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A learning trajectory of integer addition and subtraction using the *kempreng* game context

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Abstract

Traditional games can be used as a context to understand mathematical concepts. Many studies on learning trajectory (LT), which are set in the context of traditional games, have been carried out. However, no study focuses on using the context of the traditional *kempreng* game to facilitate primary students in understanding integer addition and subtraction. This research aims to design an LT through traditional game *kempreng* to help construct students' understanding and mathematical concepts through various activities that have been developed. This study uses design research with stages, namely preliminary design, teaching experiment, and retrospective analysis. This study produces LT which consists of five activities, namely: consisting of calculating addition points through the *kempreng* context, calculating subtraction (difference) through the *kempreng* context, performing additional operations on the “same” *kempreng* card, performing subtraction operations on “different” *kempreng*, and determining the results of addition or subtraction operations of number cards with the opposing group. In this study, LT set in the traditional game of *kempreng* can be used as a context in preparing learning designs that could stimulate students thinking in understanding the mathematical concepts of integer addition and subtraction. The impact of the research design also occurs on teachers. Learning becomes a student center, the teacher as a facilitator. The results of this study can have implications as one of the considerations for using contexts with real and cultural backgrounds to reduce or build a meaningful understanding of the concept of integer addition and subtraction for primary students.

Keywords: addition and subtraction; design research; *kempreng* game; learning trajectory

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Introduction

Children in the primary school age range often have difficulty completing integer addition and subtraction. Paliwal and Baroody (2020) found that grade 3 students had difficulty reasoning mathematically and were not fluent in completing subtraction (e.g., completing 23-9 = ? through mathematical reasoning addition 14+9 = 23. Amir et al. (2022) suggested that primary students in grade 4 who have instrumental understanding have weak conceptual knowledge in solving integer addition and subtraction questions involving negative numbers in the form of open number sentences (e.g., 4-10 = ? and 8 + ? = 5). Furthermore, Amir (2022) stated that mathematical learning difficulties students in grade 5 had difficulty in making visual representations of symbolic representations in completing integer addition and subtraction in the form of open number sentences.

The researchers noted at least two main problems that made it difficult for students to solve integer addition and subtraction questions. First, Bofferding and Richardson (2013) mentioned that primary school teachers have weak conceptual-based procedural knowledge and instructional strategies. The second problem is motivated by the second problem, namely the instructional integers model, which is not conceptually based. Wessman-Enzinger (2019) pointed out that often the instructional integer addition and subtraction model in primary schools is "made up", for example, adding a pair of zeros and walking forward or backward on the number line. These two problems cause primary students to have weak knowledge and understanding of integers involving addition and subtraction (Amir, 2022; Amir et al., 2022). In addition, it can cause cognitive problems, such as misconceptions, procedural errors, strategic errors, and logical errors in integer addition and subtraction (Güc & Türker, 2021; Makonye & Fakude, 2016). Furthermore, this weak conceptual understanding results in low student enthusiasm (Sari & Nursyahidah, 2022) and students' anxiety in learning integer addition and subtraction (Nurjanah & Alyani, 2021).

Conceptual problems in operating integer addition and subtraction for students can be solved through real contextual stimulation to make instruction more meaningful (Makonye & Fakude, 2016). Many previous studies emphasized the instructional activities of students (including primary students) through contextual realism in realistic mathematics education (RME). Stephan and Akyuz (2015) designed an instructional model based on RME through a financial context so that students can describe experiences (such as debts, assets, and net worths) so that the meaning of integer addition and subtraction is formed. Maryati andPrahmana (2021) used the context of bamboo woven motifs by applying the RME approach as a starting point in the process of student instructional activities so that students understand dilation and reflection in transformation geometry. Sari and Nursyahidah (2022) used the traditional market context with the RME approach so that students understood the concept of presenting statistical data. Khairunnisak et al. (2021) used contextual problems by designing RME-oriented learning to support students' mathematical representation abilities in expressing algebra. Afriansyah and Arwadi (2021) use origami context in RME learning to solve students' quadrilateral misconceptions.

