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VALIDATION OF STUDENT WORKSHEET CONTAINING SCIENTIFIC LITERACY FOR STRAIGHT MOTION MATERIALS CLASS X HIGH SCHOOL

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ABSTRACT

The 21st century requires students to be able to have the competence to think critically, communicate and scientific literacy. Efforts made by the government to meet these demands are by improving the curriculum and holding a School Literacy Movement program. But in reality there are problems related to literacy which is applied only by taking notes and listening to the teacher, the unavailability of worksheets in all subjects, and the low understanding of students in answering questions. One solution to this problem is to develop physics worksheets with scientific literacy content. The purpose of this study was to determine the characteristics (validity and practicality) of scientific literacy-laden worksheets on straight motion material. This type of research is design research. The object of research is a physics worksheet with scientific literacy on straight motion material. The research instruments used were needs analysis sheets, self-evaluation assessment sheets, one to one assessment sheets, expert validation sheets. Data analysis techniques use Aiken's formula to calculate validity. Based on the research, several research results can be put forward. First, the worksheets meets all the self-evaluation assessment criteria with a score of 100%. Second, the one to one assessment on the worksheets has an average value of 84% in the very good category. Third, physics worksheets containing scientific literacy on straight motion material are valid with an average validity value of 0.79. So, it can be concluded that the physics worksheets containing scientific literacy in the straight motion material for class X high school are valid.

Keywords:*Student Worksheet, Scientific Literacy, Straight Motion*

I. INTRODUCTION

Learning in the 21st century is required to prepare a generation that welcomes advances in information and communication technology in the lives of Indonesian people [18]. There are positive and negative impacts due to the development of science and technology in the 21st century. The positive impact is that science and technology can be the basis for the progress of the nation. While the negative impact on ethical issues, morals, global issues, and the growing moral crisis in society [23]. Education is an effort to develop full human potential, which includes aspects of personality including aspects of individuality, morality, balance between physical and spiritual needs [5]. The government seeks to increase the education quality in Indonesia by developing curriculum starting from the KTSP to the 2013 revised 2017 curriculum. The government also integrates four main things in learning, namely, 1) Strengthening Character Education, 2) learning literacy consisting of reading, writing, understanding, evaluating, and speaking, 3) 4C Skills (Creative, Critical thinking, Communicative, and Collaborative), and 4) HOTS (Higher Order Thinking Skill) [8].

Physics according to the language, comes from the Greek which means "natural science". Physics is the most basic science [17]. Physics is a field of science that investigates the natural occurrences that surround us. Cause and effect of this natural phenomenon can be explained by physics [15]. The purpose of learning physics is to equip students with the knowledge, abilities, and understanding to be able to develop science and technology. Physics learning that takes place must emphasize physics concepts based on the nature of science related to processes, products, and scientific attitudes [5]. Physics learning must include global ISOs that exist in the environment related to climate change, global warming, alternative energy, and the development of digital technology [13]. Material of teaching a variety of resources are utilized by teachers to support their execution of teaching and learning activities in the classroom. Material of teaching are arranged systematically, designed as a whole according to the competencies that will be mastered by students in learning activities. To support this, material of teaching that are in accordance with physics learning can be used [5]. One of the materials of teaching that can be used is worksheet. Worksheet are sheets with assignments that students must complete. Activity sheets typically take the shape of stages or directions that finish an activity [11]. Designed as a whole according to the competencies that will be mastered by students in learning activities. To support this, material of teaching that are in accordance with physics learning can be used [5]. One of the materials of teaching that can be used is worksheet. worksheet are sheets with assignments that students must complete. Activity sheets typically take the shape of stages or directions that finish an activity [11]. Designed as a whole according to the competencies that will be mastered by students in learning activities. To support this, material of teaching that are in accordance with physics learning can be used [5]. One of the materials of teaching that can be used is worksheet. Worksheets are sheets with assignments that students must complete. Activity sheets typically take the shape of stages or directions that finish an activity [11]. Worksheets must include the following, namely a) instructions for teachers and students, b) competencies to be achieved, c) content of the material, d) supporting information, e) exercises and sample questions, f) activity instructions, and g) evaluation [5].

