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## Development of Student Worksheets Based on Scientific Literacy in the Food Digestion System Subject of Class XI Science High School

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### ABSTRACT

This study aims to develop student worksheets (LKPD) based on scientific literacy on the digestive system subject of class XI IPA high school. The small group test was conducted at SMAN 4 Dumai, because the LKPD used so far had not been based on scientific literacy so the scientific literacy ability of students was still low. This type of research was a research and development model of Borg and Gall. The validity instruments were the RPP, the LKPD, and the question validation sheets. The practicality instrument was a questionnaire of teacher and student responses. The validator consists of 2 lecturers (subject and education experts) and 2 teachers (practitioners). The data obtained is qualitative data converted to quantitative data. RPP validation results from 7 aspects of 3.8 (valid). LKPD validation of 3.77 (valid) includes content aspects of 3.92, linguistic 3.63, content 3.67, and characteristics of 3.85. LKPD is classified as practical after being tested on 15 class XII science students who have received food digestion subject before. The results of the response of students by 3.51 from 3 aspects, namely subject, language and presentation. The results of teacher responses amounted to 3.77. It can be concluded that the LKPD developed is feasible and practically used in the learning process.

## 1. Introduction

In the 21st century there has been an accelerated change in the world of education. Science literacy is the main key to face various challenges in the world of education in the 21st century. However, the scientific literacy ability of Indonesian students is still low, based on the results of the PISA test (Program for International Student Assessment). The results of the PISA assessment in 2012

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Indonesia was ranked 64 out of 65 countries with a score of 382, in 2015 an increase in the score of 403 was ranked 62 out of 72 countries, but on average it was still below the OECD countries. (OECD, 2016).

The low ability of scientific literacy of students is partly due to the low load of scientific literacy in teaching subjects. Several studies on the low level of scientific literacy in teaching subjects include study of nine science textbooks at SMP, VII, VIII, and IX IPA in Semarang stating that textbooks have reflected scientific literacy but the proportion of the emergence of science literacy categories presented is not balanced, for science knowledge by 64%; investigation of the nature of science by 17.3%; science as a way of thinking by 13.3%; and the interaction of science, technology and society by 5.7% (Rusilowati, 2014).

Ginting et al, (2018) studied on Biology class XI textbooks on the nervous system subject in high schools in Pancurbatu sub-district get 77.20% for the body of knowledge, scientific literacy as a process of investigating at 11.32%, scientific literacy as a way of thinking for 3.39%, scientific literacy as a relationship between technology and society by 8.09%.

The category of scientific literacy in teaching subjects according to Chiapetta et al, (1993) consists of 4 aspects namely (1). Science as the body (body of knowledge), (2). Science as a way of investigation, (3). Science as a way of thinking, (4). Interaction of science, technology and society. According to Wilkinson in Rusilowati (2014) the comparison of aspects of scientific literacy is 2: 1: 1: 1.

Based on the results of researchers' observations, LKPD of Biology learning in SMAN 4 in Dumai has not included 4 aspects of scientific literacy with an ideal comparison, dominant in science as the body of knowledge, and lacking in 3 other aspects. LKPD is still in the form of a summary of subject completed with practice questions.

The digestive system is a class XI high school learning material that discusses abstract physiological processes that cannot be seen directly, including complex subject and demands the ability to memorize concepts. According to students the subject is interesting but it is less able to relate it to everyday life. The results of daily tests and absorptive capacity of the National Examination are relatively low. The things above encourage researchers to develop LKPD based on scientific literacy in the subject of the human digestive system and to determine the validity and practicality of the developed LKPD.

## **2. Methodology**

This type of research was development research using the Borg and Gall model which consists of 10 steps. In this study, only up to step 6, namely: 1). Research and information collecting, 2). Planning, 3). Develop preliminary form of product, 4). Preliminary field testing, 5). Main product revision, 6). Play field testing. The

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study was conducted at Riau University, and small group test was conducted at SMAN 4 Dumai.

