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The kite project to improve junior high school students' numeracy

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Abstract

This research occurred to improve students' numeracy skills. To help students acquire these skills, develop learning projects through a STEAM approach using kite-making and collaborative learning projects. Design collaborative learning projects using a STEAM approach to assist students in acquiring these skills. This study's primary purpose is to create kites to aid junior high school students in addressing problems concerning PLSV and the kite area. This study applies a design research type of validation study. The data collection technique used is using images, products, and review documents for data collecting. The research participants were 30 seventh-grade (Phase D) junior high school students in Palembang. This study developed a learning trajectory that includes three exercises and post-test questions. Students can investigate and address issues associated with kite construction using PLSV materials. In the second activity, students can create kites and estimate their area based on their kite-making skills. After the kite is built, students fly a kite and study it. Students can improve their numeracy abilities through project-based learning employing STEAM in the context of kite creation, as demonstrated by the findings of this study. This knowledge aids them in overcoming obstacles associated with PLSV content and expands kite-making.

Introduction

Mathematics is one of the subjects that elementary, middle, and high school students must study. According to Kemdikbud (2013), students must have logical, critical, analytical, and creative abilities, think carefully, have awareness, responsibility, responsiveness, and problem-solving. Mathematics is the most challenging and requires intellectual and cognitive preparation (Gazali, 2016). Therefore, students memorize formulas and emphasize the formation of knowledge processes and mastery of concepts. Besides that, students must be able to develop and discover their knowledge without relying on what the teacher provides.

The factor of students' creative thinking ability, which is still at a low stage in solving contextual problems, is obtained from a study of the dominant factors that influence Indonesia's less-than-optimal achievement in PISA studies (Wijayanti et al., 2021). Indonesia has a PISA score of 379 and ranked 74th out of 79 countries in 2018 (OECD, 2019). The relevance of numeracy abilities in Indonesia is not directly proportionate to the outcomes of this PISA (Nusantara et al., 2021). According to the Kemdikbudristek (2021), numeracy is the ability to: 1) use numbers and symbols related to mathematics to solve practical problems in a variety of everyday contexts; and 2) analyze the information displayed (tables, graphs, charts, etc.) and then use the results of the analysis to make predictions or draw conclusions or decisions. Because numeracy in Indonesia is still low, as indicated by the PISA score, this research uses PjBL and STEAM to strengthen students' numeracy.

Project-based learning (PjBL) is an effective instructional method that can shape students' scientific, social, and higher-order thinking activities. Implementing PjBL in teaching and learning enables students to plan learning activities, participate in collaborative projects, and develop products (Rahayu & Putri, 2021). The study also demonstrates that the PjBL learning approach enhances mathematics skills. PjBL will also have a favorable impact on the development of teamwork and the attainment of learning outcomes. Interactions between students will foster collaboration in completing projects (Putri et al., 2022). The research results also prove that PjBL improves math skills and PjBL will positively affect collaboration and achievement of learning outcomes. Interaction between children will stimulate cooperation in the joint implementation of the project (Sumarni et al., 2022). PjBL learning (Project-Based Learning) is a recommended model (Agustina & Putri, 2020; Daniel, 2016).

One of the multidisciplinary approaches is STEAM (Science, Technology, Engineering, Arts, and Mathematics). Collaboration in STEAM (Nessa et al., 2017) education will assist students in collecting, analyzing, and solving problems and understanding the relationship between problems. STEAM (Veerma et al., 2011) is typically followed by problem-based, active learning. For instance, STEAM, in conjunction with Project-Based Learning, can help students acquire problem-solving abilities and have an enjoyable learning experience.

Establishing collaborative abilities, the capacity to constructively absorb and use criticism, depict things and situations, and communicate problem-solving results is crucial in the STEAM approach to building numeracy (Siregar & Suyono, 2019). The STEAM environment enables the development of a numeracy framework (Niss, 2015; Zollman, 2012). Teachers and students value the STEAM approach because it enables them to view problems

or design processes from multiple perspectives that can be applied in the real world. Research conducted by Costantino (2017) states that teachers and students highly appreciate STEAM because it allows students to see problems or project processes from various points of view or perspectives that can be applied to real contexts.