The study of the use of context in RME learning in Indonesia involves cultural values and local wisdom (Hadi, 2017). In this case, the context in RME intersects with the context of the cultural background in ethnomathematics which is carried out in concrete, semi-concrete to abstract stages (Muslimin et al., 2020; Risdiyanti & Prahmana, 2018, 2021). For example, Risdiyanti and Prahmana (2021) study using the context of *Wayang* and *Mahabharata* in RME learning for set material. In this case, Risdiyanti and Prahmana use the context of *Wayang* and *Mahabharata*, which also have a cultural background in ethnomathematics. Furthermore, D'Ambrosio (2016) argues that ethnomathematics is seen as a way to learn mathematical concepts through socio-cultural or members of different cultures. Ethnomathematics can facilitate primary students to be the ability to construct mathematical concepts from the initial knowledge they already have (Mania, 2021). Using ethnomathematics as a basis for learning can improve primary students' understanding of finding mathematical concepts (Cimen, 2014). Thus, the study of the use of context to construct students' knowledge in order to understand certain mathematics material is seen as starting from the characteristics of RME and is seen as representing the characteristics of ethnomathematics, as long as the context presented has a cultural background and learning activities have characteristics of concrete, semi-concrete to abstract stages.

The traditional *kempreng* game from East Java has a cultural context that can be used as a starting point for learning in facilitating primary students' activities to learn integer addition and subtraction (Susanti, 2020). Susanti further explained the existence of integer addition and subtraction in the traditional game of *kempreng* is in the activity when students catch bottle caps of *kempreng* (for example, one student catches 3 bottle caps, then students will operate addition 10 + 10 + 10. If done alternately, then students can operate addition 30 + 40 + 50). Subtraction operations occur in student activities when calculating the remaining points to the maximum score (e.g., points obtained by students are 30, while the maximum points are 400, then students operate subtraction 100 – 30 = 70). In this case, students are facilitated to learn addition operations (10 + 10 + 10) followed by subtraction operations (100 – 30 = 70) (Paliwal & Baroody, 2020). Furthermore, Paliwal and Baroody revealed that through this gradual method, students are expected to be fluent in using the subtraction-as-addition strategy, namely, when students are faced with the question, what is 11 – 5 = ?. Students will use mathematical reasoning addition 5 + 6 = 11. Although Susanti's research confirms the addition and subtraction of integer operations in the *kempreng* game, Paliwal and Baroody's research states that these operations use subtraction operations as addition. However, Susanti's study has not specifically discussed how a series of measurable learning activities ranging from concrete to abstract can provide conjectures for the development of elementary students' understanding and the teacher's gradual actions in learning. Our study fills this gap to produce measurable and gradual learning activities ranging from concrete, semi-concrete to abstract for primary students and teacher stages by using a *kempreng* context in operating integer addition and subtraction.

In order to design mathematical learning is meaningful to produce maximum mathematical, conceptual knowledge for students. So, the researchers designed a learning trajectory (LT) to control, predict, and measurably evaluate learning activities. Previous researchers have also used LT to control, predict, and evaluate student and teacher activities in the classroom (e.g., Maryati & Prahmana, 2021; Risdiyanti & Prahmana, 2021; Sari & Nursyahidah, 2022). They were relating to LT, which has a particular context (including traditional games) on material related to integers in primary school. Muslimin et al. (2012) produce four LT by using the context of the traditional game of *congklak* in the form of learning activities to understand subtraction integers. Another similar LT study on integers was carried out by (Muslimin et al., 2012). This study resulted in four integer learning activities in the context of Islamic values. Nur et al. (2020) researched LT based on the context of traditional rubber games to overcome the misconceptions about integers for primary students (one of which is integer addition and subtraction). Stephan and Akyuz (2015) produced five LT in the form of practical activities in a financial context to achieve student understanding of organizing integer addition and subtraction.

The LT, set in the context of the traditional *kempreng* game on integer addition and subtraction material, is needed for primary students. This need is to construct integer addition and subtraction material concretely before understanding it abstractly. In addition, existing studies have not focused on developing LT through the context of the traditional *kempreng* game to facilitate primary students' understanding of integer addition and subtraction material. On the other hand, the traditional *kempreng* game with a cultural context is expected to make it easier for students to relate their experience to the mathematical aspects of their operation. Moreover, the traditional *kempreng* game has stages in visually representing and physical activity in operating integers (Susanti, 2020). It is because primary students find it easier to understand and operate integers through informal visual representations (not symbolic representations) (Amir & Amir, 2021; Amir, 2022). Hence, our research aims to produce LT through the context of the traditional *kempreng* game on integer addition and subtraction material for primary students.