The parameters measured in this study were: (1) Validity of LKPD; (2) Practicality of LKPD. The validator consists of 2 lecturers (subject and education experts) and 2 teachers (practitioners), the instruments to be validated are the RPP, LKPD, questions, teacher's and student's response questionnaire. The criteria for making validity decisions are  $3.25 \leq x < 4$  valid,  $2.5 \leq x < 3.25$  are quite valid,  $1.75 \leq x < 2.5$  is invalid,  $1 \leq x < 1.75$  is very invalid (Sugiyono, 2015). The questions were validated qualitatively by expert lecturers followed by validation in small groups. The formulas used to analyze the results of the validation are as follows:

$$M = \frac{\epsilon FM}{N}$$

Where: M: Average score, FM: score obtained, N: number of validation components

As for the practicality of the instruments used were questionnaire teacher and student response. Data about teacher and student responses were analyzed using a rubric modified from Purwanto (2005), as in the following Value 4: Strongly Agree, 3: Fairly Agree, 2: Less Agree, 1: Disagree. Data from the questionnaire responses of teachers and students were analyzed using the classification criteria score 3.50 - 4.00; Practical, 3.00 - 3.49; Quite Practical, 2.00 - 2.99; Less Practical, 1.00 - 1.99; Not practical.

### **3. Results and Discussion**

#### ***Reserch and Information Collection***

##### ***Analysis of Needs***

From the results of the analysis of the LKPD used so far at SMAN 4 Dumai, it was found several shortcomings, including for 6 meetings there were only 3 LKPD. From the aspect of appearance, at the first meeting there was no title, no written allocation of work time and learning resources as a reference for students. the image presented is less attractive and colorless. The appearance of LKPD in general is less attractive, so students are less motivated to use it so that learning outcomes are less than optimal. According to Harahap et al. (2012) a picture and a photo can provide a real object and is more meaningful and precise than words and improves students' thinking abilities.

From the aspect of scientific literacy, LKPD is dominant in category 1 and 2 scientific literacy, which is 50% and 48%, the third aspect is 2.3% and has not been found for the fourth aspect which is marked by no subject/ questions that lead to the application of knowledge being studied in daily life. The emergence of the four aspects of unequal scientific literacy in LKPD will affect the ability of students' scientific literacy, this is in accordance with the results of Wahyu (2016)

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research on the need for balance in the four categories of scientific literacy so that students' scientific literacy abilities can be improved.

### *Literature Analysis*

At this stage, data is collected from various literatures to get an overview of the LKPD that will be developed. The load of scientific literacy used is scientific literacy according to Chiappetta et al. (1993) which divides 4 categories of scientific literacy in teaching subjects namely (1). Science as the body of knowledge with indicators; presents facts, concepts, principles and laws, hypotheses, theories, and models. Students are asked to remember knowledge or information, (2). Science as a way of investigation with indicators; learners answer questions through the use of subject, graphs, tables, etc., make calculations, explain answers, through experiments or thinking activities (3). Science as a way of thinking with indicators; shows the historical development of an idea, illustrates the use of assumptions, cause and effect relationships, emphasizes the empirical nature and objectivity of science (scientific method), discusses facts and evidence shows how science works with inductive and deductive considerations, (4). Interaction of science, technology and society (interaction of science, technology, and society) with indicators; describe the uses and negative effects of science and technology for society, discuss social issues related to science or technology, and mention careers and occupations in the field of science and technology.

### *Curriculum Analysis*

Basic competence (KD) to be developed is KD 3.7 regarding food digestion. The digestive system subject appears every year on national exams, but the scores obtained by students are low. From the results of data analysis from the Ministry of Education and Culture's national education assessment center from 2015 to 2018 as shown in Figure 1.