One of the mathematics subjects at school is linear equations of one variable. Previous research has indicated that students need a more conceptual and procedural understanding of algebra. Therefore, teachers must construct learning procedures and tactics to help overcome students' faults (Larino, 2018). The PLSV material in previous research was in the research of Novitasari et al. (2018), who used a balancing tool. Another study by Saraswati et al. (2016) examined students' understanding of PLSV material using algebra tiles, which can help students find formal PLSV solutions. In addition, context is used as a student strategy in completing PLSV (Khuluq et al., 2015). Therefore the novelty in this research is to use the context of kite games which are used not only as a tool or context for understanding the material but can strengthen students' numeracy skills, especially students of class VII.

The setting researchers utilize in learning is the fabrication and flight of a kite. Kite is a traditional game enjoyed in numerous parts of the world, from young to old (Almanfaluthi & Juniar, 2020). However, kites are also a traditional game preferred by children in Indonesia. Kites have long been a traditional game for Indonesian children, with real-world activity as the background (Susanto, 2010). This study aimed to produce and determine the role of PLSV learning reflection through a kite-making project to strengthen the numeracy needs of seventh-grade students.

Methods

This study utilized a design research methodology for validation studies, which consists of three steps: preparing for the experiment, the design experiment, and retrospective analysis (Akker et al., 2006; Gravemeijer, 2004; Putri et al., 2022). This investigation was conducted at The State Junior High School 59 Palembang.

This study collected data from photos, videos, observations, interviews, and results of student work. The data obtained were analyzed using a descriptive qualitative approach. The research data was carried out in three steps of the validation study type.

In preparing for the experiment, researchers examined the junior high school mathematics curriculum, PjBL, and the STEAM learning approach as preparation for the experimental phase. Teachers and students were interviewed first to obtain in-depth information related to this research. Interviews with several students were also used to assess students' innate skills. The results of the interviews are used to determine the extent to which the students comprehend the learning prerequisites. Additionally, the results are used to design a series of learning activities, namely the Hypothetical Learning Trajectory (HLT). The designed HLT is dynamic, allowing for the modification and development of a cyclical process during learning (Putri et al., 2015). Interviews were conducted with mathematics teachers who teach in the class that will be the target of the research and designs the instrument together to find out the conditions of the

students, the appropriateness of the context used, the appropriateness of the material, the time and the teacher's opinion about the HLT that has been designed.

The design experiment stage consisted of pilot experiments and teaching experiments. The pilot experiment stage was carried out using learning in small groups. This group consisted of eight of state junior high school 59 Palembang students selected based on their mathematical abilities (low, medium, and high). The researcher acts as a model educator during the pilot stage of the experiment. This step assesses students' initial skills and administers the designed HLT. In addition, the data collected at this stage is required for adjusting and revising the HLT prior to its application in the subsequent experiment stage. After the pilot experiment, the researcher reflected on the advantages of applying the PjBL model as a model instructor and observer. Then, their thoughts and suggestions are utilized to enhance the learning experience (Putri & Zulkardi, 2019).

At the teaching experiment stage, students are taught by their teachers as model teachers, while researchers act as observers in learning activities. Researchers collect data in pilot and teaching experiments by documenting learning activities through videos, photos, and student worksheet results. Then, the last step is a retrospective analysis. Future learning designs were created using data from the teaching experiment steps (Putri et al., 2015). STEAM analysis on student worksheets is shown below in Table 1.

Table 1. STEAM analysis

Science	Technology
Applying Lift, Newton's Third Law, and Bernoulli's Law	• Internet to find information on kite making • Kite flight videos
Engineering	**Art**
• Designing kites • Testing and analyzing the results of kites that have been made	• Decorate the kite • Preserving traditional games
Mathematics	
• One Variable Linear Equation • Geometry (Area of the kite and rectangles)	

Results

This study was designed to produce a learning trajectory in learning using a kite-making project with the STEAM approach to improving the numeracy skills of junior high school students.