Methods

This research method uses design research to produce LT through HLT, which contains a series of continuous activities to achieve a goal (Bakker, 2018). The learning activities are divided into three sessions: model of, model for, and formal. The participants were 29 grade IV primary school students in Mojokerto, East Java, Indonesia. The research instrument uses a worksheet. Data collection techniques were carried out by observation, worksheets, interviews, and documentation (videos and photos). Interviews were conducted during the research, namely open interviews, so researchers got direct responses from students. This study's LT design and development process used three stages: preliminary design, teaching experiment, and retrospective analysis (Muslimin et al., 2012). In this study, instruments (such as observation sheets and worksheets) and HLT were carried out by expert judgment by one mathematics education lecturer, one primary student teacher education teacher, and one primary school mathematics teacher. The results of this expert judgment were declared instrument and the HLT was valid because it represented a real context with a cultural background in traditional games to stimulate understanding of integer addition and subtraction concepts for primary students.

The researchers examine the curriculum and scientific sources in the preliminary design stage. Curriculum assessment is intended to determine basic competencies and learning indicators in integer addition and subtraction used in grade 4 primary school. Scientific sources (such as national and international journals and books) were studied regarding the context of the *kempreng* game. Included is how the steps of the *kempreng* game are applied in primary student mathematics learning, especially in how the location and mathematical form of integer addition and subtraction in the game *kempreng* for primary students as a form of culture in Java. After that, a preliminary study in the form of observation was carried out on research participants. This observation aims to see the initial ability of the research participants. These two sources of scientific data and observations became the starting material for designing the HLT, which contained a series of conjectures for integer addition and subtraction mathematical activities while using the context of the *kempreng* game. The activities are divided into four meeting sessions with 90 minutes each. The first session, the activity model, was carried out for two meetings. Next, the second and third sessions are for and formal model, which is held in one meeting each.

In the teaching experiment stage, the researchers implemented the stages designed in the HLT by dividing them into five groups (5 students) and one group (4 students) chosen intentionally. Researchers tested the learning activities in this phase in two cycles. The first cycle aims to evaluate and improve the path of learning activities that have been made. In comparison, the second cycle aims to implement the activity path that has been improved in the first cycle.

In the retrospective analysis stage, the researchers analyzed the mathematical activity and the stage of student understanding using the context of the *kempreng* game at the teaching experiment stage. This study's final stage of retrospective analysis did not produce a learning instructional theory (LIT). However, the final result of the retrospective analysis becomes the material for compiling the subsequent learning trajectory and LIT that can be followed up in subsequent research.

Results

This section reviews the process of producing LT at the preliminary design, teaching experiment, and retrospective analysis stages. Each of these stages is designed for the *kempreng* game HLT activity on the material of addition and subtraction integers. The HLT is used to predict and trace the activities of students and teachers in learning when using the *kempreng* context.

Preliminary design

The HLT is used as an initial stage to design the learning concept that the primary student will pass. At this stage, the HLT was created using three activity sessions adapted from (Maryati & Prahmana, 2021), see Figure 1. The first activity begins with a concrete form (model of), the second activity in a semi-concrete form (model for), and the third activity in an abstract form (formal).

