

## Development of Student Worksheet Integrated Scientific Literacy for The Using of Physics Practicum Kit in Simple Harmonic Vibration

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### ABSTRACT

Facts found in the field found that the available Practical KIT is complete, but teaching materials in the form of the student worksheet are still built from Practical KIT and are still general in nature. One of the solutions to overcome these problems is the development of worksheets integrated with scientific literacy for the use of KIT Physics Practicum on Simple Harmonic Vibration Material. The purpose of this study was to determine the feasibility of the validity of the student worksheet integrated with Scientific Literacy. The research conducted included a type of research and development with the ADDIE model which consists of 5 stages, namely, Analysis, Design, Development, Implementation, and Evaluation. This research was conducted up to the Development stage where each stage was carried out. Evaluation Research is limited to the Development stage at the validity test stage. The object of research is student worksheet integrated with science literacy. Data sources were obtained from the results of expert validation by Physics lecturers of Faculty of Mathematics and Natural Sciences, Padang State University Padang State University. The data collection instrument in this study was a validity test sheet. Data analysis techniques for instrument and product validation using V Aiken. The results of this study obtained three results, namely first based on preliminary analysis obtained the problem of practicum KIT available has not been maximally utilized so it is necessary to develop student worksheet Integrated Scientific Literacy. Secondly, at the design stage, the student worksheet integrated with scientific literacy has been designed. Third, the validity test results obtained an average of 0.86 with a very valid category. From this study it can be concluded that the development of student worksheet Integrated with Scientific Literacy for the Use of Physics Practicum KIT on Simple Harmonic Vibration Material is feasible to use in physics learning.

**Keywords:** Student Worksheet, Scientific Literacy, Practical KIT, Simple Harmonic Vibration



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## I. INTRODUCTION

Developments in the 21st century are marked by rapidly developing science and technology. In the 21st century, humans are required to be able to master science and technology, so that quality human resources (HR) can be created. Human resources are required to have broad insight, critical thinking, and literacy skills to face the development of the 21st century. One of the government's efforts in developing education is to improve human resources in accordance with existing conditions, in order to meet the quality and quality of education in Indonesia.

Education is a deliberate and well-thought-out effort to bring about an active process of learning for students who grow academically. Education is a process in helping humans improve their quality so that they was easy to face every process of developed in an ever-changing era [1]. Other skills that must be possessed are collaboration, creation, technology and communication literacy, and media literacy. So, with the demands of existing education requires students to be easy to have literacy skills [2].

The curriculum is a tool for learning to accomplish educational objectives. The curriculum is defined as a set of plans to achieve goals, content, and learning that are used as guidelines for the implementation of learning activities to achieve specific educational goals in Law No. 20 of 2003 concerning the national education system.

The KTSP curriculum from 2006 has been improved and refined in the 2013 curriculum. The 2013 curriculum aims to increase students' mindsets and mastery of literacy. So that students can be more active, creative and innovative as well as character development that is integrated into the process of learning.

One of the skills required in the 2013 curriculum is scientific literacy skills. Literacy is one of the most important things in the world of education. Literacy is a person's ability to read, write, calculate, and critically solve problems. This will make it easier for someone to understand and utilize the information obtained either directly or indirectly with the literacy ability. Scientific literacy is a person's ability to utilize scientific knowledge, both in understanding concepts and applying them in everyday life. Scientific literacy is very necessary in this day and age, because literacy of scientific is a requirement that students must have in solving the challenges of a very fast changing era [3]. Student Worksheet integrated literacy of scientific, only refers to three aspects [4]. namely Scientific Context, Scientific Process and Scientific Concept. To improve scientific literacy skills in students, qualified materials of teaching are needed. Materials of teaching are used in the process of learning with the aim of studying and implementing learning [5]. Materials of teaching are useful for building student understanding so that students can understand the material that has been given. Materials of teaching can also support scientific literacy skills, one of which is the Student Worksheet. Materials of teaching are used in the process of learning with the aim of studying and implementing learning.

