Jumping task using the context of *kain jumputan* on the fractional operation

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**Abstract.** Jumping task is the central part of teaching that uses Higher Order Thinking Skills (HOTS). The revised 2013 Curriculum in Indonesia emphasizes learning using HOTS, and the daily life context. This research aimed to find out the characteristic of jumping tasks which valid, practical, and also useful for supporting secondary school students learning fractional operations using PMRI with the context of kain jumputan. The subject of this research was seventh-grade students of secondary school in Palembang. The research uses the method of design research with development studies type which had two stages: the preliminary and formative evaluation. This research only presented the result on self-evaluation, expert reviews and one-to-one, and small group phase. Data collection techniques using walkthrough, documentation, observation, and interviews. PMRI is used as material content and context for this research. Moreover, the Lesson Study for Learning Community (LSLC) is used in designing and implementing the learning process. The result of this research was produced mathematics problems about addition and subtraction fractional operations through the context of kain jumputan. This research is valid and practical jumping tasks on fractional operations using PMRI with the context of *kain jumputan*. Validity could be seen from the assessment of a validator (expert) regarding content, construct, and language used in the one-to-one phase. Practicality could be seen where the students could understand the language and the content of the questions that are in the jumping task. Thus, the context of *kain jumputan* can help students in representing problems by involving in mathematical expressions.

1. **Introduction**

Fractional operations is a very important topic for students to learn because it is always related to daily life. The various things related to fractional operation included recipes, calculating tips, determining the dosage of the drug and a person’s body weight [1]. Therefore, the fractional topic is always taught to students from elementary school to secondary school [2]. However, there are still many students who still having difficulties to understand the fraction topic, especially regarding fractional operations [3]. Students use more formulas and textual learning in class so that they are not related to daily life [4, 5]. Students can not represent fractions in the symbolic form [6], and students do not understand the concept of fractions themselves so that students cannot understand fractions or fractional operations significantly [7, 8].

To improve the quality of student learning fractional operations, it takes an approach to develop students so that can learn the topic meaningfully, one of these approaches is the Indonesian Version of Realistic Mathematics Education Approach (PMRI) [9]. PMRI is a learning approach that puts fractional operations probes close to the students and relevant to daily life [10]. The use of context is
very useful in PMRI, not only forming problems in a real-life, but it can be use as props, games, or other things also helps students to learn material easily [11]. The use of the real context of learning implemented through PMRI is the use of rowing in the fraction, the context of the sprint in Asian Games in division fractional, the addition of fractions using the context of swimming, and the use of South Sumatera Context [12-15]. The real context in PMRI can also be implemented in the form of culture with the aim to position mathematics into the form of a social environment. The use of cultural context that has been used such as Palembang tajung cloth motif [16], the use of the context of Cak Ingkling [17], the game of Coconut Shell [18], and the context of Limas House [19].

To organize learning to be more innovative, the teachers must have a plan, a teaching strategy, and conduct an evaluation so the teachers can make a learning instrument that can help students understand the topic. Teachers have difficulties when making the instrument that can develop students’ mindset. Therefore, The Lesson Study for Learning Community can be used as a teacher’s step in developing instruments that are in accordance with the student’s mindset [20]. Lesson Study for Learning Community (LSLC) is important to use as a teacher’s reference in making instruments better and can develop student learning methods [21]. Lesson Study for Learning Community consists of four stages, namely plan, do, see, and re-design [22]. This stage is used in improving the quality of learning and student understanding in learning topics [23].

In the do stage, students will work on sharing task that contain the problems with easy to moderate levels of difficulty and the students solve it together with their team [22]. Through jumping tasks, the tasks can directly use some problems and students can develop their high-level thinking skills [24]. The use of jumping task can help students to develop high-level thinking skills [25].

Based on this background, the researcher was interested in designing the jumping tasks problem in the fractional operation using PMRI with the context of kain jumputan. This research aimed to find out the characteristic of jumping task which valid, practical, and also useful for supporting secondary school students learning fractional operations using PMRI with the context of kain jumputan.

2. Method
This research uses design research as the method with the type of development study. This research focused on two stages, namely preliminary stage and formative evaluation that consisted of self-evaluation, expert reviews, one-to-one, small group, and field test [26-28]. The subjects of this research are seventh-grade students of junior high school in Palembang. Data retrieval is done using walkthrough, documentation, observation, and interviews.