Before starting the lesson, the researcher interviewed students as research subjects to determine students' initial abilities while taking turns doing pre-tests. The pre-test results showed that students understood the principles of variables and geometry (area). The pre-test aims to determine students' abilities and initial knowledge about PLSV and the kite area. This pre-test consists of 3 description questions. The pre-test was carried out on three students at the research preparation stage. Students have tried to answer correctly and according to their thoughts and abilities, so the developed HLT is appropriate. After knowing the students' initial

abilities through the pre-test, a pilot experiment was carried out. In this step, the researcher involved eight students divided into two heterogeneous groups, with the researcher as the model teacher. The pilot experiment results show that students can solve problems together in groups based on the problems given (Figure 1).

Figure 1. Students together solve the given problem.

Then, a retrospective analysis of cycle one (pilot experiment) was performed. The results are used for improvement before entering the teaching trial stage. After a retrospective analysis in cycle 1, the actual learning trajectory during the learning process slightly improved the designed HLT. HLT is structured based on project learning syntax, namely:

1. Stage 1: Fundamental questions
   The teacher provides information about traditional games. At this stage, students are expected to be able to answer the teacher's questions and answer kites as one of them.
2. Stage 2: Analyze the problem and design a product plan
   Some student activities plan the size of the kite that will be made. Students determine the size by analyzing the calculation of the size of the kite's wings
3. Stage 3: Monitoring the kite design
   Presenting the results of calculating the size of the kite in activity 1.
4. Stage 4: Setting the project schedule
   Set the kite-making schedule for the next lesson and prepare the tools for kite-making and testing, such as paper, glue, bamboo slats, sewing thread, and nylon thread. The teacher asked students to learn how to make kites via the internet, and the teacher provided information about the duration of time in making kites.
5. Stage 5: Manufacturing implementation and monitoring product development
   Students are asked to make and measure the area of the kite made in activity 2 and fly and observe the kites flown in the field to answer activity 3.
6. Stage 6: Testing the results
   Students are asked to present the results of kite making and product conclusions in front of the class.

7. Stage 7: Evaluation of learning experience

After studying this project, the teacher evaluates the material obtained, such as PLSV and Geometry material, especially the area of a kite.

The next stage after the pilot experiment is the teaching experiment in class 7.4 (Phase D). Using the phases of the PjBL learning model and STEAM approach, results and discussion of the kite-making context learning project are presented. 27 D-stage students participated in learning activities according to the steps of this design study technique.

The apperception duration during the learning process is 7 minutes; students sit in groups. The math teacher at the school is the instructor at this stage. The teacher distributes worksheets to students. Three to four students with a certain level of problem-solving ability are grouped for cooperative learning. Figure 1 illustrates the instructor's view of project-based learning.

The worksheet is divided into two, namely kite-making with two stages of activity; the first stage is the planning stage, the second stage includes the activities of building and flying (testing) kites, and the evaluation stage. When a student who does not understand asks his group members for help by saying, "Please teach me," the student who is asked to teach must teach his group members until he can do it himself. In addition, the teacher divides the class into groups of three to four students who work collaboratively to address the challenge stated in Activity 1, namely kite planning. Figure 2 depicts students collaborating across groups.

Figure 2. Students collaborate in groups.

The teacher monitors students according to the PjBL learning model's stages when they are engaged in activity 1. There should be no teacher intervention with students. They are encouraged to ask their classmates so that groups can collaborate if there are questions from students who need help comprehending (Figure 3). The project-based approach has two benefits: teaching students the skills needed to create products independently and making students competent by developing knowledge from a deeper understanding of concepts (Kokotsaki et al., 2016).

Figure 3. Students ask their friends.

The next day will focus on implementation-stage learning. The implementation phase consists of two activities, namely kite-making and kite-flying. Following the apperception, the instructor reviewed the previous lesson. The instructor reminded the class of the materials and time required to construct the kite. Students work collaboratively to construct kites. Students will compare kite-making's planning and implementation phases to determine whether the kite-making process will be the same.