The government has made maximum efforts to increase the student learning quality, but in reality what is happening in the field is not in accordance with the expected conditions. Preliminary study activities were carried out during street vendors at Widiya Dharma Private High School PT Asam Jawa, Pangarungan Village, Kec. Torgamba, South Labuhan Batu Regency, North Sumatra. The results of observation and distribution of questionnaires to Class X students obtained several facts related to the learning process. First, based on observations at school, the researcher found the fact that physics worksheets were not yet available at the school. Class X-XII students do not use worksheets either in physics or other subjects. This happens because the school is trying to meet the needs of textbooks as teaching materials for all subjects. So that the provision of worksheet in schools has not received special attention. So, students do not use worksheets in learning. Second, based on the technique of distributing questionnaires to students, it was found that 61% of students stated that they only applied literacy, taking notes and listening to the teacher when explaining the material so that other literacy skills were not used such as reading, searching, understanding, finding and evaluating activities. Third, Material analysis is carried out to see and find out material that is difficult for students to understand. This analysis is carried out based on the values of students in each material that reaches the Minimum Learning Mastery Standard. Based on the daily test scores, it was obtained that students who did not complete the material on the nature of physics were 82.89%, on the material of magnitude and measurement 77.63%, on the vector material 57.89%, and on the material of straight motion 39.47%. The low level of understanding in analyzing the questions makes students not serious in working on the questions given, so that the scores obtained have not reached the Minimum Learning Mastery Standard. In fact, from the results of the needs analysis by distributing questionnaires, there were several problems that were found, this was not in line with the expectations desired by the government.

Scientific literacy consists of two words, namely literatus which means literate or educated, while scientia implies to be knowledgeable. Scientific literacy is the capacity to apply scientific knowledge to formulate hypotheses, gather data, and draw conclusions in order to comprehend nature and the changes brought about by human activity [9]. The purpose of the importance of scientific literacy is that students are expected to be able to meet the times, namely to become problem solvers with competitive, creative, innovative personalities, character, and able to collaborate [6]. With scientific literacy, it is hoped that students will have the following abilities: a) the ability to know and understand scientific concepts and processes needed to participate in society, b) the ability to find and determine answers to questions stemming from the curiosity of students related to experience. in everyday life, c) the ability to predict and explain a phenomenon, d) can identify scientific problems, e) have the ability to evaluate scientific information based on the sources and methods used, f) can draw conclusions based on evidence [3]. So, scientific literacy is one of the efforts to answer the challenges of the 21st century that can be carried out in 21st century education in preparing the desired human resource (HR) capabilities so as to achieve the demands

of the 21st century [16]. The purpose of this study was to determine the characteristics (validity and practicality) of scientific literacy-laden worksheet on straight motion material.

II. METHOD

The research type used was design research (Design Research). Design research is research to design/develop interventions (such as programmes, strategies, learning materials, products and systems) with the aim of solving complex educational problems and to advance knowledge about the characteristics of interventions and the processes for designing and developing them. This study uses the Plomp Development Model which consists of three phases, namely (1) preliminary research, (2) prototyping phase (development phase), (3) assessment phase [6]. The object of this research is the physics worksheet containing literacy of scientific in the material of straight motion for class X high school. This worksheet consists of basic competencies 3.4 and 4.4.

In this study, the Plomp model consists of three stages. However, in the development of worksheets containing literacy of scientific, the stages carried out will be limited to the stages of (1) preliminary research (initial research) and (2) prototyping phase (development phase) which includes formative evaluation. This initial research is a stage for analyzing needs and context analysis, reviewing the literature, developing a conceptual or theoretical framework for the study [6]. In the prototype phase there are several stages as formative evaluation. In the formative evaluation stage, it consists of self evaluation, expert review, one-to-one, small group, and field test [7]. In the development of this worksheet, it will be limited to the small group trial stage. The stages of formative evaluation [21] have been shown in Figure 1.