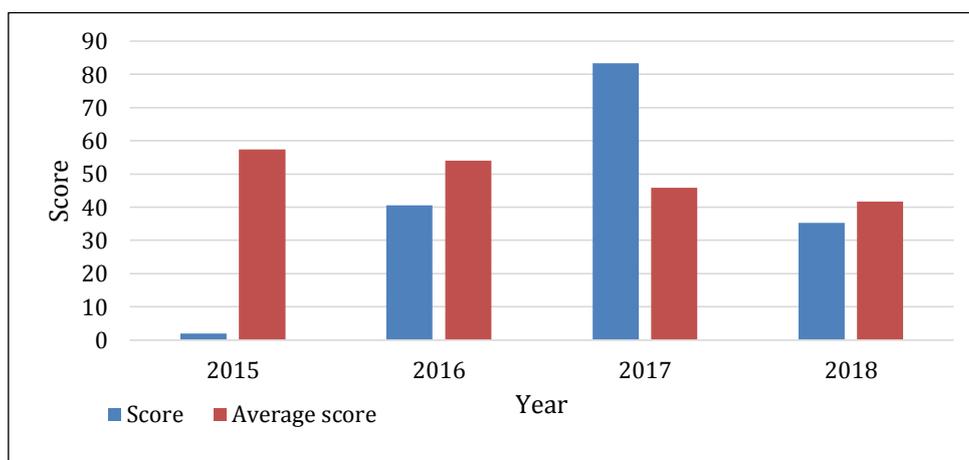


Figure 1. UN Value of Digestive System Subject in SMAN 4 Dumai

Figure 1 shows that the results of the National Exam scores for SMAN 4 Dumai students on the digestive system subject for the last 4 years are below the average, except in 2017. Overall for 4 years the average value for the digestive system was 40.26 which is in the less category

Based on the results of students' in the 2017-2018 daily test scores on the subject of the food digestive system also show that students who reach the minimum completeness criteria (KKM) are low can be seen in Figure 2.

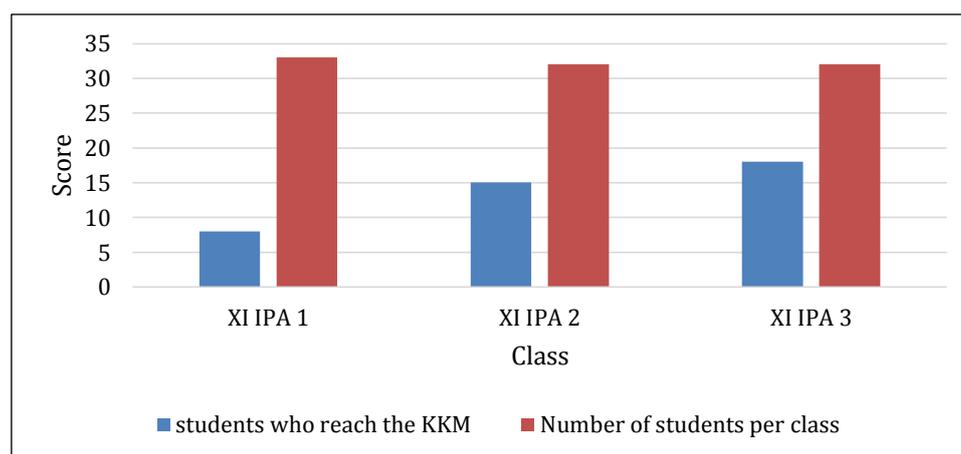


Figure 2. The Results of Daily Tests of the Food Digestive System in the 2017-2018 School Year

Figure 2 shows that the results of daily tests it was seen that students who reached KKM in class XI IPA.1 were 24%, XI IPA.2 48% and XI IPA.3 40%. Overall students who completed as much as 37%.

From the acquisition of UN results and low daily tests, the digestive system is quite difficult, according to Muldayanti (2013) research, digestion is difficult because it has many abstract concepts, and is important because it is applied in daily life. Based on the results of needs analysis, literature and curriculum, it is necessary to develop LKPD based on scientific literacy that can stimulate students to become scientific literates.