In the preliminary stage, the researchers analyzed the subject of this research, the curriculum, and make instruments that consist of sharing task and jumping tasks. At the preliminary stage, researchers focused on providing jumping task instruments. In the self-evaluation phase, the researchers evaluated and reviewed the initial prototype to go to prototype 1.

In the expert review phase, prototype 1 is validated by an expert by observed, assessed, and evaluated. The expert evaluated prototype 1 in terms of content, constructs, and language. Besides, the panel discussion was held simultaneously with expert assessments. The discussion panel is one of some essential steps in the development of a high-quality test [29]. The researchers conducted a one-to-one phase for 3 students who had high, medium, and low abilities. The one-to-one phase is useful to see the clarity/readability of students to solve the problem. From expert reviews and one-to-one phase, prototype 1 will produce a valid prototype 2.

Prototype 2 will be tested in the small group phase. In the small group phase, prototype 2 will be tested by 6 students who had different abilities (low, medium, and high). The small group phase is used to see the practicality of prototype 2. This small group phase would be produced by prototype 3 that valid and practical.

3. Result and Discussion
The study was conducted in junior high school with three students in the one-to-one phase and six students in the small group phase. One-to-one phase and Small group phase consisting of the students who had low, medium, and high abilities. This research has passed 3 of the 4 stages of design research development study type, namely expert reviews, one-to-one, and small group.
3.1. Preliminary
At the preliminary phase, the researchers and teacher determining students who would be chosen based on the level of students mathematical ability. After that, the researchers got three students seventh grade in one-to-one phase and six students in the small group phase with low, medium, and high ability levels.

Next, the researchers analyzed the curriculum, determine the characteristic indicators of the problem achieved, and the step of the problem that students used to represent the problem by involving mathematical expressions. Because the implementation of learning process uses LSLC, the researchers make the problem into two, namely sharing task and jumping task. Providing a sharing task is done as an initial step for students to solve the problems in groups and proceed with giving jumping tasks that contain the problem with higher levels of difficulty than sharing tasks [22]. The main focus of this research is the jumping task, so the researchers will show more specific characteristics regarding jumping tasks.

In jumping tasks, the researchers develop the problem using real-life context by kain jumputan. This jumping task problem is associated with fractional operation content. The jumping task contains kain jumputan problem which would be asked how large the area of kain jumputan that will be used if that is known only the part that has been taken and the one of the kain jumputan areas used. The content of the problem used in jumping task is fractional operations with the prediction of the level was 5 (according to HOTS difficulty level).

3.2. Formative Evaluation
3.2.1 Self Evaluation
In the self-evaluation, the researchers evaluate and review the prototype based on three characteristics, namely content, construct, and language. These three characteristics are used as assessments carried out by the researchers, supervisors, and peers. The problem of jumping task that has been made is evaluated and examined by researchers. The results obtained from this phase are prototype 1 which would be tested by experts and one-to-one. Problems made by researchers in the self-evaluation phase can be seen in Figure 1.

![Jumping Task Problem](image)

Mrs. Ranti bought kain jumputan as a material for making bags for her children. This fabric will be given to her three children named Susan, Lili, and Amira. Susan gets \( \frac{1}{4} \) part of kain jumputan, Lili gets \( \frac{5}{6} \) parts of kain jumputan, and Amira gets kain jumputan with an area of 6m\(^2\). What is the size of kain jumputan that Mrs. Ranti gives to her children?

**Figure 1.** Jumping task problem before revision
3.2.2 Expert Review and one-to-one

After going through the self-evaluation stage, the researchers conducted an expert review and one-to-one phase which this step was carried out to see whether jumping task was a valid problem. The expert review stage is validated by CM (from Indonesia). Experts will assess and evaluate the jumping task regarding the content, constructs, and languages of the problems. Besides, a panel discussion was conducted by five mathematics education students who also researched LSLC and three Sriwijaya University lecturers.