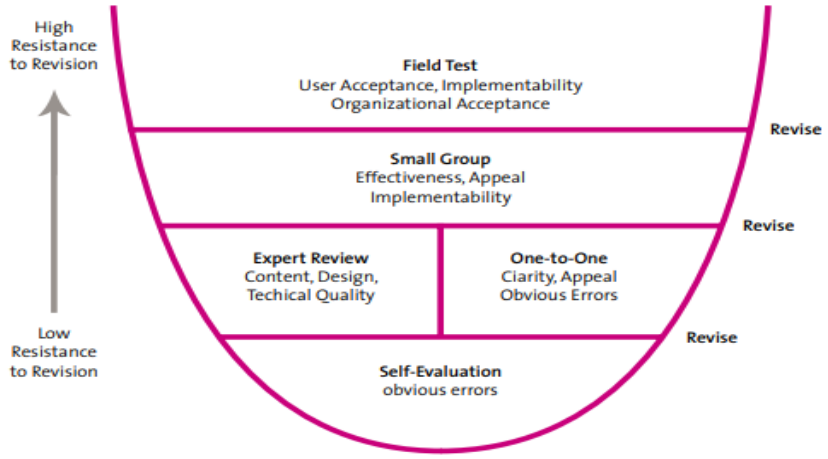

Fig.1. Formative evaluation layer

The analytical technique used is descriptive statistical analysis. Descriptive statistics can be presented by presenting data through tables and graphs. Value weights are calculated using Aiken's V formula to be able to calculate the content validity coefficient based on the results of research from a panel of n experts on an item in terms of the extent to which the item can represent the measured construct [1]. The research was conducted by assigning a number between 1 (ie very irrelevant) to 5 (ie very relevant). The range of V numbers is from 0-1 [2]. The analysis of the results of the validity test in the study was carried out by providing an answer score according to the following criteria:

Table 1. Scoring Criteria

Criteria	Score
Very Relevant	5
Relevant	4
Quite Relevant	3
Less Relevant	2
Irrelevant	1

(Source: Ref [14])

$$V = \Sigma s/[n(c-1)] \quad (1)$$

Information:

s = r – lo
r = The score given by the assessor
lo = The lowest value of the validity assessment (in this case = 1)
n = Number of validators (in this case = 3)
c = The highest score of validity assessment (in this case = 5)

With the interpretation of the validity data based on the following table:

Table 2. Aiken's. Validity Interpretation

Correlation Criteria	Interpretation Validity
V 0.80	Very Valid
0.60 V < 0.80	Valid
0.40 V < 0.60	Quite Valid
0 V < 0.40	Less Valid

(Source: Ref [14])

III. RESULTS AND DISCUSSION

Formative Evaluation Results

a. Self Evaluation

Self-evaluation is carried out by researchers to assess and find out the shortcomings contained in the worksheet product developed. This assessment uses an instrument in the form of a questionnaire which is assessed directly by the researcher. There are several aspects that are assessed in the self-assessment including a) the completeness of the literacy of scientific component; b) analysis of student needs; c) completeness of worksheets; and d) worksheet display. This stage is carried out by researchers at each stage completed during the development process so that researchers produce worksheets containing literacy of scientific as planned and are ready to be evaluated in the next stage.

b. One to One Assessment Results

The results of the One to one assessment of worksheet containing scientific literacy were obtained from a questionnaire filled out by representatives of 3 students. One to one assessment results are used to assess the strengths and weaknesses of the worksheets that have been made based on the assessments of students. Based on the assessment questionnaire used, one to one result can be analyzed for the four components of the worksheet assessment. The first component is the material which consists of four indicators, namely 1) ease of understanding of the material, 2) clarity of the material, 3) the attractiveness of the material, and 4) the recency of the material. The results of the value plot of the four material component indicators in the One to one assessment are shown in Figure 2.

