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Development of Students' Worksheet based on Problem Based Learning with Game Based Learning And Pacu Jalur In Bouyance Force

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ABSTRACT

Indonesian local wisdom-based learning still needs to be improved, such as Pacu Jalur. This is useful for introducing the nation's culture to students, so they are not forgotten. However, learning local wisdom must also be integrated with technology-based learning so that it remains in line with current developments. The purpose of this research is to develop students' worksheets for Game-based PBL models integrated with Local Wisdom Pacu Jalur in physics learning. The topic chosen in this study is Bouyance Force. The method in this study uses the 4D model, namely Define, Design, Develop, and Disseminate. The developed students' worksheets have been validated by three physics education lecturers. The research results obtained are aspects of content eligibility 85 (decent), presentation 90 (very feasible), appearance 88 (very feasible), and language 89 very feasible. Based on these findings, it can be concluded that the students' worksheets developed are feasible and ready to be implemented in physics learning on the topic of bouyance force. The recommendation for further research is to test students' worksheets in large-scale learning in physics classes.

Keywords : Student worksheet; Problem-based learning Game; Pacu Jalur.

I. INTRODUCTION

Many studies prove that students have difficulty understanding physics concepts. One of the concepts that is difficult for students to understand in this lesson is static fluid material. In this material, [1] found students' difficulties in understanding the concepts of mass, density, and volume of immersed objects. [2] also found students' difficulties in determining the magnitude of the buoyant force on the Archimedes principle in this static fluid material. In addition, [3] also found students' difficulties in using the buoyancy formula, determining the force and the resultant and the fluid level in the Archimedes case. This finding is also like [4] where students generally experience difficulties in applying Archiemedes' principles. In other words, the difficulties experienced by these students are closely related to their ability to understand physics concepts.

Students' difficulties in understanding physics concepts show that their cognitive abilities are still not good. This is because cognitive abilities are related to the ability to understand symbols, formulas, and notations, as well as calculations and understanding of solving physics problems [5]. This condition is also evidenced by their difficulties in conceptual understanding [6], problem solving [7], and mathematical abilities in physics [8]. This difficulty can be overcome by providing a variety of learning activities and methods in the classroom [9]. Therefore, we need an appropriate learning activity to improve students' cognitive abilities.

There are many research methods that can be used to improve students' cognitive abilities. One of them is by using a contextual approach in which the teacher uses learning media that is close to students. Contextual approach that can be used in learning by presenting material based on the concept of local wisdom content knowledge. [10] found that the integration of local wisdom can improve students' conceptual understanding, motivation, and attitudes. [11] also found that the integration of local wisdom can improve students' conceptual understanding skills. Therefore, the presentation of local wisdom can be used to improve students' cognitive abilities including static fluid material in physics learning.

Local wisdom-based knowledge content related to static fluid material is Pacu Jalur. Pacu Jalur is a tradition of traditional long boat rowing competitions on the Batang Kuantan river. Pacu Jalur has existed since the 17th century in Kuantan Singingi, Riau Province [12] and has become a culture that has been passed down from generation to generation to date. Pacu Jalur has local potential for the Kuantan Singingi community such as tourism and economic potential. The concept of physics in Pacu Jalur is mass density, density, buoyancy, and Archimedes' law [13]. Pacu Jalur as a local wisdom helps students understand the concept of applying Archimedes' law in everyday life.

Content knowledge based on local wisdom needs to be combined with other learning methods. Content knowledge based on local wisdom cannot explain thoroughly in teaching physics concepts. One of the learning methods that can be used is problem-based learning. Apart from being close to students (contextual), problem-based learning can also improve problem-solving abilities and student motivation in learning [14]. This student motivation can help students to learn physics better. Thus, to improve students' cognitive abilities, they must be happy and motivated in learning.

Various studies show that students' motivation in learning physics is still low. [15] found 27% of students did not have high motivation in learning physics. In addition, [16] found that most students (> 75.0%) felt that learning Physics at school was boring and they agreed that Physics learning methods were less able to attract students' attention. Students who have low motivation in learning physics need lessons or examples that are concrete and close to them [17]. One of the learning methods that is close and concrete with the student's environment is problem-based learning. Apart from that, nowadays students are very happy with their gadgets to play games. Thus, problem-based learning can also be combined with game-based learning methods.

Game-based learning learning activities can support student learning motivation. [18] found that digital game-based learning has a significant effect on student motivation. Chen also found that digital game-based learning can help students improve their problem-solving skills elaboratively through games. In addition, [19] found that digital game-based learning has a significant effect on learning performance, motivation, self-efficacy and learning experience. This study shows that game-based learning activities are significant in improving student learning outcomes.