### **Planning**

From the results of the analysis, the human digestive system consists of 6 meetings. Meetings 1, 3 and 5 designed non-experimental LKPD using the PBL model, according to Lufri et al. (2020) Problem Based Learning can improve students' Biology competencies. At the 2,4 and 6 meetings are experimental LKPD using guided inquiry models, the use of guided inquiry models in learning has been proven to improve learning outcomes according to Sukini et al. (2020) the average value of student learning outcomes in the experimental class reaches 81.82 and Ardianto et al. (2019) the increase in learning outcomes by 86%.

The four aspects of scientific literacy are made analogies in the form of short sentences (Budiningsih, 2015) that make it easy to remember and understand. Science as a body (body of knowledge) is analogous to the phrase "Let's Learn". Science as a way of thinking is analogous to the phrase "Let's think scientifically". Science as a way of investigation is analogous to the phrase "Trying to Come". Interaction of science, technology with society (interaction of science, technology, and society) is analogous to the phrase "Science in life". LKPD is packed with a variety of images and colors so that interesting images can clarify concepts, improve students' memories regarding what is being learned and challenge students to explore the subject (Fitri, 2014).

### Initial Product Development (Draft 1)

At this stage LKPD draft 1, syllabus, lesson plans and questions were developed. LKPD is made by paying attention to aspects of readability and graphics (colors or images), according to Wulandari (2017) that the display aspect is a very important aspect in LKPD so that students are interested and increase the motivation of students to complete existing tasks.

Category 1 Scientific literature: Science as the body of knowledge. Placed in the discourse and phase 1 activities, as shown in the Figure 3.



Figure 3. Category 1 Literacy Science Layout

Contains a brief theory about the topic being studied. Discourse can be in the form of news pieces from various sources and is used as subject to answer questions on activities. In the orientation of the problem contains brief facts.

### Science Literacy Category 2: Science as a way of thinking

Placed in Activity Phase 2 contains activities or questions that require students to answer questions through the use of subject, graphs, tables, make calculations, explain answers, involve experiments or thinking activities, as shown in the Figure 4.

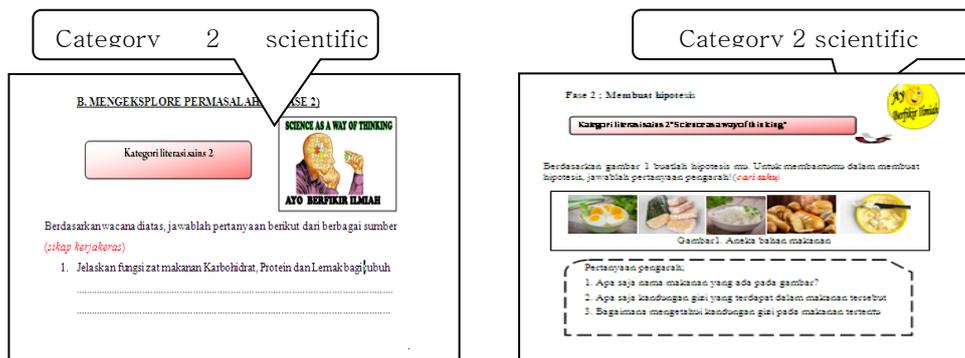


Figure 4. Science Literacy Layout category 2

Science Literacy Category 3: Science as a way to investigate  
 Placed in Activity Phase 3, carry out scientific investigations and collect and analyze data, the layout looks like Figure 5.