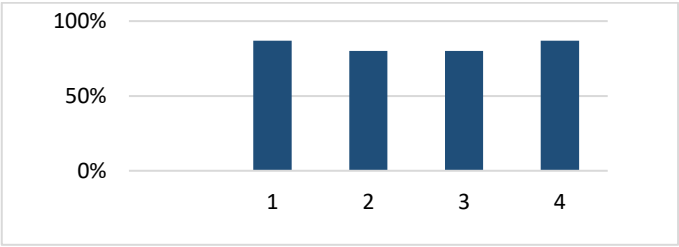

Fig. 2. Material Component Assessment in one to one Assessment

Figure 2 explains the each component value of the material component ranging from 80 to 87. Of the four indicators, there are two indicators that have the highest value, namely the ease of understanding the material and the up-to-dateness of the material at 87%. The result of the average assessment of the material components is 83.5%. This the material components are in very good criteria.

The second component is a learning design which consists of four indicators, namely 1) the readability of the text on the worksheet containing scientific literacy, 2) the clarity of objectives in the worksheet containing literacy of scientific, 3) the coherence of the learning process in the worksheet containing scientific literacy, and 4) the attractiveness of the presentation strategy. The results of the value plot of the four instructional design component indicators in the One to one assessment are shown in Figure 3

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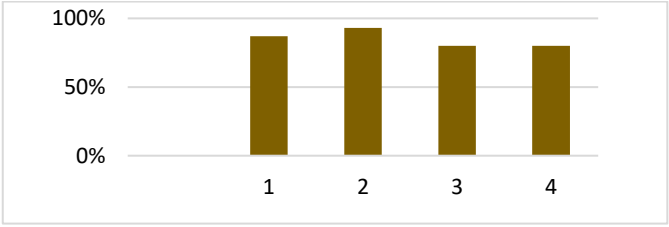

Fig.3. Assessment of Learning Design Components in One to One Assessment

Figure 3 explains the each component value of the learning design component ranging from 80 to 93. Of the four indicators, there is an indicator that has the highest value, namely the clarity of objectives in the worksheet with a content of 93%. The results of the average assessment of the learning design components are 85%. This the learning design component is in very good criteria.

The third component is implementation which consists of three indicators, namely 1) ease of use of worksheet containing scientific literacy, 2) the time required to understand worksheet is not too long, and 3) utilization of worksheet in the future. The results of the value plot of the three implementation component indicators in the One to one assessment are shown in Figure 4.

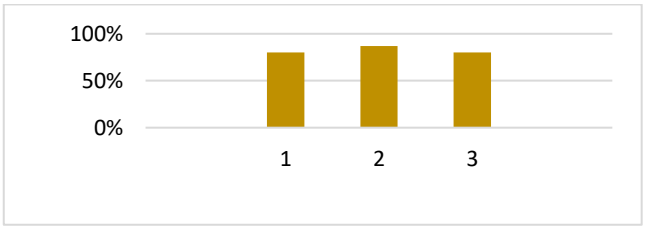

Fig. 4. Assessment of Implementation Components in one to one Assessment

Figure 4 explains the each component value of the implementation component ranging from 80 to 87. Of the three indicators, there is an indicator that has the highest value, namely the time it takes to understand worksheet is not too long at 87%. The average assessment result of the implementation component is 82.3%. Thus the learning design component is in very good criteria.

The fourth component is technical which consists of six indicators, namely 1) image clarity on the worksheet containing scientific literacy, 2) color clarity on the cover of the worksheet containing scientific literacy, 3) color clarity in the image, 4) placement of layout elements (title, subtitle, illustration, pictures and charts) are placed consistently on the worksheet containing scientific literacy, 5) using printed letters and not using Latin or Roman letters, and 6) the appearance of the worksheet is attractive. The results of the value plot of the six technical component indicators in the One to one assessment are shown in Figure 5.