Games that are integrated into learning can be digital games. Digital game design can use Scratch which is a visual programming language and open-source application. Game scratch activity can significantly contribute to student academic achievement [20]. Digital educational games have advantages over traditional games. Students are more interested in playing digital games than traditional games. In addition, the use of digital educational games can increase collaboration, social experience, higher internal and external motivation among students and play experiences that create challenges, joy, and a sense of success in learning [21].

Digital game-based learning has been developed by several researchers. [22]developed a serious game for attractive mathematics learning. They explain the design and development steps from graphic environment, building design to music and sound using 3D unity. Furthermore, [23] analyzed the effect of digital game-based learning on student motivation and achievement. They found that digital game-based learning had a positive effect on students' motivation and learning achievement. Furthermore, [24] developed guided inquiry worksheets based on educational games using macromedia flash. They produce educational game-based guided inquiry worksheets using macromedia flash that are valid and practical. However, other researchers have not developed Problem-based learning worksheets for students using Scratch Games and local wisdom Paju Jalur on buoyancy force topic. Student worksheets are important to support student learning activities in class. Thus, we determine the formulation of the problem is (1) how is the feasibility of student worksheet problem-based learning Game and Pacu Jalur local wisdom on buoyancy force topic?

II. METHOD

The design of this research is Research and Development. Meanwhile, the instructional design model used is the 4D type. ADDIE consists of stages, namely (1) define; (2) design; (3) develop and (5) disseminate. This research procedure through 4 steps. The first step is to analyze students' difficulties in learning static fluid material, curricula and lessons that have been developed on static fluid topics and content knowledge based on local wisdom that supports static fluid topics. The second step is to develop based on problem-based learning models, game-based learning methods and Scratch Games. The third step is to develop students' worksheet. as well as students' worksheet validation to experts. The fourth step is to validate the students' worksheet to expert lecturers. And the fifth step is to evaluate each step as shown in Figure 1.

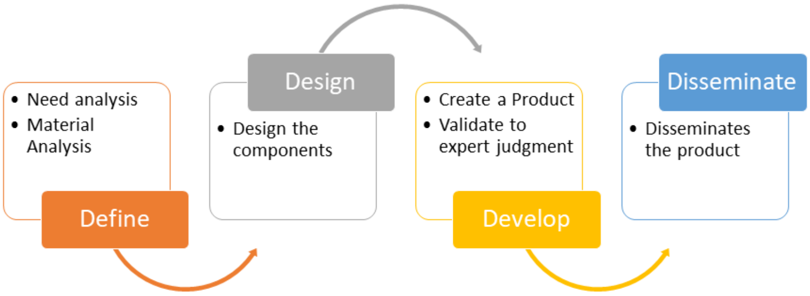

Fig. 1. 4D Model

The assessment data provided by the validators was then analyzed descriptively quantitatively to determine the eligibility of the students' worksheet. The first data analysis to be carried out is to determine the conversion value of the questionnaire value scale. Based on the opinion of [25], the thing that must be found first is the range of assessment scores. After conducting data analysis, the feasibility score range is obtained as shown in Table 1.

Table 1. Score and category of feasibility

Score	Category
$X > 85$	Very Worth it
$70 < X \leq 85$	Worthy
$55 < X \leq 70$	Enough
$40 < X \leq 55$	Less Eligible
$X \leq 40$	Very Inadequate

The analysis was carried out based on the assessment by three people. The experts were given a validation sheet to assess the developed students' worksheet as shown in Table 2. They provide an assessment with a score range of 1-4 from very bad to very good. The data obtained from experts is then analyzed to determine whether the students' worksheet being developed is feasible or not.

Table 2. Indicator of Assessment

No	Statement	Validator 1	Validator 2	Validator 3
	Content Eligibility			
1	Material suitability with learning outcomes (CP)	3	3	3
2	Coverage of material with learning objectives (TP)	3	3	3
3	The suitability of the material with the developmental characteristics of students	4	3	4
4	Correct facts, concepts, principles, procedures, and skills	4	3	3
5	Coverage of the PBL model syntax in students' worksheet	4	4	4
6	The inclusion of the steps of the 21st century approach in students' worksheet	4	4	3
7	The correctness of the student's work steps	3	3	3
8	Usefulness for students in the learning process	3	4	3
9	Material coverage supports the improvement of attitudes, knowledge, and skills	4	4	3
	Presentation			
10	Sequence conformity, systematics in the presentation of students' worksheet (title, activity, andevaluation steps)	4	4	3
11	Suitability of student activities in students' worksheet with the chosen theme	4	3	4
12	Availability of questions that direct students to be active in the learning process	4	3	4
13	Availability of questions that interest students for independent learning	3	3	4
	Appearance			

14	Appropriateness of the use of type and size of letters	4	3	4
15	The suitability of the display design between the title and the pictures, tables andgraphs	4	3	4
16	Clarity of presentation of illustrations, real pictures, graphs, tables, and information(attractive color match)	4	3	3
17	Clarity in including text sources, tables, graphics, and images	4	3	3
	Language			
18	Clarity of information conveyed	4	3	4
19	Clarity of language used	3	3	4
20	Clarity of good and correct use of Indonesian	3	4	4

III. RESULTS AND DISCUSSION

Student worksheets focus on material for the Archimedes style or local potential-based buoyancy force Pacu Jalur Kuantan Singingi, Riau Province. Student worksheets are developed based on the Problem-based-learning model and use the game-based-learning method with visual programming language technology. The activity steps arranged on student worksheets can be seen in Figure 2.