The final stage is a retrospective study of previous research outcomes, particularly student responses, product presentations, and constructed kite items. The outcomes of the students' responses consisted of two steps: the planning stage in activity 1, which involved planning the stages of kite construction, and the implementation stage in activities 2 and 3, which included the ability to construct and fly (trial) kites.

Student activity sheet (SAS): Planning and design stages

The instructor gives out Student Answer Sheet 1 (SAS). The objective of action 1 is, Students can evaluate and resolve challenges in planning kite construction or the initial phases of project planning/design based on their prior understanding of PLSV and Area of Kites. Pratama (2016) and Rahayu (2021), PjBL seeks to resolve issues by encouraging daily actions to discover new information related to necessary knowledge. Then, students employ the prerequisite knowledge to address typical life challenges, including constructing kites. The instructor provides an outlook on engaging learning: The students will construct kites.

For this reason, it is vital to grasp the material studied earlier, particularly PLSV and the area of the kite. Explaining the learning objectives by exploring past information relating to kite games and participating in preserving traditional games, one of which is kites. Some questions asked by the teacher to students.

"Does anyone know about traditional games in Indonesia that also exist in other countries?"

"What are the benefits of flying kites as a traditional game?"
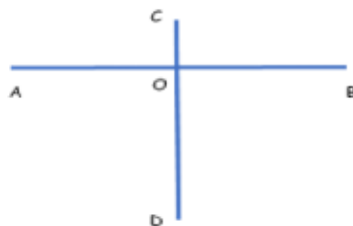
"Have you ever played a kite?"

"Have you ever made it?"

The following is an example of questions at the planning stage (Figure 4):

Tahap Perencanan dan Perancangan

Buatlah layang-layang dengan ketentuan sebagai berikut:

Misalkan kerangka layang-layang tersebut terdiri dari garis horizontal AB dan garis vertikal CD pada gambar berikut :

Gambar 1. Kerangka Layang-layang

Pada layang-layang terdapat dua bilah bambu yang berpotongan. Bilah bambu digunakan sebagai sayap (bambu horizontal) dan punggung (bambu vertikal). Ukuran bambu yang disiapkan masing-masing 58 cm untuk sayap dan 50 cm untuk punggung layang-layang.

1. Diketahui panjang ruas garis CO adalah 10 cm. Jika panjang ruas garis OD dimisalkan sebagai x, maka hitunglah panjang ruas garis OD tersebut.

Figure 4. Problem 1 during the planning and design stage (in Indonesian)

The first planning problem is in English (Figure 5).

Planning and Design Stage

Make kites with the following conditions:

Suppose the kite framework consists of a horizontal line AB and a vertical line CD in the following figure:
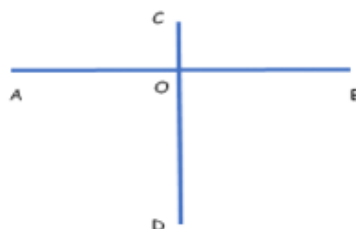
Figure 1. Kite's Frame

In the kite there are two intersecting bamboo blades. Bamboo slats are used for wings (horizontal bamboo) and back (vertical bamboo). The size of the bamboo prepared was 58 cm for the wings and 50 cm for the kite's back, respectively.

1. The length of the line segment CO is 10 cm. If the length of the line segment OD is assumed to be x, calculate the length of the line segment OD.

Figure 5. Problem 1 during the planning and design stage (in English).

Students finally responded to questions based on the guidelines provided in SAS and student responses in SAS 1.

1. If the length of the line segment OD is considered to be x and the length of the line segment CO is 10 cm. Compute the length of the line segment OD.