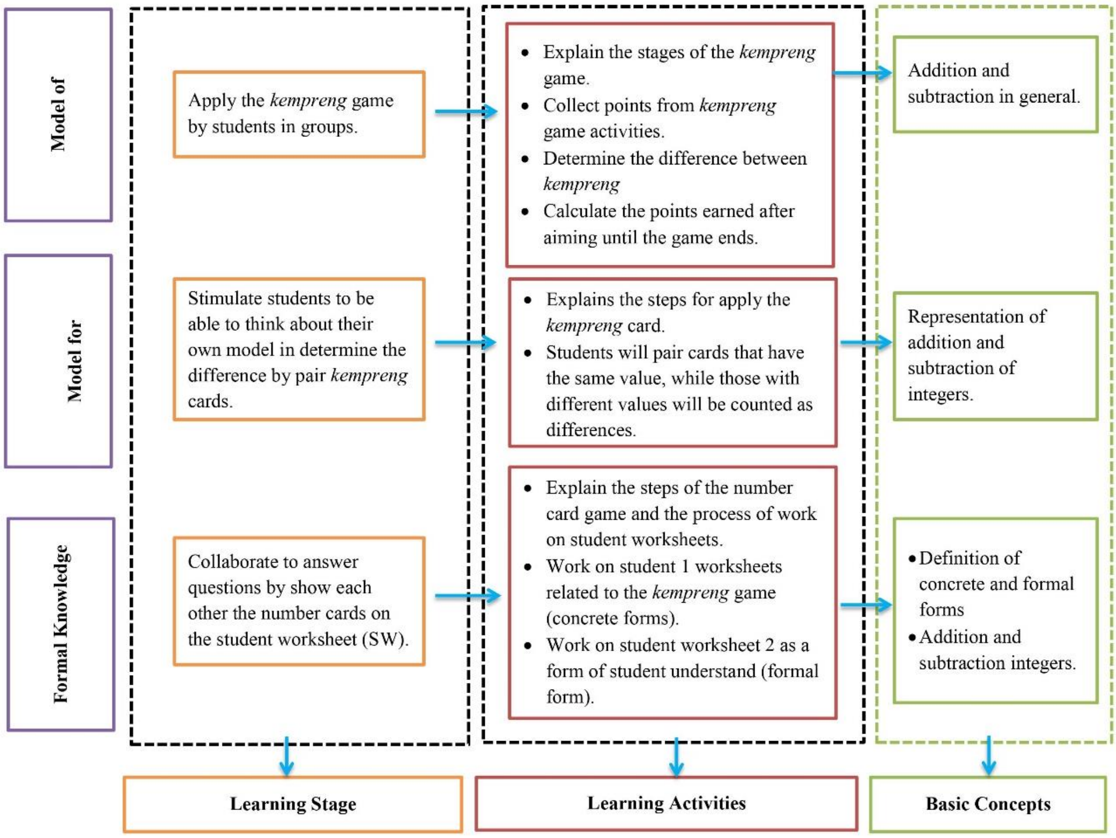


Figure 1. The relationship between learning stages, learning activities, and basic concepts

The HLT developed in Figure 1 contains learning activities. The series of HLT activities are arranged based on three categories: learning objectives, learning activities, and the basic concepts of addition and subtraction integers (Gurbuz & Ozdemir, 2020). Then from each of these categories, HLT activities are mapped into learning activities that are oriented from concrete to abstract, namely model of, model for, and formal (Nuraida & Amam, 2019).

Teaching experiment and retrospective analysis

This section presents the teaching experiment and retrospective analysis stages simultaneously. The presentation is carried out according to the learning stage, including activities and basic concepts designed in model of, model for, and formal knowledge. This learning stage is divided into understanding the concept of the *kempreng* game, determining the difference and negative numbers using the *kempreng* card, and writing the results of the number cards on the worksheet.

Calculating addition through the kempreng context

At the early stage of activities, students are reminded again about the *kempreng* game that has been done or experienced. The teacher starts the lesson by distributing a reading to the students. Then ask the students about their knowledge and experience with the traditional game of *kempreng*. The teacher provides an opportunity for students to convey their experiences if they have ever played *kempreng* (bottle cap). Afterward, the teacher asked the students to read the material studied in the *kempreng* game, namely the addition and subtraction of integers in the student's book. Next, the teacher asks students to follow the steps of the *kempreng* game explained. The game's duration depends on the shooting process that the student takes.

Students apply the *kempreng* game, which one student in each group represents. The way to do this game is by aiming. Then, students count the points they get during the shoot from start to finish. When calculating points, students will work in a format like Figure 2. In this format they will write down the results they get, for example 5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 40. The results will show how the primary student understands the concept of addition using a concrete object, namely *kempreng*.

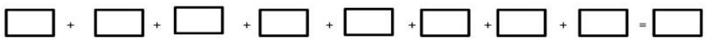


Figure 2. Format for calculating addition via *kempreng*

Calculating subtraction (difference) through the kempreng context

Students will determine the difference obtained during the activity, as shown in Figure 3. In the figure, it can be seen that the implementation is done by giving black color to the representation of the *kempreng* obtained by each group to find out the difference. The picture description is also written in mathematical form (8 – 7 = 1).

