.

6. Recommendations

The study recommends developing mathematics books to include practical sensory activities "such as folding activities" that help students move according to Bruner's representations from the concrete to the abstract. The study also recommends checking out the book activities for 5th grade in the geometry unit, which could lead to some geometry fallacies and the emergence of alternative concepts. It is also recommended to practice "folding activities" as an attractive educational model that achieves motivation, play, and learning at the same time, especially for the primary educational levels. Only one folding activity can achieve many of the academic and geometry-related goals outlined in the textbook. It is important to use origami activities as an alternative "evaluation" tool to traditional tests that are confusing and cause concern for some students. Origami activities are fun and can cover many of the goals in an engineering unit with just one folding activity. Also, they allow all students to feel a sense of accomplishment, regardless of the student's academic level.

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