   Students' answer :
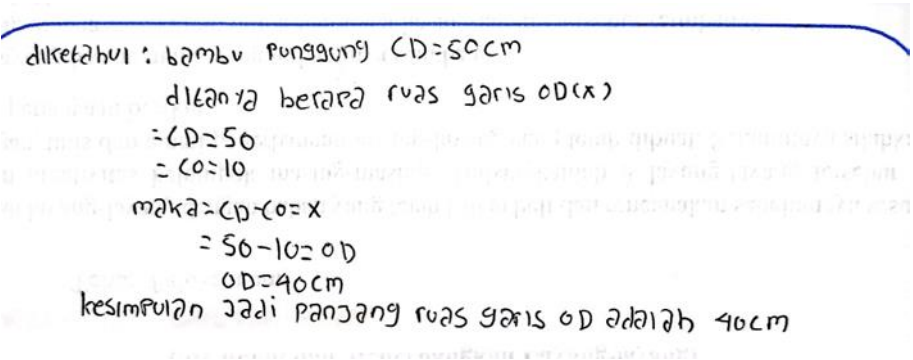
Indonesian
Translation
Known: bamboo back (CD) = 50cm Wanted: How many line segments OD (x)? CD = 50 CO = 10 So, CD – CO = x 50 - 10 = OD OD = 40 cm Conclusion: So, the length of the line segment OD is 40 cm.

Figure 6. Student responds to the first question during the planning stage

Figure 6 displays student responses as evidence that they can analyze and solve issues using one-variable linear equation content. This demonstrates the use of representation in the analysis received from the supplied information (graphs, tables, charts, diagrams, etc.), as measured by the numeracy indicators (Han, 2017).

2. Isilah tabel di bawah ini. Buat ukuran panjang sayap kiri (AO) dan kanan (BO) pada garis AB yang akan kamu buat dengan ketentuan sebagai berikut:

Tabel 1. Ketentuan Model Layang-layang

Model A	Model B	Model C
Misalkan panjang sayap adalah p. Sayap kiri lebih pendek 10 cm daripada sayap kanan.	Misalkan panjang sayap adalah q. Sayap kanan lebih panjang 14 cm daripada sayap kiri.	Sayap kiri dan kanan memiliki panjang yang sama. Misalkan panjang sayap adalah r.

Lengkapi Tabel 2 berikut dari informasi yang disajikan pada Tabel 1!

Tabel 2. Ukuran Sayap Layang-layang

Panjang Sayap		Jumlah Panjang Sayap (58 cm)
Sayap Kiri (p-10)	Sayap Kanan (p)	......
......	......	......
Sayap Kiri (q)	Sayap Kanan (q+14)	......
......	......	......
Sayap Kiri (r)	Sayap Kanan (r)	......
......	......	......

Figure 7. Problem 2 during the Planning and Design Stage (in Indonesian)

2. Fill in the table below. Measure the length of the left (AO) and right (BO) wings on the AB line that you will make with the following conditions:

Table 1. Kite Model Terms

Model A	Model B	Model C
Let the wing length be p. The left-wing is 10 cm shorter than the right-wing.	Let the wing length be q. The right-wing is 14 cm longer than the left-wing.	The left and right wings are the same lengths. Let the wing length be r.

Complete Table 2 below from the information presented in Table 1!

Table 2. Kite Wing Size

Wing Length		Total Wing Length (58cm)
Left Wing (p-10)	Right Wing (p)	......
......	......	......
Left Wing (q)	Right Wing (q+14)	......
......	......	......
Left Wing (r)	Right Wing (r)	......
......	......	......

Figure 8. Question table in English

Students' answer:

Indonesian

Tabel 2. Ukuran Sayap Layang-layang

Panjang Sayap		Jumlah Panjang Sayap (58 cm)
Sayap Kiri (p-10)	Sayap Kanan (p)	$(P-10) + P = 58$
24	34	58
Sayap Kiri (q)	Sayap Kanan (q+14)	$q + (q+14) = 58$
22	36	58
Sayap Kiri (r)	Sayap Kanan (r)	$r + r = 58$
29	29	58

a. $(P-10) + P = 58$
$P - 10 + P = 58$
$P + P - 10 = 58$
$2P - 10 = 58$
$2P = 58 + 10$
$2P = 68$
$P = \frac{68}{2}$
$P = 34$
$p - 10 = 34 - 10 = 24$

b. $q + (q+14) = 58$
$q + q + 14 = 58$
$2q + 14 = 58 - 14$
$2q = 44$
$q = 44 : 2$
$q = 22$
$q + 14 = 22 + 14 = 36$