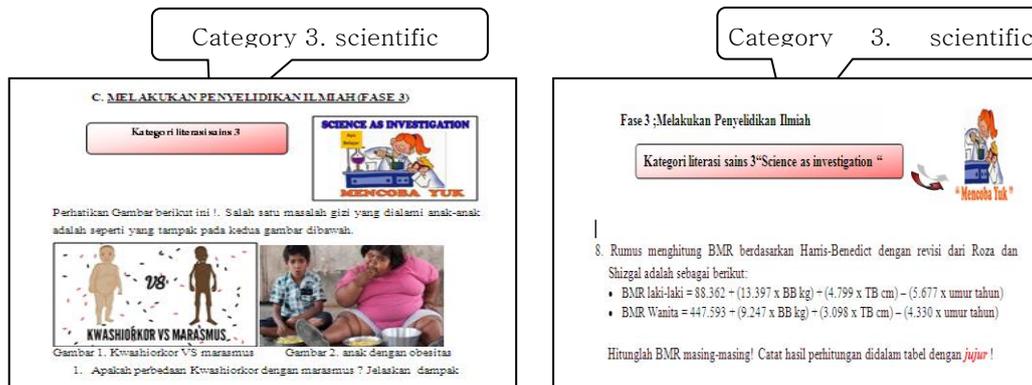


Figure 5. Category 3 Literacy Science Layout

Science literacy Category 4: Interaction of science, technology and society.  
 Placed in phase 5 activities, namely analyzing and evaluating the problem solving process and conclusions. The problems contained in LKPD are oriented towards contextual problems, so students are aware of their usefulness in daily life (Afdareza, 2020), as shown in the Figure 6.

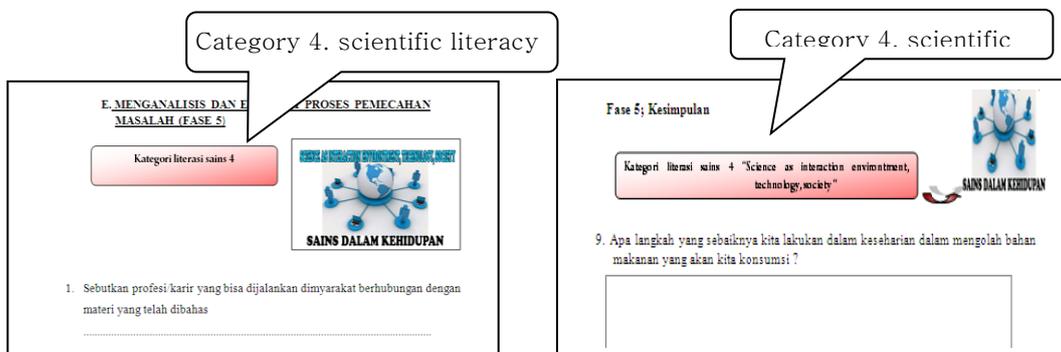


Figure 6. Science Literacy Layout category 4

### ***Preliminary Field Testing.***

Initial product validation, table-top test (desk evaluation) to determine the feasibility of LKPD draft 1 before small group trials, by 2 expert validators (lecturers) and 2 practitioners (teachers).

### ***RPP Validation***

RPP validation uses a validation sheet consisting of 7 aspects of assessment as shown in the Figure 7 below