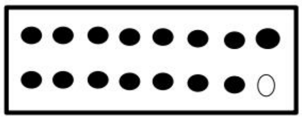
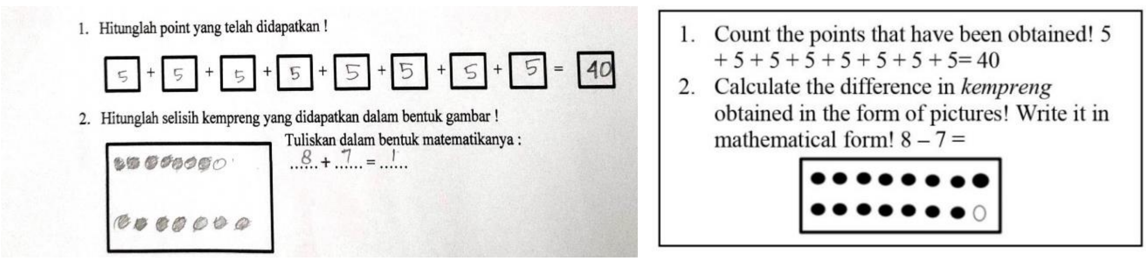


Figure 3. Illustration example of calculating subtraction through *kempreng*

Students apply the *kempreng* game, which one student in each group represents. The way to do this game is by aiming. Then, the students counted their points during the shoot from beginning to end, as in Figure 4. The researchers conducted questions and answers with students about the difference and stimulated students to find ways to determine the difference (Shutenko et al., 2021). This is because they will get a different number of *kempreng*. The winner in the second activity will get more *kempreng*. In addition, researchers provide opportunities for students to ask questions or give feedback on activities in this activity (Chevalier et al., 2022). The analysis in the activities model consists of predictions for students and teacher responses in answering questions given by students in Table 1.



(a) (b)

Figure 4. Highlights of counting points

Table 1. Activities session in model of

Activity Model of → Descriptor (1) The teacher asked the students about their knowledge and experience with the *kempreng* game.	
Student Predictions	- Knowing or having knowledge and experience of playing *kempreng*. - Does not have the knowledge and experience of playing *kempreng*.
Teacher's Response	Stimulate students to answer questions about the *kempreng* game.
Activity Model of → Descriptor (2) The teacher pairs and mentions the difference during the *kempreng* game.	
Student Predictions	Pairing and mentioning the difference when the *kempreng* game takes place correctly or not
Teacher's Response	- Guiding students to pair and mention the difference during the *kempreng* game - Providing verbal appreciation of student work.

Based on the first session of the model of activity, students can understand the basic mathematical concepts of arithmetic operations. Students were very enthusiastic in carrying out the first activity and actively asked questions during the activity. These results indicate that explaining the material in concrete is easier for students to understand.

Performing addition operations on the "same" kempreng card

The second session aims to encourage students to understand negative integers and the difference in the addition and subtraction of integers through the *kempreng* game. With the hope of being able to answer questions in the student book regarding the reduction of positive integers. As well as linking this chapter's math material into a *kempreng* game through kempreng cards (Susanti, 2020). In this session, students listen to the teacher's explanation of how to use the *kempreng* card. Students must also understand the negative integers material in the student book before the activities model for begins. The game will be divided into two parts: performing addition operations on the "same" *kempreng* cards and subtraction operations on "different" *kempreng* cards. After that, implement the *kempreng* card that has been designed.

The students show the results of the card game. Then calculations are carried out using addition operations. Figure 5 shows an illustration of the addition operation performed by students. The illustration was obtained when students used a *kempreng* visual representation.

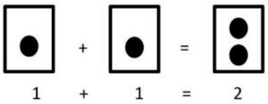


Figure 5. Illustration of *kempreng* (visual) representation of addition operation

Performing a subtraction operation on a "different" kempreng card

The result of the card game is shown and calculated. The form of the questions that will be given uses the *kempreng* representation and performs subtraction arithmetic operations, as shown in Figure 6. Evaluation activities are in the form of question-and-answer discussions between teachers and students. The data was obtained when the activity had taken place in the second session. This card game is played with each group of two players. Before being dealt, the cards are shuffled first, then divided. Each player gets 6 *kempreng* cards because the number of cards is 12. If the representation of the *kempreng* is the same, then it is not counted as a difference. However, “if the representation of *kempreng* is different, it is called the difference. For example, the card shown with the *kempreng* image is one and one, so it is not a difference. If one and two *kempreng* are shown in the picture, it is called a difference”, see Figure 7. As an evaluation of activity two, each student shows the results of the *kempreng* game he has done. The analysis in the model for consists of activities, predictions of student responses, and teacher responses in answering questions given by students in Table 2.