c. $r + r = 58$
$2r = 58$
$r = \frac{58}{2}$
$r = 29$

Translated into English

Table 2. Kite Wing Size

Wing Length		Total Wing Length (58cm)
Left Wing (p-10)	Right Wing (p)	$(p-10) + p = 58$
24	34	58
Left Wing (q)	Right Wing (q+14)	$q + (q +14) = 58$
22	36	58
Left Wing (r)	Right Wing (r)	$r + r = 58$
29	29	.58

a. $(P-10) + P = 58$
$P - 10 + P = 58$
$P + P - 10 = 58$
$2P - 10 = 58$
$2P = 58 + 10$
$2P = 68$
$P = \frac{68}{2}$
$P = 34$
$p - 10 = 34 - 10 = 24$

b. $q + (q+14) = 58$
$q + q + 14 = 58$
$2q + 14 = 58 - 14$
$2q = 44 : 2 = 22$
$q = 22$
$q + 14 = 22 + 14 = 36$

c. $r + r = 58$
$2r = 58$
$r = \frac{58}{2}$
$r = 29$

Figure 9. Students' answers to number 2 at the planning stage

Figure 9 depicts students' responses to number 2 during the planning phase as evidence that they can use one of the numeracy indicators, namely the use of representations in the form of various numbers and symbols related to elementary mathematics, to solve problems (Han, 2017).

Student Activity Sheet (SAS) : Implementation Stage

On the second day of instruction, the instructor reviewed the prior session, which involved designing kites in response to the questions posed in activity 1. The instructor then instructed pupils to construct and fly kites during the Project implementation phase. Throughout the process of kite construction, pupils work in the preceding group. The instructor reviews the necessary materials and the duration of kite-making.

Figure 10. Second day learning

On the second day of instruction, the principal project implementation activities consist of kite construction and kite testing, which are detailed in Activities 2 and 3. The activity's plans determine materials for kite construction. Students create kites in collaboration. Students will examine the planning and implementation phases of kite-making to determine whether the kite-making process will be the same.

Figure 11. The process of making a kite

Following are questions and instructions for the kite flight trial stage:

1. Letakkan kerangka yang telah dibuat pada kertas yang disediakan.
2. Jiplaklah 3 pola layang-layang yang akan dibuat pada kertas yang disediakan dengan menambahkan 2 cm pada setiap titik sudut.
3. Hitunglah luas pola layang-layang model A dalam satuan unit.
4. Hitunglah luas pola layang-layang model B dalam satuan unit.
5. Hitunglah luas bangun dan pola layang-layang model C.
6. Bila kertas yang digunakan sebanyak 2 kertas, maka tentukan luas dari sisa kertas yang tidak digunakan.

Figure 12. Questions at the Implementation Stage (in Indonesian)

1. Place the framework that has been made on the paper provided. Trace the three kite patterns that will be made on the paper provided by adding 2 cm on each side.
   a) Calculate the area of the model kite pattern A in units.
   b) Calculate the area of the model kite pattern B in units.
   c) Calculate the area of the figure and the pattern of the C model kite!
   d) If two papers are used, determine the area of the remaining paper that is not used.

Students' answer :

a) Calculate the area of the model kite pattern A in units.

luas pola layang-layang model A = 82 unit

Students answered that the area of model A kite pattern is 82 units. In this problem, immediately calculate the kite pattern with the checkered paper provided. Like the first question, the second and third questions also use checkered paper.

b) Calculate the area of the model kite pattern B in units.

luas pola layang-layang model B = 93 unit

Students answered that the area of model A kite pattern is 82 units.

c) Calculate the area of the figure and the pattern of the C model kite!

a.) luas pola model C = 97 kotak unit
$d_1 = 50 + 2 + 2 = 54$ cm
$d_2 = 53 + 2 + 2 = 57$ cm
$L = \frac{1}{2} \times d_1 \times d_2$
$= \frac{1}{2} \times 54^{27} \times 57 = 1539$ cm².

b.) luas bangun layang-layang
$d_1 = 50$ cm
$d_2 = 53$ cm
$L = \frac{1}{2} \times 50^{25} \times 53$
$= 1325$ cm².