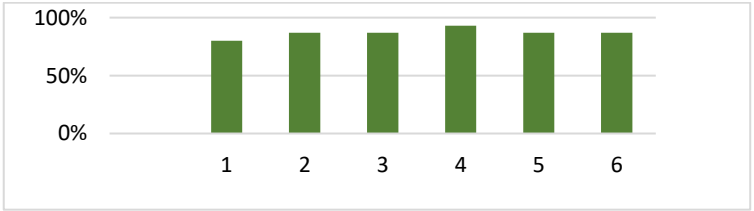

Fig. 5. Technical Component Assessment On One to One Assessment

Figure 5 explains the value for each indicator of the technical component ranging from 80 to 93. Of the six indicators, there are indicators that have the highest value, namely the placement of layout elements (title, subtitle, illustrations, pictures and charts) are placed consistently on the worksheet loaded. Scientific literacy by 93%. The result of the average technical component assessment is 86.8%. Thus the technical component is in very good criteria. The results of the value in average of the One to One assessment component on the physics worksheet with scientific literacy on the material of straight motion have been shown in Figure 6.

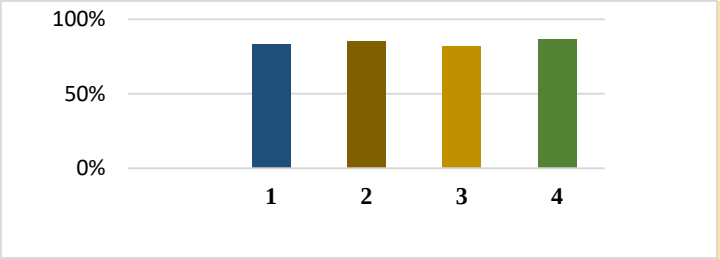

Fig. 6. One to one Rating Result Chart

Figure 6 explains the average each component value of the One to one assessment ranging from 82 to 87% with the value in average of the component being 84.25%. The four components of the One to one assessment are very good.

c. Validation Assessment Results

The structure of physics worksheets containing literacy of scientific in straight motion materials is guided by the 2008 Ministry of National Education regarding guidelines for developing material of teaching, one of which is worksheets. The structure of this worksheet includes, 1) title, 2) learning instructions, 3) competencies to be achieved, 4) supporting information, 5) activities and work steps, 6) assessment. The activities and steps include literacy of scientific as shown in Figure 7.