Student worksheet is a basic activity that can help teachers in the process of learning and also help students to better understand the concept of learning according to the demands of the applicable curriculum. Student worksheet is made to invite and involve students actively in learning in the classroom and in the laboratory. In practicum activities, worksheets have an important role so that practicum activities can run in accordance with learning objectives. Student worksheet guides students in doing practicum with the stages, namely directing students to identify parts, make tables, make observations, and write or draw their observations results and finally draw conclusions [6]. There are three steps in the preparation of student worksheet, namely curriculum analysis in the form of core competencies, basic competencies, Indicators and subject matter, Developing a student worksheet needs map determining the title of the student worksheet, and Writing student worksheet [7].

In general, the process of learning physics in high school is divided into two, namely the process of learning in the classroom and the process of learning in the laboratory. In the process of learning in the classroom the teacher emphasizes more on theories, concepts and practice questions, while in the process of learning conducted in the laboratory in the form of practical activities that bring students closer to the application of physics learning in everyday life. The main objective of the practicum is to train students to work according to scientific procedures, gain knowledge, skills and scientific values so that practicum activities can provide direct experience by students.

When doing practicum, of course, you need practicum equipment in the form of Integrated Instrument Components (KIT). The practicum KIT is a practical tool that is designed simply so that students can experiment in groups [8]. Practical KIT is used as a medium or tool to achieve a student learning goal in accordance with the applicable curriculum [1]. KIT is a set of equipment that aims to improve student learning achievement with dynamic, creative, relevant conditions and assist teachers in the process of learning as a medium or tool to achieve learning objectives in accordance with the applicable curriculum. Where the physics practicum KIT consists of mechanics, waves and optics, thermodynamics and electricity and magnetism practicum KIT.

Based on the description above, various efforts have been made by the government to improve students' scientific literacy skills. The reality found in the field has not depicted the ideal conditions. The factors causing the mismatch between real conditions and ideal conditions are known from the analysis conducted with students and teachers at school. These factors concern needs analysis and curriculum analysis.

The first factor is the needs analysis based on the results of the questionnaire obtained a percentage of 90.7% of students are more interests and easy to understand physics material when carrying out practicum in the laboratory. As well as students prefer to learn in the laboratory than in the classroom with a percentage of 86% and students prefer to learn physics when related to everyday life with a percentage of 94.2%. Based on interviews that have been conducted with teachers, it is known that the practicum KIT in the school is complete consisting of Mechanics KIT, Electricity and Magnetism KIT, Optical KIT and Wave KIT and thermodynamics, but the existing KIT has not been maximally utilized, so in the needs analysis it can be seen that the problems found are that students are more interested and easy to understand physics material if it is coupled with carrying out practicum in the laboratory but practicum activities in each school have not been carried out optimally. This is due to inadequate teaching materials or guidance specifically for practicum activities.

The second factor is the analysis of the curriculum obtained from the results of the questionnaire found a percentage of 86% of students more easily understand physics material by using student worksheet and a

percentage of 93% of students prefer physics learning using student worksheet made by the teacher himself. Based on the results of interviews with teachers that the worksheets in schools, especially practical worksheets, already exist, it's just that the worksheets are still in the form of practical KIT guidebooks that are still generally described. Therefore, the problem was found that students prefer to learn and understand physics material by using worksheets when carrying out practicum but the worksheets used in schools are not optimal.

The results of the analysis show that there are several problems found, this is not in accordance with the desired expectations. One solution to the problems described above can be overcome by developing scientific literacy integrated worksheets, so that the learning process is more effective. The students not only learn in a pleasant atmosphere but are also able to use scientific knowledge, so that they are able to apply it in everyday life.