Along with expert reviews, jumping tasks will be tested through the one-to-one phase. At this phase, jumping tasks will be tested by three seventh grade students who have different abilities. The three students are AA (low ability), RM (moderate ability), and ZZ (high ability). The three students were asked to work on the case about jumping task and then students would ask each other about opinions, suggestions, and comments about the problems in it. The aims are to see the response, constraints, and understanding of students in understanding the problems in jumping tasks, as well as clarity and readability of the problem. The following are comments/suggestions from experts and students and the jumping task revision decision in Table 1.

| Validation | Comments/ Suggestions | Revision |
|------------|-----------------------|----------|
| CM         | The problem is in accordance with the concept and material, the question is in accordance with the PMRI approach stage, jumping task is formulated in easy-to-understand language, but the question is has not HOT's yet. | Improving the question sentence becomes: "How much the whole area of kain jumputan does Mrs.Ranti give to the children?" |
|            | Fractional operations added, not just subtraction operations. | Improving the sentence known in the question to be: "and Amira got the width of kain jumputan covering 6 m²" |
| Panel Discussion | The description of Amira's area is given by "m²" T | Improving the sentence in the jumping task to be: "Mrs. Ranti gives a piece of kain jumputan" |
| Students   | Students think Amira's area is only an integer so it can be got by adding Susan’s and Lili's parts immediately. |  |
|            | The information about how many pieces of kain jumputan is given |  |

From the comments or opinions from experts and students, there are improvements to the problem including clarifying the sentence questions on the problem, correcting the information that is known from the problem, and clarifying how many kain jumputan is known. Also, can be concluded that prototype 2 is valid. The content, constructs, and language of the jumping task are validated by the validator's assessment as well as students' responses, constraints, and understandings from the one-to-one phase regarding clarity and readability of the problem are validated by the students [29]. Valid prototype 2 is shown in Figure 2.
3.2.3 Small Group

The small group phase is carried out to see the practicality of jumping tasks to students in representing problems. At the small group phase, the researchers tested the problem in the jumping task followed by 6 seventh grade students with different abilities in the learning process. The students consisted of WA (moderate ability), AA (low ability), ZZ (high ability), RT (low ability), RF (moderate ability), and NM (high ability). An example of an answer from one of the students in the small group stage is shown in Figure 3.

![Jumping Task Problem](image)

Mrs. Ranti bought a piece of kain jumputan as a material for making bags for her children. This fabric will be given to her three children named Susan, Lili, and Amira. Susan gets \(\frac{1}{4}\) part of kain jumputan, Lili gets \(\frac{3}{4}\) parts of kain jumputan, and Amira gets kain jumputan with an area of 6\(m^2\). How much the hole area of kain jumputan that Mrs. Ranti gives to her children?

**Figure 2.** Jumping task problem after revision

![Figure 3](image)

Figure 3 shows the students can understand and represent the problem by involving mathematical expressions. Students supposed a piece of cloth is one and also reduced the part of Susan and Lili to find out how many parts Amira got. Students could find out the entire area of the fabric by dividing Amira's cloth area that is 6 \(m^2\) by the number of parts that Amira got from the previous reduction. The entire area of the fabric is 16 \(m^2\) the same as the students’ result that was obtained before. Students who have the low ability go through several obstacles in answering questions. AA (low ability) had difficulty to find out the entire area of the fabric even when AA known how many parts Amira gets. However, AA asked for help by saying "please teach me" to ZZ, so that AA could understand how to find the entire area of the kain jumputan [22-24].

**Figure 3.** AA’s Answer
The analysis result of students’ worksheet shows that students can solve problems in jumping tasks correctly by using kain jumputan context [25]. Students involve mathematical expressions in representing problems. It can be seen in the students’ answers that put the problem into a mathematical form and make a mathematical model to find out the entire area of kain jumputan. This is consistent with the research by [30] which involves mathematical expressions in presenting problems to make students easier in finding solutions.

Based on the students’ results from the small group phase, it can be concluded that students can understand the problem and answer it correctly. Also, at the stage of the learning process, students can be active in discussing the context of the problem using kain jumputan and can help students solve the problems by implementing problems in real form. There is no revision of prototype 2 towards prototype 3. From the small group phase with prototype 2 would produce a valid and practical prototype 3. Practicality can be seen while students can understand the problem in jumping tasks and can answer the problem correctly [27, 28, 31], where students correctly involve mathematical expressions in representing problems of jumping tasks with real context [32].

4. Conclusion
The researcher has produced valid and practical jumping task problem using the context of kain jumputan. Validity can be seen from the validator's assessment of the content, constructs, and language and from the students is comments and opinions from the one-tone phase regarding clarity and readability of the background. For the practicality of the small group phase, it can be seen when the students understand the problems in jumping tasks and answer the problem correctly, while students involve mathematical expressions in writing solutions to the problem correctly.

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