Translated into English :

· Pattern area of model C = 97 units
$d_1 = 50 + 2 + 2 = 54\ cm$
$d_2 = 53 + 2 + 2 = 57\ cm$
$L = \frac{1}{2} \times d_1 \times d_2$
$L = \frac{1}{2} \times 54 \times 57 = 1539\ cm^2$

· Kite Area
$d_1 = 50\ cm$
$d_2 = 53\ \ cm$
$L = \frac{1}{2} \times 50 \times 53$
$L = 1325\ cm^2$

d) If two papers are used, determine the area of the remaining paper that is not used.

Translated into English :

Paper = rectangle

$p = 29 \; unit$

$l = 19 \; unit$

Paper scrap $= 2 \times rectangle \; area - model \; A - B - C$

$= 2 \times p \times l - model \; A - model \; B - model \; C$

$= 2 \times 29 \times 19 - 82 - 93 - 97$

$= 830 \; unit.$

Figure 13. Student answers the question of the implementation stage of making a kite

Figure 13 displays the students' responses to the implementation phase of kite-making, indicating that they can solve the problem by calculating the area of paper used to make kites by making assessments and decisions.

After the kite has been constructed, it will be flown (trial) alongside questions that students must answer while viewing its flight. Figure 14 illustrates the procedure via which students pilot kite flights.

Figure 14. Students try out the kites they have made

The questions that students must answer after observing the kites being flown are as follows:

1. Terbangkanlah layang-layang yang telah kamu buat.
2. Amati layang-layang yang diterbangkan. Apa yang terjadi pada layang-layang A, B, dan C?
3. Layang-layang mana yang seimbang saat diterbangkan? Mengapa itu bisa terjadi?
4. Setelah menerbangkan layang-layang, kemukakan pendapatmu tentang apa itu "seimbang"? dan bagaimana cara kalian untuk menjaga layang-layang tersebut tetap terbang seimbang!

Figure 15. Questions at the Implementation Stage (in Indonesian)

1. Fly the kite that you have made.
2. Observe the flying kite. What happened to kites A, B, and C?

Student's answer:

Amatilah layang-layang yang diterbangkan. Apa yang terjadi pada layang-layang A, B, dan C?

a. Tidak terbang
b. Tidak terbang
C. tidak bisa Terbang

Figure 16. Students' answer in activity 3

Student's answer that kites A and B cannot be flown, while kite C can be flown.
3. Which kite balances when flying? Why did it happen?
Student's answer:

layang.layang C.
memiliki Ukuran yg sama dan Sismetrisi dan udara/ang
in yg mendukung layang-layang untuk terbang yg menyebab-
kan gaya angkat (lift) yaitu perbedaan kecepatan
permukaan layang-layang sesuai hukum bernoulli.
Hukum newton III pada layang-layang dibelokan.

Figure 17. Students' answers about kites that can be flown

Students write that "Model C kites have the same size and are symmetrical and the air/wind supports the kite to fly which causes lift, namely the difference in the surface speed of the kite according to Bernoulli's law. As well as newton's third law occurs when a kite is flowing". This student's answer supports the STEAM analysis in the Science section, namely observing Lift, Newton III's Law, and Bernoulli's Law during the trial phase.
4. After flying kite, express your opinion about what "balance" means? Moreover, how do you guys keep the kite flying in balance?
Student's answer :

apaltu Soimbang = Stabil Sejajar, dan dengan ukuran
yang sama atau simetris kiri dan kanan juga ditunjuk-
an pada saat layang-layang terbang.

Figure 18. Students' answers conclude kites that can be flown

Students wrote, "Balanced means stable/parallel and of the same size or symmetrical left and right are also shown when the kite is flying". This answer directs students to know that the PLSV material in the project is proven by the balance when the kite is flown. Research of Novitasari et al. (2018) uses a balancing tool.

The final step involves evaluating the results of the product by exhibiting the kites that have been constructed. The instructor inquires about the procedure and its outcomes. Students are shown displaying their work in Figure 18.