Based on this background, the researcher wants to develop a Physics worksheet with scientific literacy content, where the worksheet developed is on simple harmonic vibration material. Thus, the title of this research is "Development of student worksheet Integrated Scientific Literacy for the Use of Physics Practicum KIT on Simple Harmonic Vibration Material".

## II. METHOD

The type of research used is research and development or (Research and Development). This research is used to develop new products and improve existing products [9]. The model used for this research is ADDIE (Analyze, Design, Develop, Implement, Evaluate). The ADDIE model is a research model that provides opportunities for continuous evaluation and revision so that the resulting student worksheets will be valid student worksheets.

The research procedures that will be carried out are guided by the steps of research and development (Research and Development). The model that will be used in this research is the ADDIE model which consists of 5 stages which include Analysis, Design, Development, Implementation, and Evaluation. This ADDIE model can be seen in Figure 1 below:

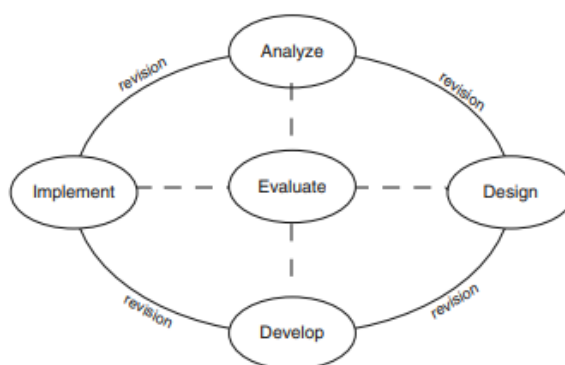


Fig. 1. Model ADDIE

From Figure 1, it can be seen that the analysis stage is the initial stage carried out in the research [10]. The analysis in this study includes needs analysis, curriculum analysis, and analysis of student characteristics. At the analysis stage, it will be seen the level of need and usability of the student worksheets developed which are adjusted to the curriculum and student characteristics. The second stage is design where at this stage the student worksheets that are developed according to the analysis that has been done previously are designed. In the third stage, namely the development stage, it is also called the product realization stage. The stage of developing student worksheets is carried out in accordance with the design that has been planned at the design stage. The fourth stage, namely the implementation stage, this stage is the stage of implementing the design of student worksheets with a wider range after the student worksheets are declared suitable for use with valid, practical, and effective categories. The fifth stage is evaluation, this stage can be carried out at each stage so that the evaluation stage must be present at each stage of the research.

The results of the development are then validated by validators who will be carried out by three physics lecturers of Faculty of Mathematics and Natural Sciences, Padang State University and will provide an assessment of the student worksheets that have been developed. The validation components include content eligibility, language, presentation and graphics. The four validation components will be further elaborated into several indicators in the validation questionnaire. These indicators describe the content of the student worksheets

developed. The validation questionnaire is used to assess how feasible the student worksheets that have been developed are. The validation test data obtained was analyzed with Aiken's Index ( $V$ ) which is formulated as follows:

$$V = \frac{\sum s}{n(c - 1)}$$

$$s = r - l_0$$

Information:

$V$  = rater deal index

$l_0$  = The lowest validity rating score (in this case 1)

$c$  = The highest validity rating score (in this case 5)

$r$  = Number given by an appraiser

$n$  = Number of raters

**Table 1.** Categorization Based on Aiken's  $V$ . Index

interval	Category
0.4	Invalid
$0.4 < V < 0.8$	Valid
$0.8 < V$	Very Valid

(Source : Ref [11])

### III. RESULTS AND DISCUSSION

#### Results

##### A. Analysis

This activity consists of 3 activities, namely needs analysis, curriculum analysis and characteristic analysis. The needs analysis was carried out by conducting interviews and filling out a questionnaire given to the physics teacher of SMAN 2 Payakumbuh. The results of interviews and questionnaire results at SMAN 2 Payakumbuh researchers get learning resources in the form of student worksheets have not been integrated with scientific literacy. In addition, the use of practical KIT in schools is still considered low. The availability of practicum KIT at SMAN 2 Payakumbuh is complete but its use is not maximized. Based on these results, student worksheets need to be developed.