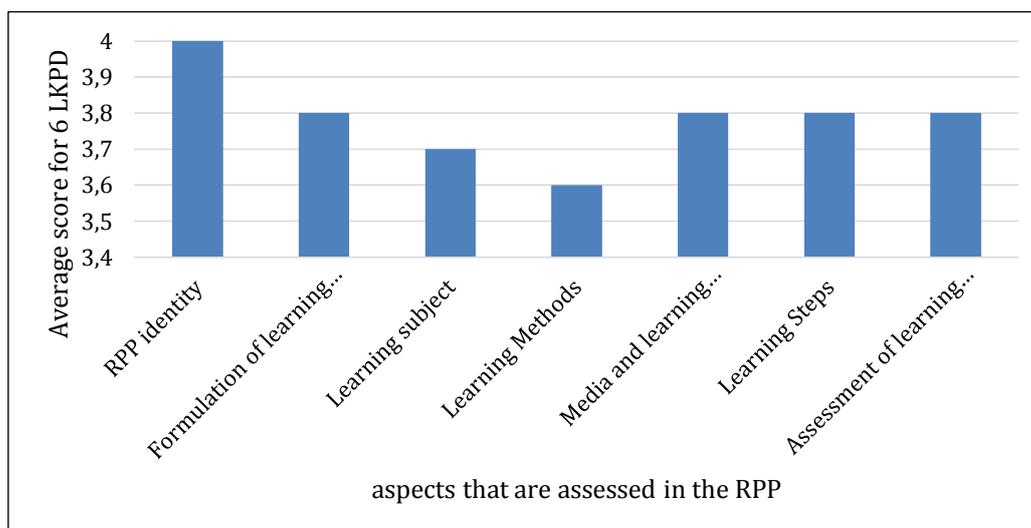


Figure 7. Result of RPP Validation

Figure 7 shows the average value of RPP validation results is 3.8 with valid categories. Aspect of Identity gets a value 4. Based on these data it can be concluded that the lesson plans developed are suitable for use in learning.

### ***LKPD Validation***

Validated components include aspects of subject/ content, linguistic, presentation, and characteristics of LKPD based on scientific literacy. The results of the LKPD validation in detail can be seen in Figure 8. From the Figure 8 it can be seen that of the 4 validated aspects of the LKPD (eligibility of content, language, presentation, and characteristics of the LKPD), all of them are classified as valid. In general, the developed LKPD has met the eligibility of content because the material is adequate to achieve Basic Competence (KD) and the activities therein are in accordance with the intelligence to be integrated, namely scientific literacy and character education, according to Hariadi (2009) that LKPD which is feasible from the aspect of content is LKPD which have included the intelligence that the researcher wants to develop.

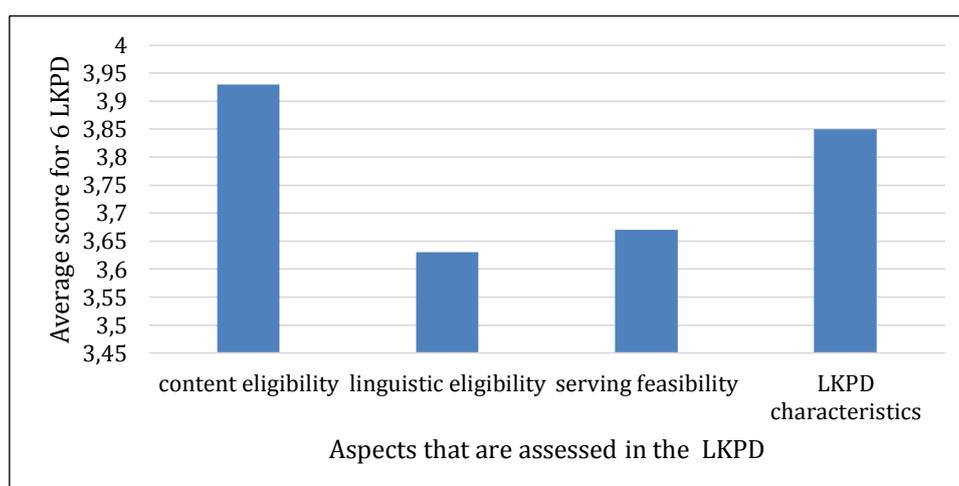


Figure 8. Results of LKPD Validation

The linguistic feasibility aspect aims to assess the level of readability or use of language in LKPD. This aspect gets a score of 3.63 in the valid category, this shows that LKPD is in accordance with the level of student development and is easy to understand. This is in accordance with the opinion of Untari (2008) that good teaching materials use a variety of communicative language so as to make students seem to interact with the teacher through writing.

The presentation aspect get a score of 3.67 (valid). In this aspect, LKPD is assessed from the completeness of the components, a continuous and consistent presentation order, the use of appropriate illustrations and drawings. The LKPD developed is in accordance with its components with the PBL model and guided inquiry. The coherence of the components in the LKPD must be in accordance with the learning model used according to the opinion of Untari (2008) and it also requires consistency so that it is easily recognized, remembered and learned by students. The lowest score is obtained on the indicators of using illustrations and pictures, this is because some of the pictures on the LKPD are too small so that they are less legible. The importance of pictures or illustrations in teaching materials can increase student interest and learning outcomes, this is according to the opinion of Anidityas (2012) which states that through pictures students can clearly see what is being discussed so that it can increase interest and learning outcomes.