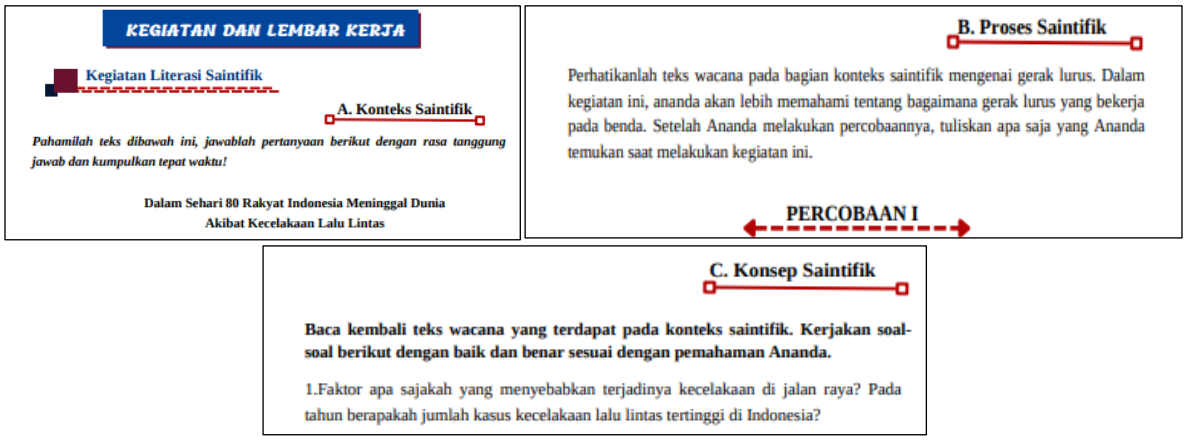

Fig.7. Activities and Work Instructions on worksheet

The results of the worksheet validation assessment containing scientific literacy were obtained from a questionnaire filled out by 3 physics lecturers at the Faculty of Mathematics and Natural Sciences UNP as validators. The value in average of the validation component is obtained from the value in average of the indicators on all components. Based on the assessment instrument used, it can be analyzed the validity results for the four components of the assessment of physics worksheets containing scientific literacy. First, the content feasibility component consists of nine indicators, namely 1) conformity with core competencies and basic competencies, 2) conformity to students' needs for worksheet, 3) the truth of the substance of the material, 4) worksheet contains 3 aspects of scientific literacy (scientific context, scientific process, and scientific concept), 5) scientific context, 6) scientific process, 7) scientific content, 8) benefits for increasing knowledge insight, and 9) conformity with values, morality and social.

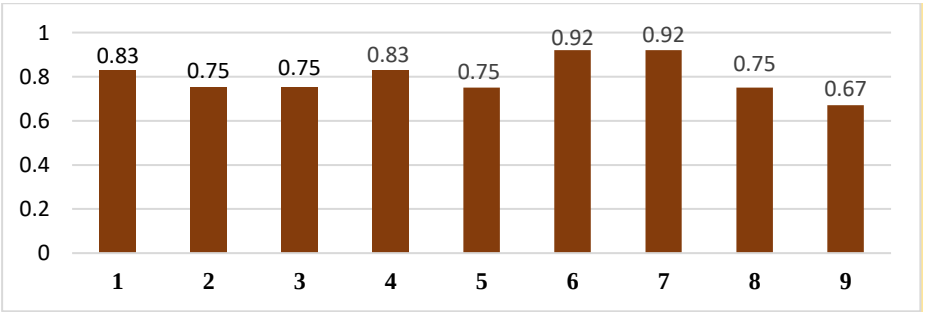

Fig. 8. Content Component Assessment Chart on Worksheet Validation

Based the data by Figure 8, it can be explained that the each component value of the content component ranges from 0.75 to 0.92. Of the nine indicators in the content assessment component of the worksheet, there are two categories, namely valid and very valid. The very valid category ranges from 0.83 to 0.92 and the valid category ranges from 0.67 to 0.75. The value in average obtained on the content component is 0.80. Thus the content component is in the valid category.

Second, the linguistic component consists of four indicators, namely 1) readability, 2) clarity of information, 3) conformity with Indonesian language rules, and 4) effective and efficient use of language. The results of the value plot of the four linguistic component indicators are shown in Figure 9.

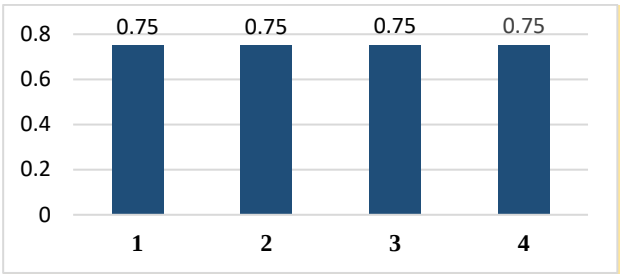

Fig. 9. Assessment of Language Components in Worksheet Validation

Based the data by Figure 9, it can be explained that the each component value of the linguistic feasibility component is 0.75. Of the four indicators, the linguistic assessment component has an average value of 0.75. Thus the linguistic component is in the valid category.

Third, the presentation component consists of five indicators, namely 1) the clarity of the objectives of the experiment in the worksheet, 2) the order of presentation, 3) the provision of motivation, 4) interactivity (stimulus and response), and 5) completeness of information (study instructions, core competencies and basic competencies, material, work steps and assessment). The results of the value plot of the five presentation component indicators are shown in Figure 10.

