Designing Worksheet Using The Context Of Sugarcane

Nur Lailatul Fitri, Suparman

Abstract: This research aims to design worksheet that is expected to support seventh-grader learning fractions. The researcher used sugarcane as a starting point in this research. The learning goals in the first activity is students are expected to be able to make partition into equal parts. Moreover, students understand the fractions notation. In this activity, students should solve a problem with a fair sharing sugarcane. A fair sharing activity related to daily life and it can be imagined by students. While in the second activity, students learn to understand the equivalent fractions. The researcher used the ADDIE model to design the worksheet by implementing IRME approach. This model consist of five-phase namely analysis, design, development, implementation, and evaluation. The validation process is carried out by expert media. The result of validation shows that the design of worksheet includes into very good category. The design of worksheet can be developed to be worksheet prototype.

Index Terms: Fractions, IRME, Sugarcane, Worksheet

1. INTRODUCTION

REALISTIC Mathematics Education (RME) is a mathematics education approach developed by Hans Freudenthal at the Freudenthal Institute in the Netherlands [1]–[3]. He assumes mathematics as a human activity and must be taught in order to be useful [1], [4], [5]. In his view, students should be given a chance to reinvent mathematics concept by mathematizing the real world problem [1]–[3], [5]. Consequently, mathematizing become a key process in mathematics education [1], [5]. Realistic Mathematics Education (RME) known as PMRI (Pendidikan Matematika Realistik Indonesia) or IRME (Indonesian Realistic Mathematics Education) in Indonesia since 2001[3]. IRME starts from context (real experience) in daily life by students so it can be the bridge between the real knowledge towards too formal mathematical knowledge of students [2], [3], [6], [7]. Learning mathematical concept become more meaningful and enjoyable by using the context that can present an abstract mathematical concept in the form of representation so that students easy to understand [3], [7]. Therefore, learning mathematics become more meaningful by applied IRME approach. Fractions deserve an essential place in primary school [8]–[10]. Students are allowed to deepen their knowledge that may arise from their experience in learning whole numbers [11]. Understanding fractions is the foundation for arithmetic using percentages and decimals [10]. It is also essential for learning algebra and geometry [11], [12]. Hence, fractions become essential to learn a higher mathematics level.

The concept of fraction can be transformed into daily life [3], [8]. Yet learning fractions become a great challenges for students [13]–[15]. Many students had difficulties understanding the concept of fractions [3], [6], [7], [9], [13]. This is due to students didn’t receive the basic concept of fractions [6]. Students tend to be taught practical formulas in learning fractions [16]. Consequently, they are still not getting the meaning of fractions [17], [18]. They are incorrectly ordered fractions from least to greatest [8], [13]. Furthermore, they had difficulty in adding fractions with different denominator [18]. Therefore, solutions are needed so that students can masters the concept of fractions. The worksheet is a way to facilitate students in learning the concept of mathematics. Students worksheet contain materials, summaries, and instructions that refer to a certain basic competency that must be achieved by students [19]. So, it is necessary to design teaching materials in the form of students worksheet based on IRME approach. Fractions can be transformed into daily life by implementing this approach. This research used the context of sugarcane as a starting point to learn fractions. The use of context can present the concept of fractions to be easy to understand by students.

2 METHOD

ADDIE model used to design students worksheet based on IRME approach that can support students learning fraction. There were four phase namely: analysis, design, development, implementation, and evaluation. The procedure of this research can be seen in Fig 1.

First, the analysis carried out to identify the problem in mathematics learning by survey and literature studies. This phase concern to needs analysis, curriculum analysis, and students. Second, designing the draft of worksheet include formulating the competencies and the learning goals to
establish the materials. Moreover, to select the learning approach and also determine the structure of the worksheet. Third, developing worksheet by implementing IRME approach. Fourth, validating and assessing the design of the worksheet. Lastly, the worksheet must be revised according to the validation result.

3 RESULT AND DISCUSSION

3.1 Analysis
The first phase of the ADDIE model is analysis. This phase consist of three stage. The three of stage can be explained as follow:
1. Teaching material
   This stage carried out to find out the availability of learning resources used in the learning process. Moreover, the researcher determine the needs of teaching material to support students in the learning process.
2. Curriculum analysis
   The second stage is determining the uses of the curriculum so that the teaching materials are relevant to the curriculum. The researcher also determines the competencies that will be achieved by students.
3. Students analysis
   The last stage is to identifying the character and students ability. It is done by interview the students. This result of analysis phase becomes the inputs for the design phase.

3.2 Design
The second phase of the ADDIE model is design. This phase using the output of the analysis phase to design the teaching material in the form of students worksheet. The design phase is carried out by considering the elements needed in developing the student worksheet. The researcher designed the worksheet includes selecting the learning approach, formulating the competencies and the learning goals. Moreover, the researcher establishes the structure of the worksheet. Several study showed that IRME can support students learning fractions [6], [7], [18], [19]. So, the researcher implementing IRME approach to design the worksheet using the context of sugarcane. There are five characteristic of the IRME approach [20].

1. The use of context in phenomenological-exploration
   This characteristic focuses on the use of context related to daily life. The researcher used the context of sugarcane as starting point. Students seemed familiar with this context. Another hand, the context used in this research is real and can be imagined by students. This starting point used to introduced fractions.
2. Using models and symbols for progressive mathematization
   One of implementations of the second characteristic of IRME is to connects the something concrete to the something abstract, students are encouraged to construct models such as schemes, notations, or descriptions [21].
3. The utilization of the students’ contribution
   Students are determine their own strategies during the learning process. The biggest contribution to the learning process is expected from the students’ contributions. The teacher acts as the facilitator.
4. Interactivity
   Students get more experiences such as discussion. They have a chance to share their ideas with teacher and also with fellow students.
5. The relationship with other learning topics
   Learning fractions using the context of sugarcane as a starting point, shows that there is a connection between fraction with other learning topics.