The characteristic aspect assesses the emergence of scientific literacy and character education in LKPD. The four components of literacy are proportional, namely with a ratio of 2: 1: 1: 1 (Rusilowati, 2014). The LKPD also provides short stories, words of motivation for character education for students.

### ***Main Product Revision / Revision 1***

The results of validation by LKPD lecturers and teachers have been declared valid, with some improvements according to the suggestions and comments from

the validator. A draft 2 product is produced that is ready to be tested in small groups. The improvement results are presented as follows:

- (1) Choosing a discourse that is not too long. In LKPD which is prepared in the discourse and exploration activities section, problems that are too long. According to the validator, this will complicate and cause students to lack time. It is recommended to shorten the discourse.
- (2) Write down the source of the picture quotation.  
In the compiled LKPD there are still images that are not mentioned by the source of the citation, it is recommended that the source be written down.
- (3) Changing picture illustrations on aspects of scientific literacy  
Illustration of images for science literacy in LKPD is too striking (dominant) causing disturbances in the focus of students, according to the validator to be replaced with a simpler one and the size of the illustrated images in LKPD is made more proportional.

### **Main Field Testing / Draft 2**

After the LKPD is validated and revised, a practicality test is performed. Through the questionnaire responses of teachers and students towards the developed LKPD. The questionnaire responses from the teachers and students obtained the results as in Figure 9.

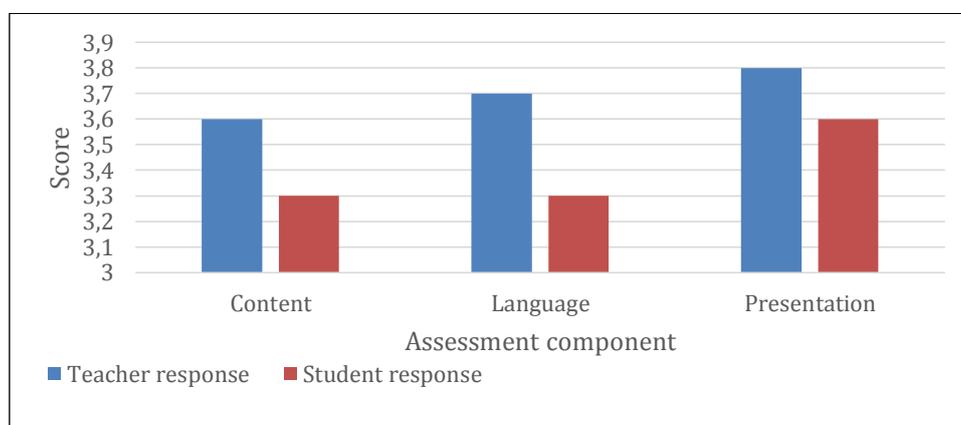


Figure 9. Data on the Results of the Teacher's and Students Response Questionnaire

Figure 9 shows the results of teacher and student responses are practical categories, namely 3.7 and 3.5. The results of the teacher's response to the material aspect received low scores on the indicator of the adequacy of time allocation, this is overcome by reducing the length of the discourse. Whereas in the students' responses, there were some materials that were difficult because they did not remember the material anymore. From the aspect of the presentation it gets high practicality because LKPD contains interesting illustrations, pictures, motivational stories. Practical material is very interesting because in science

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learning emphasizes that students get direct experience to develop their competencies (Syafaren, 2019).

#### 4. Conclusion

This study has shown about the validity of the learning instruments. Student Worksheets (LKPD) Biology based Scientific Literacy for Second Class of High School digestion system subject developed is valid (suitable for use in the learning process) and practical in use. The validity of these learning instruments was based on the assesment of validators.

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