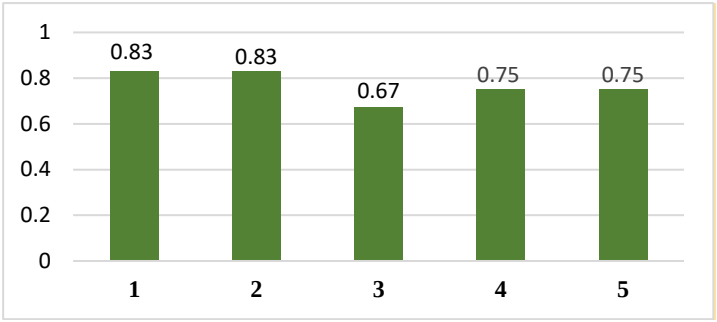

Fig.10. Presentation Component Assessment on Worksheet Validation

Based the data by Figure 10, it can be explained that the each component value of the presentation component ranges from 0.67 to 0.83. Of the five indicators in the presentation assessment component on the worksheet, there are two categories, namely valid and very valid. The very valid category ranges from 0.83 and the valid category ranges from 0.67 to 0.75. The value in average obtained on the presentation component is 0.77. Thus the presentation component is in a valid category.

Fourth, the graphic component consists of three indicators, namely 1) use of fonts (type and size), 2) display design and layout, and 3) illustrations, graphics, images, and photos. The results of the value plot of the three graphic component indicators are shown in Figure 11.

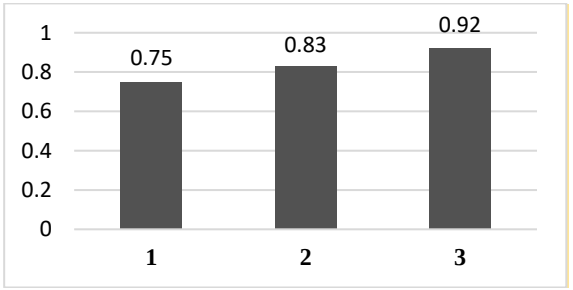

Fig. 11. Component Assessment Chart in Worksheet Validation

Based the data by Figure 11, it can be explained that the each component value of the graphic feasibility component ranges from 0.75 to 0.92. Of the three indicators, there are two categories of the assessment component of the worksheet, namely valid and very valid. The very valid category ranges from 0.83 to 0.92 and the valid category ranges from 0.75. The value in average obtained on the graphic component is 0.83. Thus the graphic component is in the valid category. The results of the value in average of the validation component on the physics worksheet with scientific literacy on the material of straight motion have been shown in Figure 12.

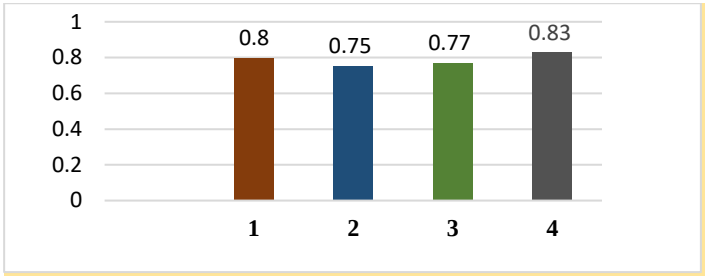

Fig. 12. Component Assessment Chart in WorksheetValidation

Based the data by Figure 12, it can be explained that each component value of the validation assessment ranges from 0.75 to 0.8. Of the four indicators in the content assessment component of the worksheet, there are two categories, namely valid and very valid. The very valid category ranges from 0.8 and the valid category ranges from 0.75 to 0.79. The value in average obtained in the validation assessment is 0.79. Thus the components in the validation assessment have valid validity.

Discussion

The content feasibility component consists of nine indicators. These indicators include 1) Conformity with core competencies and basic competencies, 2) Conformity with student needs for worksheet, 3) Truth of material substance, 4) worksheet contains 3 aspects of scientific literacy (scientific context, scientific process, and scientific concept), 5) Context scientific, 6) Scientific process, 7) Scientific content, 8) Benefits for increasing knowledge insight, and 9) Conformity with values, morality and social.