Figure 19. Students presenting product results

The outcomes of students' responses during the planning phase of each topic are weighted differently based on their preferences for the material. Nonetheless, they received the answer of 40 cm and measured the left and right wings during planning. Some students measure kite wing plans with a ruler to verify their calculations. A minor difference determines the kite's left and right sides during implementation.

After all project learning activities are in the teaching experiment phase, each student receives a final exam that tests students' knowledge of PLSV material and project learning. Students can apply STEAM and bring up numeracy ability indicators in project learning from activities 1, 2, and 3 (Han, 2017; Kemdikbudristek, 2021). The indicators that appear in student activities and answers are by numeracy skills (Kemdikbudristek, 2021), namely: 1) numbers and mathematical symbols used to solve practical problems in various real-life contexts; 2) analyzing the displayed data (tables and charts) then the results of data analysis are used to make predictions and draw conclusions or decisions. So that students' numeracy skills improve their ability to think using procedures, concepts, mathematical tools, and facts to strengthen skills using numbers, symbols, and information visible in the context of the natural world, namely making and flying kites.

Discussion

From the entire process of making and testing products (Fauziah et al., 2017; Repko et al., 2017), students can conclude clearly and accurately, based on the results of observations and measurements, that the manufacturing process applies and integrates existing concepts and procedures while enhancing professional skills. It also supports the BIE (1999) assertion that project-based learning assists students in mastering subjects and processes.

According to the student interview instructions, completing activities in the form of projects connected to the real world is more exciting and fun, and learning becomes more meaningful. It follows the opinion of Dewey (Williams, 2017) that with the experience of learning activities tailored to the needs of students, learning that is connected to the real world will make students learn actively.

Numeracy is also a student's ability to understand and apply mathematics learning in everyday life (OECD, 2016). Numeracy is a student's ability to formulate, use, and interpret mathematics in various contexts, including mathematical reasoning and mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena (OECD, 2018). Numerical indicators that appear to students can be seen in student answers in activity sheets, such as data displayed in table format or symbols in answering questions. Predictions and assessments are also included in activity 3 when students try out the kites they have made. According to Zulkardi et al. (2020), there is a unique process when students understand and solve problems: solving difficulties, looking at photos and reading questions, and reading and comparing all information.

STEAM-based learning can boost critical thinking, creativity, and 4C skills (Engelman et al., 2017; Henriksen, 2014). The STEAM method prepares pupils for 21st-century abilities (Siregar, 2020). STEAM-based techniques are adaptable, collaborative, and cognizant of recent teaching and learning trends.

In the prior study, such as research of Rohimah et al. (2022), the material for one-variable linear equations employing STEM is discussed in the dynamo-powered toy vehicle project. In addition, utilizing a balancing tool, Novitasari et al. (2018) studied the material of one-variable linear equations. In addition to resarch of Mustopo (2019) on the project to determine the area of a flat shape. The PLSV material and geometry, especially the area of the kite and rectangles, were designed by researchers as a project-based learning trajectory. Thus, pupils comprehend and apply information to their daily lives by building their kites and preserving traditional games.

Conclusion

The project's learning trajectory through PLSV and Geometry, notably kite, assists students in improving the material and the process of making and flying kites collaboratively with groups through problem-solving contexts that can enhance student numeracy skills. There are two stages to the progression of learning. Through collectively creating, implementing, and assessing products, 21st-century skills such as teamwork, communication, creativity, problem-solving, and critical thinking can emerge, thereby enhancing student numeracy. Due to their learning trajectories involving disciplined material in context, kites are a jumping-off point for project-based learning. Based on a review of the STEAM approach, these values include knowledge in relevant contexts and developing fascinating and engaging student skills.

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Conflicts of Interest

Authors have no competing interests. In addition, the writers have addressed ethical concerns like plagiarism, misconduct, data fabrication and falsification, double publishing and submission, and redundancy.

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Author Contributions

Nabila Putri Isamer: Conceptualization, writing - original draft, editing, and visualization; **Ratu Ilma Indra Putri:** Writing - review, formal analysis, corresponding author and methodology; **Zulkardi:** Validation and supervision.

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