Furthermore, curriculum analysis is conducted. The purpose of this curriculum analysis is so that the student worksheets developed can be in accordance with the needs of the current curriculum. At this stage of curriculum analysis, an analysis of the use of student worksheets to be developed and an analysis of learning materials is carried out. The material presented in the student worksheet is adjusted to the demands of the competencies that must be possessed by students, so it is necessary to study the Core Competencies and Basic Competencies of physics learning. The material used in this LKS is Simple Harmonic Vibration in Basic Competency 4.11. Conduct harmonic vibration experiments on simple swing and/or spring vibrations along with their presentation and physical meaning.

##### B. Design

The appearance of the student worksheet structure is in accordance with the 2008 Ministry of National Education. The components contained in the student worksheet structure are the content feasibility component, the linguistic component, the presentation component and the graphic component [12]. The result obtained from this design stage is a complete view of the worksheet product that has been designed. The product of this research is a worksheet integrated with scientific literacy for the use of practicum KIT on simple harmonic vibration material. The worksheet structure is made in accordance with the design which consists of a cover, learning instructions, competencies to be achieved, activities and work steps and assessment. The work steps in this worksheet are made based on the steps in scientific literacy which consist of scientific context, scientific process and scientific concepts, finally the worksheet display assessment is designed based on the following design such as this cover:



Fig. 2. Student Worksheet Cover

### C. Development

Based on the design results that has been conducted in the previous student worksheets stage and then the development stage is carried out, this stage aims to produce valid scientific literacy integrated worksheets. At this stage, validation activities were carried out by three validators, namely three physics lecturers of Faculty of Mathematics and Natural Sciences, Padang State University. As for the assessment of the integrated scientific literacy student worksheets using a validation instrument consisting of four components, namely the components of content feasibility, language, presentation and graphics.

The first component is the content feasibility component. The content feasibility component consists of six indicators, namely 1) The material presented in the student worksheet is in accordance with the indicators of competency achievement and learning objectives, 2) The student worksheet material is arranged in accordance with the development of science, 3) The material presented in the student worksheet is in accordance with the mindset of student development, 4) The practical KIT presented is in accordance with the student worksheet material. 5) The basic concepts presented in the student worksheet are correct, 6) the use of student worksheet guides students to develop scientific skills. The content feasibility indicator value results plot are shown in Figure 1

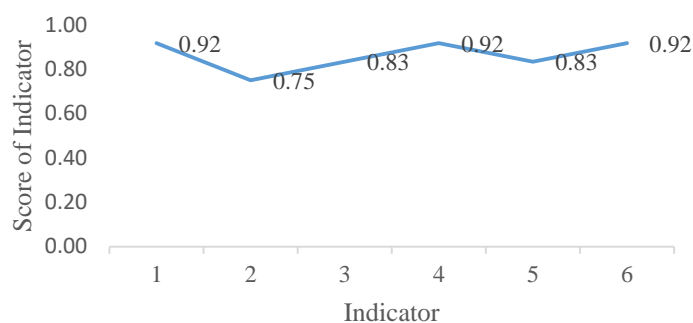
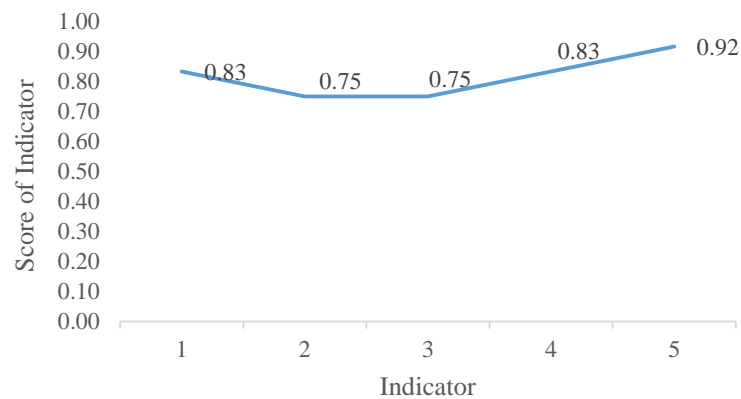