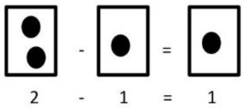
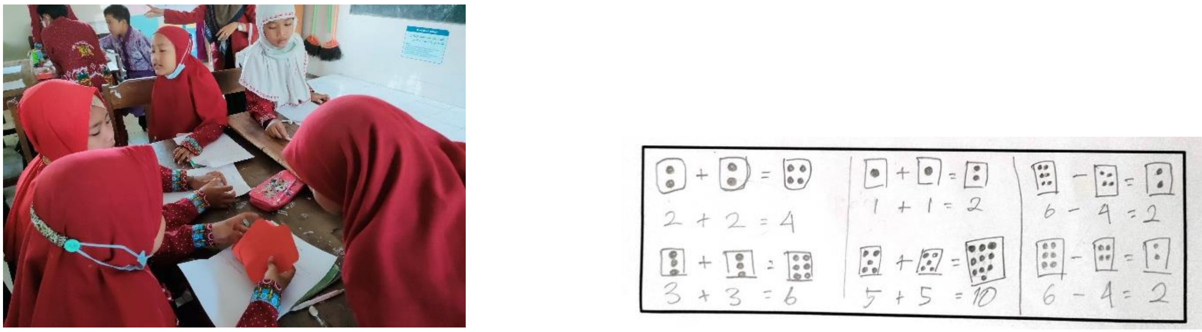


Figure 6. Illustration of the *kempreng* (visual) representation of the subtraction operation



(a) (b)

Figure 7. (a) Implementing the *kempreng* card (b) Result of model for

Table 2. Activities session in model for

Activity Model for → Descriptor (1) Students observe and understand negative integers or differences.	
Student Predictions	Understanding or not understanding negative integers.
Teacher's Response	Facilitating students to understand negative integers or differences.
Activity Model for → Descriptor (2) Students implement the *kempreng* card game and show the results or differences in the *kempreng* cards that have been applied.	
Student Predictions	Able or not able to show the results of the *kempreng* card that has been applied.
Teacher's Response	- Explaining and showing the results of the *kempreng* card game. - Giving verbal appreciation to students.

The results of the analysis in the second session were that they could understand the basic mathematical concepts of difference which could be seen from the results shown by the students. The *kempreng* card game is a representation of the *kempreng* form. In this case, learning is still done using concrete objects.

Determining the result of the addition or subtraction operation from number cards with the opposing group

This activity aims to encourage students' understanding of the addition and subtraction of integers when they know that integers consist of two parts: positive integers and negative integers. To explain to students through number card games, they are continued by working on the questions that will be in this activity. The form of the questions will not be related to concrete objects or representations of *kempreng*, see Figure 8. This is to measure the primary student's understanding of the addition and subtraction of integers carried out in the activities of model of and model for

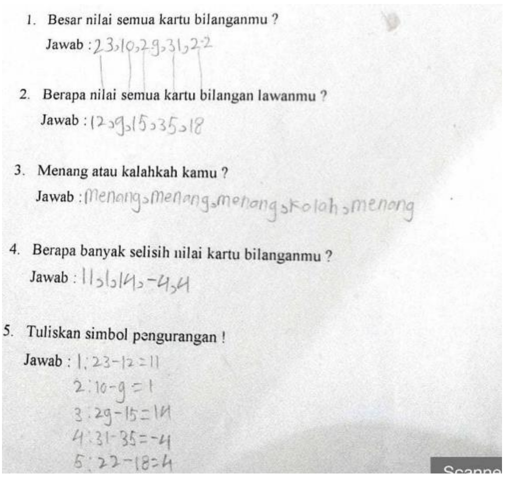
31 – 15 = 16

10 – 25 = -15

20 – 10 = 10

Figure 8. Examples of *kempreng* (symbolic) representation of the subtraction operation

Students collaborate with opposing groups to answer questions that have been given to evaluate students' understanding of the material addition and subtraction integers through the game *kempreng*. Finally, after students work on the questions that have been given, the teacher will discuss to discuss the problem. To play number cards, students must collaborate with opposing groups or exchange the cards they get to answer questions. There are 10 number cards in which there are different values. As a form of evaluation, in the activity, three students will work on questions in formal form (Forgasz & Markovits, 2018), as in Figure 9. Analysis of formal knowledge consists of activities, predictions of student responses, and teacher responses in answering questions given by students in Table 3.