The outputs of this phase will be the inputs for the development phase.

3.3 Development
The researcher designed the cover of students worksheet. The cover contains the author’s name, worksheet title, image illustration, student identity, institutional logo and curriculum logo used. The worksheet title describes the contents of the worksheet as a whole. Also informing about the learning approach used, in this research is IRME. The image illustration on the worksheet portrays the context used as a starting point, which is sugarcane. Although, student identity shows the ownership of worksheet so that it is easy to recognized by both teacher and students. The cover of the worksheet can be seen as follow Fig 2.

![Fig 2. The cover of worksheet](image)

The point of this phase is to compile the lesson materials. The worksheet contains the learning goals and instrucions for each lesson can be seen as follow Fig 3 below.

![Fig 3. The first lesson contains the learning goals](image)

Based on the instructions in Figure 3, students must solve the problem on the worksheet in groups. This fulfill the characteristic of the utilization of the students’ contribution and interactivity on the IRME approach. Students actively contribute to the learning pocess through discussion and
The first lesson on this worksheet consists of two activities. The learning goals on the first activity is that students are expected to be able to make partition into equal parts. Moreover, students are understanding the notation of fractions. In this activity, students should solve a fair sharing problem. The problem is given through a story as follows: Mr. Hidayat has a garden planted with sugarcane. One day, Mr. Hidayat invited his three children to go to the garden. After arriving there, he cut one of the sugarcane to give to his children. If one of sugarcane is divided into three equal parts, how many part each child receives? The researcher also provides an image to illustrate the problem of fair sharing sugarcane above, as seen in Fig 4.

**Fig 4. The illustration of fair sharing sugarcane**

The characteristic of IRME approach namely the use of context in phenomenological exploration shown in the first activity. The researcher used sugarcane as a starting point through a fair sharing problem to help students learning fractions. The context used often found by students in daily life. Furthermore, the situation can be imagined by students. They learn to make partitions on manipulatives sugarcane to solve the problem as follow Fig 5.

![Fig 5. The manipulative sugarcane](image)

The learning goals on the second activity is that students can understand the equivalent fractions. As seen in Figure 6, there are two strips on the left and right side. Through group discussion, students must divide the strip on the right side then shade it so that it has the same value as the strip on the left side. Next, students write down the number of shaded areas in fraction notation.

**TABLE 1**

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Calculation</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X &gt; \bar{x}_1 + 1,8 SB_1$</td>
<td>$X &gt; 16,9$</td>
<td>Very good</td>
</tr>
<tr>
<td>$\bar{x}_1 + 0,6 SB_1 &lt; X \leq \bar{x}_1 + 1,8 SB_1$</td>
<td>$13,6 &lt; X \leq 16,9$</td>
<td>Well</td>
</tr>
<tr>
<td>$\bar{x}_1 - 0,6 SB_1 &lt; X &lt; \bar{x}_1 + 0,6 SB_1$</td>
<td>$10,4 &lt; X \leq 13,6$</td>
<td>Pretty good</td>
</tr>
<tr>
<td>$\bar{x}_1 - 1,8 SB_1 &lt; X \leq \bar{x}_1 - 0,6 SB_1$</td>
<td>$7,1 &lt; X \leq 10,4$</td>
<td>Less</td>
</tr>
<tr>
<td>$X \leq \bar{x}_1 - 1,8 SB_1$</td>
<td>$X \leq 7,1$</td>
<td>Very less</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>Validator name</th>
<th>Position</th>
<th>Result</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tri Purwanto, S.Pd.</td>
<td>Teacher of mathematics</td>
<td>17</td>
<td>Very good</td>
</tr>
<tr>
<td></td>
<td>education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irham Baskoro, S.Pd.</td>
<td>Teacher of mathematics</td>
<td>18</td>
<td>Very good</td>
</tr>
<tr>
<td></td>
<td>education</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>17,5</td>
<td>Very good</td>
</tr>
</tbody>
</table>

**TABLE 3**

<table>
<thead>
<tr>
<th>Suggestion and comment on</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add the author biography</td>
<td>Adding the author biography</td>
</tr>
<tr>
<td>The context used at the activity must be detailed</td>
<td>Has revised</td>
</tr>
<tr>
<td>Need more instruction in activity 1</td>
<td>Adding the instruction</td>
</tr>
<tr>
<td>Add note in the images</td>
<td>Has revised</td>
</tr>
</tbody>
</table>

Fig 6. The second activity
3.4 Implementation
The purpose of this stage is to validate the design of the worksheet using the context of sugarcane. The validation process carried out by media expert. The validity level of student worksheet could be known by seeing the score of validity questionnaire namely (5) very good, (4) good, (3) good enough, (2) less, and (1) very less. The score obtained by calculating the average then converted into qualitative data [23]. The categories of feasibility can be seen in Table 1. The validity of media was obtained from the expert. The result of the validity shown in Table 2. The validation result showed that the design of worksheet includes in the very good category with the average 17.5.

3.5 Evaluation
The purpose of the evaluation stage is to revise the design of worksheet according to the validation result. Table 3 showed the suggestion from the expert.

4 Conclusion
The design of the students worksheet by implementing IRME approach was developed using ADDIE model which consist of analysis, design, development, implementation, and evaluation. The validation result showed that the design of worksheet includes in the very good category with the average 17.5. The design can be developed to be worksheet prototype.

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References