Fig. 3. Presentation Component Indicator

Based on the picture, it can be explained the value of each indicator of the content feasibility component with intervals ranging from 0.75 to 0.93. Of the six indicators are included in the valid and very valid categories. So, the average value obtained on the content feasibility component is with an interval of 0.86 where this value is included in the very valid category.

The second component is the linguistic component, the linguistic component consists of five indicators, namely 1) Consistency in the use of terms and symbols presented in the student worksheet, 2) The information provided in the student worksheet is clear and precise, 3) The writing of sentences in the student worksheet is in

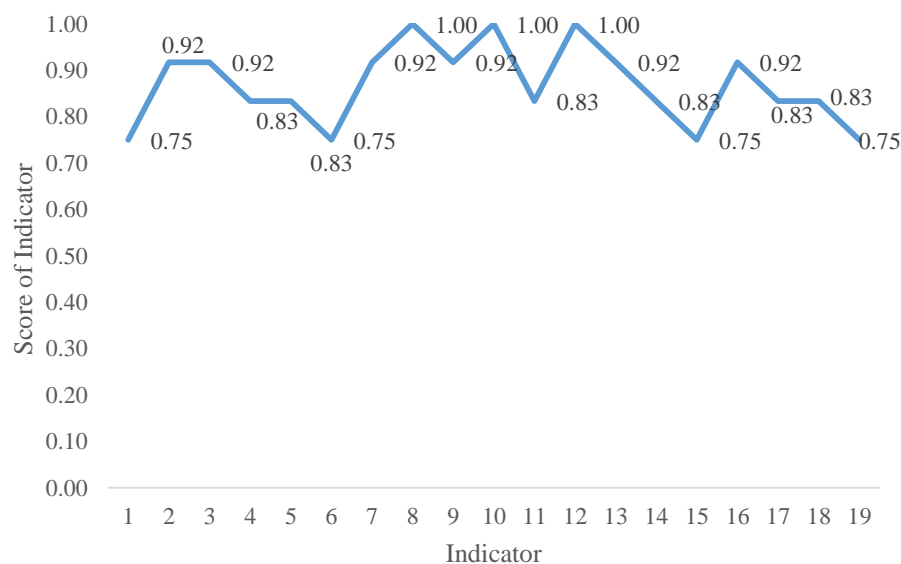
accordance with the language rules. Indonesia, 4) Student worksheet uses correct vocabulary and sentence structures, 5) The language used in student worksheet is easy for students to understand. The value data results plot for each linguistic component indicator are shown in Figure 2



**Fig. 4.** Language Component Indicator

Based on the picture, it can be explained the value of each linguistic component indicator with intervals ranging from 0.75 to 0.93. Of the five indicators are included in the valid and very valid categories. So the average value obtained on the content feasibility component is with an interval of 0.82 where this value is included in the very valid category.

The third component is the presentation component. The presentation component consists of 1) Student worksheet has clear learning objectives, 2) Student worksheet structure is appropriate based on the 2008 Ministry of National Education, 3) Student worksheet encourages students to read and work in scientific literacy, 4) Practical KIT information for scientific literacy activities is complete, 5) the completeness of the presentation of the scientific literacy component which consists of three components, namely the scientific context, the scientific process and the scientific concept. The presentation indicator value data results plot can be seen in Figure 3