1. The value of all your number cards ? 23, 10,29,31,22
2. What is the value of all your opponent's number carrds ? 12,9,15,35,18
3. Do you win or lose ? win, win, win, lose, win
4. How much is the diference in the value of your number card? 11,1,14,-4,4
5. Write subtraction symbol !
   1. 23 – 12 = 11
   2. 10 – 9 = 1
   3. 29 – 15 = 14
   4. 31 – 35 = -4
   5. 22 – 18 = 4

Figure 9. Results of formal activities

Table 3. Activities session in formal knowledge

Formal Knowledge Activities → Descriptors (1) **Let's Think 1** Students define the addition and subtraction of integers.	
Student Predictions	Defining the addition and subtraction of integers when they know that integers consist of 2 positive and negative integers.
Teacher's Response	Exploring students' difficulties when defining addition and subtraction of integers in the activities that have been carried out.
Formal Knowledge Activities → Descriptors (2) **Let's Think 2** Students work together on a worksheet using number cards.	
Student Predictions	Able or not able to work on student worksheets using number cards.
Teacher's Response	Guiding students in using number cards and answering worksheets.

Formal Knowledge Activities → Descriptors (3) **Let's Think 3** Students write the results of understanding in a formal form through the second worksheet.	
Student Predictions	Able or not able to write the understanding results in a formal form.
Teacher's Response	Exploring students' difficulties in answering questions in a formal form.
Formal Knowledge Activities → Descriptors (4) **Let's Think 4** Students explain the learning experiences they get during the *kempreng* game.	
Student Predictions	Can or cannot express feelings and interests during the *kempreng* game.
Teacher's Response	Stimulate students to be able to explain the *kempreng* game as a form of student evaluation.

Based on the analysis results in the third session, they can understand addition and subtraction integers if they have positive (+) results. However, primary students will be confused if they are faced with a negative result (-). Evidenced by some students who experience errors in the results that are negative (-). Of the 15 students who worked on the questions, 10 answered correctly, and 5 answered incorrectly.

Discussion

At the preliminary design stage, it produces HLT, which includes connecting the learning stages, learning activities, and basic concepts. The results of the design experiments that have been designed show that the use of traditional games is the first step to determining the extent to which students understand the addition and subtraction of integers. LT is designed to determine the stage of students' understanding of the learning material being studied (Sari & Nursyahidah, 2022). The learning trajectory that has been designed has the appropriate results as designed by the researchers. The description of each learning activity is depicted in Figure 10. The learning stage starts from concrete, semi-concrete to formal. The strategies and models used are self-discovery, group discussions, and direct question-and-answer activities to measure student understanding.

At the teaching experiment stage, various activities start from understanding the concept of the *kempreng* game using *kempreng* as a context to explore students' thinking, because the first activity uses concrete objects. In the LT presentation, the model of is divided into two: calculating points (addition) from playing *kempreng* and calculating subtraction from playing *kempreng*. Counting points with addition counting operations, namely 5 + 5 + 5 …. + 5 = ?. The second question is doing the subtraction arithmetic operation, namely 8 – 7 = 1. The results obtained in the activity model show that the use of the *kempreng* context makes it easier for primary students to understand addition and subtraction integers through the subtraction-as-addition strategy (Paliwal & Baroody, 2020).