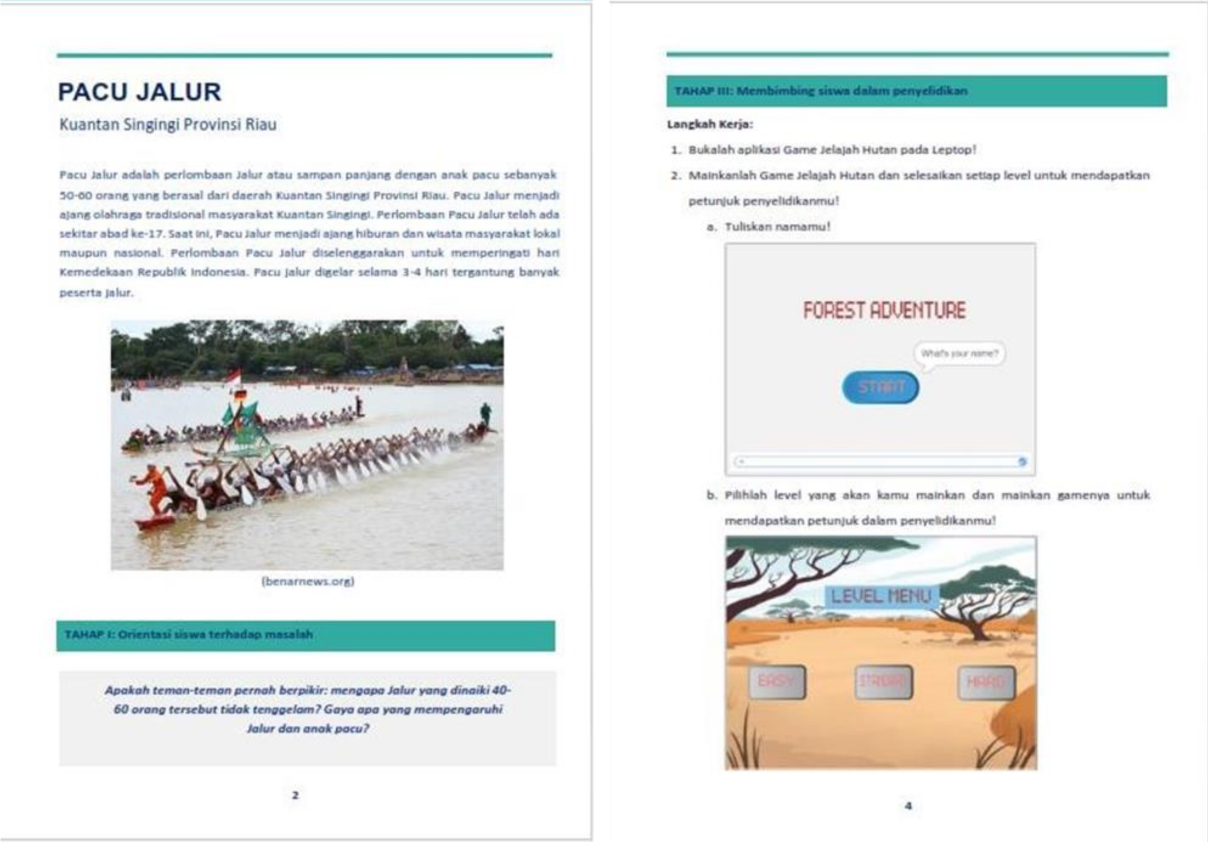

Fig. 2. Students' worksheet on PBL with Game base Learning integrated with Pacu Jalur

Define

The define phase carried out in this study is needs analysis and material analysis. Needs analysis is used to determine the needs of students and teachers in carrying out game-based learning processes. This analysis was carried out by conducting interviews with physics teachers. In this study material analysis was also carried out. This aims to determine the characteristics of what material is appropriate for use in game based PBL learning models. The topic of static fluid, especially the buoyant force, is the material studied in this study. This is because this topic is very interesting to do virtually, and it is difficult to do if it is integrated with the local wisdom of Pacu Jalur.

Design

The design phase is carried out by compiling the designs and components needed in the students' worksheet on the integrated Game-based PBL model Local Wisdom Pacu Jalur on the topic Bouyance Force.