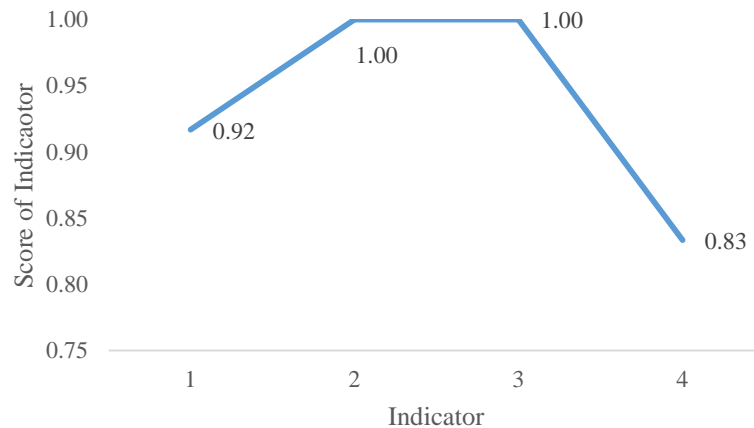


**Fig. 5.** Presentation Component Indicator

Based on the picture, it can be explained the value of each indicator of the linguistic component with intervals ranging from 0.75 to 1. Of the nineteen indicators, they are included in the valid and very valid

categories. So, the average value obtained on the presentation component is with an interval of 0.86 where this value is included in the very valid category.

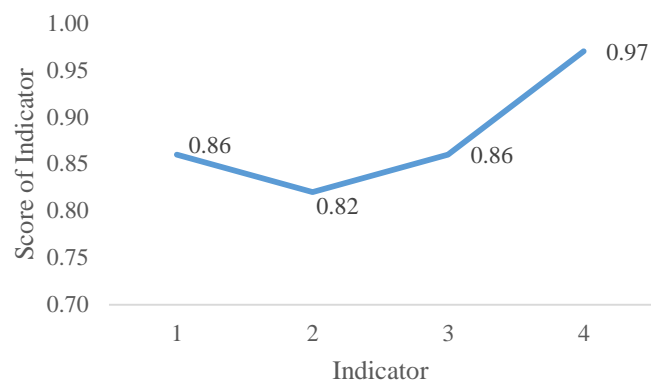
The fourth component is the graphic component. The graphic component consists of four indicators, namely 1) the use of fonts (types and sizes) used in proportional student worksheets, 2) the layout and layout of the student worksheets are proportional, 3) illustrations, pictures, and photos presented on the student worksheets are in accordance with the material, 4) The color combination on the cover and each student worksheet is proportional. The value data results plot for each graphic indicator are shown in Figure 4.



**Fig. 6.** Graphical Component Indicator

Based on the picture, it can be explained the value of each indicator of the linguistic component with intervals ranging from 0.83 to 1. Of the nineteen indicators included in the valid and very valid categories. So, the average value obtained on the presentation component is with an interval of 0.97 where this value is included in the very valid category.

The average value of each assessment component in the scientific literacy integrated student worksheet is obtained by calculating the average value of each component. The component value is obtained from the average value of each indicator. The validity component consists of 1) content feasibility, 2) language, 3) presentation, 4) graphic. Based on this value, the data results plot of the average value of the validity component can be seen in Figure 5.



**Fig. 7.** Average Indicator of Each Component

Based on the average value obtained by the 4 components of this validity assessment, the value of the overall validity of the product can also be calculated by averaging the validity value of the 4 components above so that a value with an interval of 0.87 is obtained, which is at this value the student worksheet product is integrated with scientific literacy. can be categorized as a very valid product.

## Discussion

In this discussion, the research results conducted and the limitations experienced during the research are presented. The results obtained are the validation results carried out by validators who are experts from physics lecturers, of Faculty of Mathematics and Natural Sciences, Padang State University. The student worksheet validation assessment instrument consists of 4 assessment components, these components include the content feasibility component, language, presentation, and graphics [12].