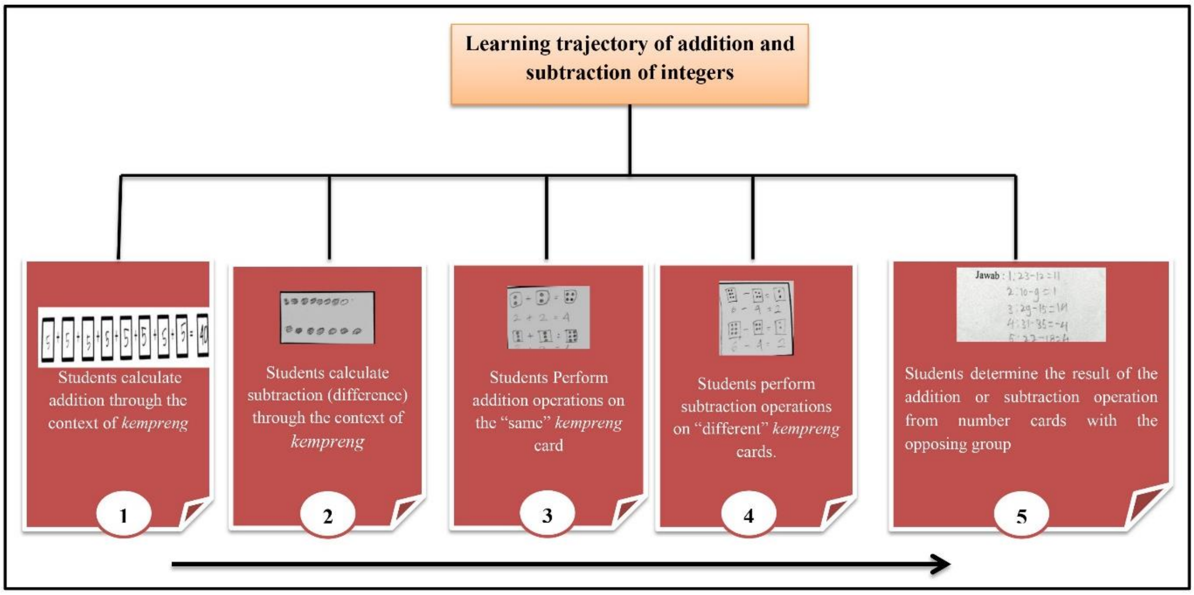


Figure 10. A series of LT activities using the context of the *kempreng* game

Furthermore, in determining the difference between negative integers using a *kempreng* card. Using the representation of the *kempreng* card as a medium to stimulate students' understanding of addition and subtraction integers (Mainali, 2021). After that, students will pair cards that have the same number. After that, it will be counted as an addition counting operation. Another case for different cards is considered a form of subtraction. The explanation in the LT stated that the activities model for were divided into two parts: performing addition operations on the "same" *kempreng* card and subtraction operations on the "different" *kempreng* card.

The activity of writing the results of number cards shapes students' thinking so that they can think formally. This activity guides students from concrete to abstract thinking (Özdemir et al., 2021). In addition, students will work with opposing groups in solving problems in formal activities. In the learning trajectory explanation, it was explained that in the formal primary student activity, the result of the addition or subtraction operation of the number cards collaborated with the opposing group. Based on the analysis results in the third session, they can understand addition and subtraction integers if they have positive (+) results. However, primary students will be confused if they are faced with a negative (-) result. However, out of 15, only 5 had difficulty answering questions with negative values. In this activity, primary students will learn many things about the importance of cooperation in solving a problem (Stovner & Klette, 2022).

The retrospective analysis stage produces a learning trajectory that follows the primary student's way of thinking. Furthermore, the resulting learning trajectory can be used at the teaching trial stage. Some literature also makes mathematics learning designs with an RME approach, such as the set of numbers using the Mahabharata story (Risdiyanti & Prahmana, 2021), subtraction integers using the traditional game of *congklak* (Muslimin et al., 2012), and addition and subtraction of numbers using rubber bands (Edo et al., 2015)

Overall, the LT generated in this study stimulated primary students' activities according to their stages of development in understanding integer addition and subtraction operations. These activities are oriented towards horizontal and vertical mathematization (Gravemeijer &

Eerde, 2009). In this case, the context in the *kempreng* game is real and represents a cultural context close to students' lives. This situation implies that LT activities in the model of, model for, and formal knowledge form a series of iceberg activities for primary students to form students' knowledge in a meaningful way as well as in previous studies (e.g., Kurniawati & Amir, 2022; Risdiyanti & Prahmana, 2021). However, the LT constructed through the context of the *kempreng* game has a particular novelty characteristic carried out separately in several other previous studies. The first characteristic is a series of more measurable activities using a *kempreng* context to understand integer addition and subtraction operations. It is different from what was done by (Susanti, 2020), which only presented the stages of the *kempreng* game, without any conjectures and student responses in understanding integer addition and subtraction operations. The second characteristic is the involvement of the subtraction-as-addition strategy in operating integer addition and subtraction, as in the study (Paliwal & Baroody, 2020). The third characteristic is a visual representation and physical activity involvement in operating integer addition and subtraction as in the previous study (e.g., Amir & Amir, 2021; Amir, 2022).

Conclusion

The learning trajectory consists of five activities. Namely, calculating addition points from playing *kempreng*, calculating the difference (subtraction) from playing *kempreng*, performing addition operations on the "same" *kempreng* card, performing subtraction operations on "different" *kempreng*, determining the results of addition operations or subtraction of number cards in collaboration with the opposing group. The results of this study indicate that a series of activities designed in the learning trajectory using the context of the *kempreng* game can stimulate primary students' understanding of integer addition and subtraction operations. The results are described in tables, activity descriptions, and pictures. However, the learning trajectory still needs to be tested in teaching by involving the whole class and students to obtain a better learning trajectory.

Conflicts of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

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