The prepared students' worksheets include covers, PBL learning steps, descriptions of Pathways and Game based learning.

Develop

This development stage produces a product based on the design that was made in the previous stage. The resulting product includes game based PBL model worksheets integrated with Local Wisdom Pacu Jalur on the topic Bouyance Force. The preparation of students' worksheets refers to BSNP Permendikbud No 22 of 2016. Students' worksheets that have been designed in the previous stage are the initial product. The develop stage is carried out to produce an effective and ready-to-use final product. The analysis was carried out based on the assessment by three people. The experts were given a validation sheet to assess the developed students' worksheet. They provide an assessment with a score range of 1-4 from very bad to very good. The data obtained from experts is then analyzed to determine whether the students' worksheet being developed is feasible or not. The results of the expert assessment can be seen in Figure 3.

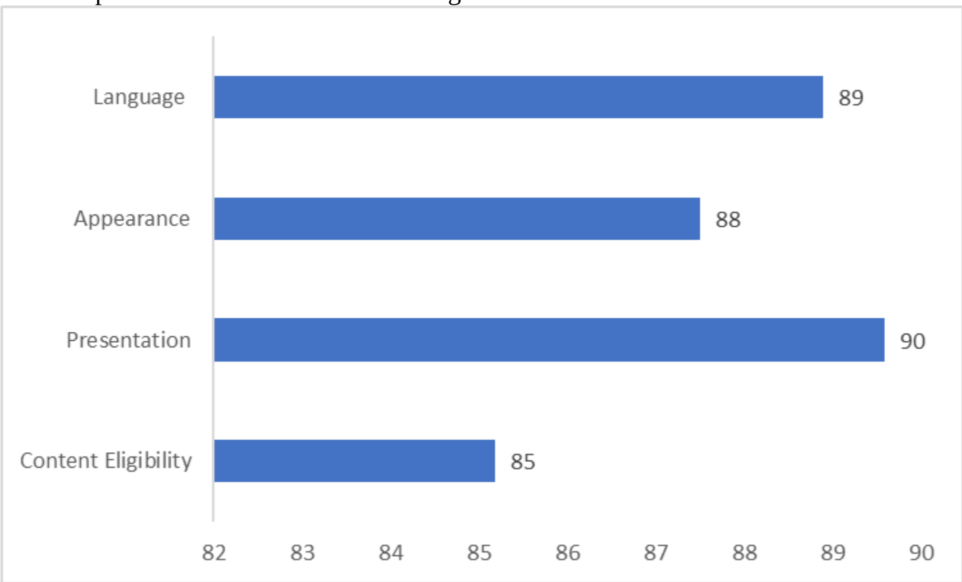

Fig. 3. Result of Expert Judgment

Based on the results of the feasibility analysis of students' worksheet, it can be concluded that the PBL model students' worksheet with the local culture of game-assisted runway runways is feasible to use with an average score of 88 (very feasible). In addition to providing numerical ratings, the validators also provide descriptive assessments in the form of suggestions and input. The suggestions, input, and comments of experts on the developed students' worksheet can be seen in Table 6. Game based learning help students in the investigation stage to solve problems. The scratch game used is a forest exploring game which consists of easy, standard, and hard levels. At each level of the jungle exploration game students can find clues to complete their investigations. if the student has found all the clues at that level, then the student can move on to a level at a more difficult level.

Based on the results of quantitative and qualitative data analysis obtained by experts, it can be concluded that the developed students' worksheet is feasible and ready to use. This is because students' worksheet uses scratch technology devices that enable learning to be more interesting, more creative, and more challenging [26] and can improve computational thinking skills [27]. In addition, students' worksheet is also structured using the PBL model where it can foster active, independent, interactive, communicative learning and student involvement [28]. Not only that, but students' worksheet is also prepared with the concept of local culture that can preserve cultural values [29]. All these factors make the students' worksheet developed already very good and ready to use.

Disseminate

At this stage, the researcher disseminates the product developed to a number of research actors so that it can be used as an alternative medium in learning physics. In addition, researchers publish research results in accredited journals from the Ministry of Education, Culture and Higher Education

IV. CONCLUSION

Students' worksheet which was developed using scratch media on the topic of Archimedes' law is appropriate and ready to be used based on expert judgment. The assessment is carried out based on the feasibility aspects of the content, presentation, appearance, and language. The aspect that has the highest criteria is presentation while the lowest is content feasibility. Even though it has the lowest score, the content feasibility aspect remains above the eligibility threshold so that it can be said to be feasible. In addition, an assessment is also carried out in a descriptive way for students' worksheet improvement. The development of game-based worksheets with scratch media is very suitable for use in learning. In addition, PBL based on local culture also supports students' worksheet which will be used in the learning process.

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