The content feasibility component on the student worksheet validation sheet consists of six indicators. The average value of the validity of the content feasibility component with an interval of 0.86 so that the product criteria are at a very valid level of validity, which is in the interval range of  $0.8 < V$ . This is supported by the material presented by student worksheet in accordance with core competencies, basic competencies, achievement indicators competencies, learning objectives, materials arranged in accordance with the development of science and scientific literacy activities of students in accordance with the mindset of students. This is in line with Yusuf's opinion that materials of teaching that present students' emotional development in the form of moral messages and good activities will teach students so that they form good character [13].

The linguistic component in the student worksheet validation sheet consists of five indicators. The average value of the linguistic component with an interval of 0.82. The validity criteria of the student worksheet are at a very valid level of validity, namely in the interval range of  $0.8 < V$ . In this component, the researcher obtains input from the validator so that the language used in the supporting information is simpler and more effective. It is intended that the worksheets developed are easily understood by students.

The presentation component in the product validation sheet consists of nineteen indicators. Where four indicators in general and fifteen indicators regarding aspects of scientific literacy assessment consisting of three aspects. The first scientific context has three indicators, the second scientific process has six indicators and the third scientific concept has six indicators. The validation results showed that the first indicator, namely the student worksheet, has clear learning objectives, the sixth, namely the student worksheet contains the basic concepts of material relevant to the learning objectives and the fifteenth, namely the phenomena presented in the student worksheet follow the development of science and technology, has the lowest validation results with a value of 0.75. In the student worksheet, the learning objectives have not been explained in the student worksheet, so the value on this indicator is still relatively low. Furthermore, the sixth indicator has something to do with learning objectives, but the learning objectives are still not explained in the student worksheet so that the value of this indicator is also low. Finally, in the fifteenth indicator, the phenomena presented in the student worksheet are still general in nature that are close to everyday life and have not followed the development of science and technology. The average presentation component with a value of 0.86 so that the product criteria are at a very valid level of validity, which is in the interval range of  $0.8$  small than  $V$ . This shows that the presentation in the student worksheet is still valid. This shows that the presentation in the student worksheet made by the researcher is in accordance with the structure in the student worksheet making guidelines in accordance with the statement [12]. This is in line with the opinion of Khairunnisa's which states that the student worksheet is prepared systematically and must pay attention to the presentation structure, because the presentation developed in the student worksheet can attract students' interest in learning so that it can increase students' curiosity in learning physics [14].

The graphic component on the student worksheet validation sheet consists of four indicators. In general, the validation results show that the graphic component has a very high validation value. With indicators of fonts, layouts, image illustrations and photos that are in accordance with the material and have a proportional shape and cover that already has a good color combination so that the student worksheet used is interesting to read. This is in accordance with Yunita's opinion which states that attractive illustrations plus the right layout can make the student worksheet more harmonious and interesting to learn and can motivate students to use the student worksheet in learning [15]. The average grading component with a value of 0.97 so that the product criteria are at a very valid level of validity, which is in the interval range of  $0.8$  small than  $V$ .

Based on the validation results by experts, the validity value of the scientific literacy integrated worksheet for the use of physics practicum KIT on simple harmonic vibration material is 0.86 with a very valid category. This is in line with the Aiken's Index category which meets the valid criteria with the right elements [8]. In carrying out this research, it is not easy to get perfect results due to limitations. The input and suggestions from these experts are used to improve the feasibility of the student worksheet.

#### IV. CONCLUSION

Based on the results of the research and discussion that has been carried out, several conclusions can be stated as follows: LKS integrated scientific literacy for the use of physics practicum kits on simple harmonic vibration material using the ADDIE research and development model through 5 stages of the ADDIE development model, namely Analysis, Design, Development, Implementation and Evaluation. The scientific literacy integrated student worksheet for the use of physics practicum kits on simple harmonic vibration material



that has been developed is evaluated by the validator and revised according to the input, suggestions and responses from the validator so that the scientific literacy integrated student worksheet can be said to be valid and meets the criteria for validity which is very valid from the average value with the four components with a value of 0.86.

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