Based on several indicators on the content feasibility component, there are the lowest and highest values for that component. The indicator of conformity with morality and social values got the lowest score of all indicators on the content feasibility component, which was 0.67. This is because the worksheet still provides little application of morality for students. The highest value of the content feasibility component contains two indicators, namely the scientific process indicator and the scientific content presented in the worksheet, which is 0.92. The highest score was obtained on the scientific process and scientific content indicators because the worksheet was in accordance with the scientific literacy indicators, namely in the scientific context, scientific process, and scientific concept. In scientific literacy, there are scientific contexts, scientific processes, and scientific concepts.

The linguistic feasibility component consists of four indicators. These indicators include 1) readability, 2) clarity of information, 3) conformity with Indonesian language rules, and 4) effective and efficient use of language. Based on several indicators on the linguistic component, a moderate value was obtained for the linguistic component. Of the four indicators on the linguistic component have the same value of 0.75. This is because each indicator has the same discussion, namely about language in physics worksheets containing scientific literacy. The presentation component must include indicators of readability, clarity of information, conformity with Indonesian language rules, and effective and efficient use of language [5].

The presentation component consists of five indicators. These indicators include 1) clarity of experiment objectives in worksheet, 2) sequence of presentation, 3) providing motivation, 4) interactivity (stimulus and response), and 5) completeness of information (study instructions, core competencies and basic competencies, materials, work steps and assessments). Based on several indicators on the presentation feasibility component, there are the lowest and highest values for that component. The indicator that has the lowest value compared to other indicators is found in the motivational indicator with a value of 0.67. This is because the worksheets developed by researchers still provide little motivation to students. The motivation when learning is with a clean heart, it will be easy to accept knowledge and stick to the mind and heart so that it becomes useful knowledge [20]. The highest value of the presentation feasibility component contains two indicators, namely 1) the clarity of the experimental objectives in the worksheet and 2) the order of presentation. With a value of 0.83 for each indicator. This is because in developing worksheet, the learning principles must be met, namely the material of teaching used are arranged systematically. material of teaching are systematic so as to facilitate students in learning. This is because in developing worksheet, the learning principles must be met, namely the material of teaching used are arranged systematically. Material of teaching are systematic so as to facilitate students in learning. This is because

in developing worksheet, the learning principles must be met, namely the material of teaching used are arranged systematically. Material of teaching are systematic so as to facilitate students in learning [19].

The graphic component consists of three indicators. These indicators include 1) use of fonts (type and size), 2) display design and layout and 3) Illustrations, graphics, images, and photos. Based on several graphic indicators, the lowest and highest values of the graphic components were obtained. The indicator that has the lowest value compared to the others is found in the indicator of the use of fonts (type and size) with a value of 0.75. This is because in writing worksheets there are still errors in the use of fonts such as font size for writing physics equations. To make worksheet, one must pay attention to the graphic of the worksheet developed. The quality of the letters that make them readable and understandable by the reader [12]. The highest value is found in the illustration indicators, graphics, pictures and photos with a value of 0.92. This is because the worksheets already contain illustrations, graphics, pictures, and photos that can represent learning material. Aspects of the content of material of teaching consist of the completeness of layout elements, color combinations as well as illustrations and pictures [7]. In the validation assessment instruments there are four assessment components in the worksheet. The assessment components used in the worksheets include the feasibility of content, language, presentation, and graphics. Based on the validation results, obtained an average value of 0.79 validation. According by the value in average obtained, it can be concluded that the physics worksheets produced are valid for use in the physics learning process.

IV. CONCLUSION

Based on the results of the research and discussion conducted, the validity value of each worksheet component was obtained. The results of the content feasibility component in the category were valid, the linguistic feasibility component in the category was valid, the presentation feasibility component in the category was valid, and the graphic feasibility component in the category was very valid. Thus, the validation of physics worksheets containing scientific literacy on this linear motion material can be classified in the category was valid.

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