



Portfolio assessment with dimension of learning: an approach on the mastery of concept



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ARTICLE INFO

Article history

Received January 6, 2021
Revised February 3, 2021
Accepted February 20, 2021

Keyword:

Dimension of learning
Mastery of concepts
Portfolio assessment

ABSTRACT

Portfolio assessment with the dimension of learning approach is an ideal combination to improve mastery concept and habits of mind students. The use of this assessment and approach can fully describe the students' abilities during the learning process. This study aims to determine the effect of using portfolio assessment with the dimension of learning approach on students' mastery of concepts on the excretion system material at the state senior high school in Pekanbaru City. This research is a weak experiment research with pretest posttest group design. The instrument in this study was a matter of conceptual mastery using Marzano's taxonomy. The instrument used was valid and reliable with a value of 0.56. The data were processed descriptively using the N-Gain formula and inferential statistics with one sample t test with a value of 0.31. The results of this study indicate that the students' mastery of concepts after the use of portfolio assessment with the dimension of learning approach increased for W senior high school 0.39 (sufficient); X senior high school 0.54 (sufficient); Y senior high school 0.68 (sufficient) and Z senior high school 0.39 (sufficient) with an average of 0.50 in the sufficient category. After the inferential test was carried out, it was obtained t-count (10.67) > t-table (0.00) so that it could be concluded that the use of portfolio assessment with the dimension of learning approach could significantly influence students' mastery of concepts. Referring to the findings of this study, teachers at the senior high school level, especially in the field of biology, can use portfolio assessment with the dimension of learning approach as a form of innovative assessment in the learning process.



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Introduction

The learning process involves interaction between educators and students to achieve certain goals. This process needs to be designed in such a way and implemented properly so that learning objectives can be achieved. However, it is often found that students who are in the same teaching group can reach different understandings. That is why assessment is a central process in effective teaching. Only through the assessment can we find out whether a certain sequence of learning activities has achieved the desired learning goals (Holmes, 2002; Wiliam, 2011) and prove the extent to which students' abilities and improve these abilities (Joshi et al., 2015).

The term assessment was originally used to describe the process of evaluating the effectiveness of a sequence of teaching activities when the activity is completed. Actions that guide the learning process before the end of a sequence of activities are generally not considered a type of assessment (Wiliam, 2011). Currently, assessment refers to all activities carried out by teachers and students in assessing themselves. This process can provide information that is used as feedback to modify teaching and learning activities (Black & Wiliam, 2010). Another definition of assessment was also expressed by Cowie and Bell (1999), namely the process used by teachers and students to recognize and respond to student learning that aims to improve learning. Assessment is carried out during the teaching process for the purpose of improving teaching or learning (Amua-Sekyi, 2016; Shepard, 2005) by using instruments and processes to gather evidence about student learning (Van der Kleij et al., 2015).

Starting from the various previous definitions, it seems that there are two very important features in designing assessments that will support learning. The first is evidence that is generated and can be followed up instructional (Wiliam, 2011). The evidence referred to here is more than just information about the existence of a gap between current and desired performance. Evidence should also provide information on what types of teaching activities are likely to result in improved performance. The second requirement is that students are involved in action to improve learning by reflecting

on various ways to advance their own learning (Wiliam, 2011). Educators often measure student success by only looking at the student's ability to reveal what they have learned (note learning), without paying attention to the ongoing process (Joshi et al., 2015). Although this test can identify students who are less knowledgeable, this type of test cannot identify why students are not proficient. Tests are also not closely related enough to classroom teaching and curriculum to identify what misconceptions students have or information that could help students (Trumbull & Lash, 2013).

Several research results in Indonesia show that educators make more assessments based solely on the results of tests carried out by students regardless of the process that takes place during learning (Retnawati et al., 2016; Zulfikar, 2018) and one of the causes of this phenomenon is the difficulty of teachers in designing and implementing authentic assessments (Rizavega, 2018). Other studies have shown that the types of assessment that are often used by teachers in daily teaching practice in secondary education are: (a) paper and pencil tests, (b) asking questions, (c) class conversations, (d) homework assignments, and (e) student observations (Kippers et al., 2018). Joshi et al. (2015) in their writing explained that the assessment system still focuses on the type of summative assessment carried out at the end of learning so that the process carried out during the learning period has not been paid attention.

All learning activities become more meaningful if all processes are monitored and assessed fairly. This process can provide feedback for students and teachers in improving learning. Good feedback practices are not only about providing accessible information but also facilitating students to be able to evaluate the progress of the processes they have carried out so that students can strive to improve learning. This is also related to providing good information to teachers through the assessment process carried out (Amua-Sekyi, 2016). Therefore, ideally teaching and learning activities need to be evaluated by conducting process assessments. The assessment process uses continuous assessment and is not limited to tests (Frohbeiter et al., 2011) but uses techniques that reveal how students understand certain concepts (Supovitz,

2012). Assessment of the learning process can be done using alternative assessments, one of which is portfolio assessment (Birgin & Adnan, 2007; Mhlauli & Kgosidialwa, 2016; Mogonea, 2015).

Portfolio assessment is one of class-based assessments of a systematic and organized set of student work taken during the learning process over a period of time, used by teachers and students to monitor student progress or progress in one or more areas (Paulson et al., 1991) through analyzing, synthesizing, producing, creating and interacting with other people. All evidence of student activity in portfolio assessment needs to be collected continuously according to predetermined criteria to show student effort, progress, and achievement over a certain period of time (Barton & Collins, 1997). The element of reflection is an important part of portfolio assessment because it can improve students' thinking skills and understand more deeply a subject (Paulson et al., 1991).

Portfolio assessment is very well applied in the learning process at all levels of education, from school to university level (Ling, 2016) because this assessment has several advantages such as (1) emphasizing the assessment of the process of changing student abilities, (2) enabling assessment is more complex than traditional assessments, (3) allows teachers to assess students based on the characteristics, needs and strengths of each student, (4) allows students to assess themselves (self-assessment) and (5) can describe the strengths and weaknesses students, can also monitor student progress. Mokhtaria (2015) adds that portfolio assessment also has good accountability and describes the learning process authentically.

Several studies have provided information that portfolio assessment has a significant effect on learning outcomes (Cakani et al., 2010) both in science subjects (Cakani et al., 2010; Haruna et al., 2018; Tawiland & Amin, 2013) as well as in language and arts subjects (Artini et al., 2014; Ling, 2016; Sulistyono et al., 2020). Involving students in collecting various tasks in portfolio assessments can monitor the development of each student so that in the end it improves student learning abilities (Sahu et al., 2008) including generic science skills (Ramlawati et al., 2014). In addition, portfolio assessment

also offers a deep and student-centered learning process to improve student learning outcomes (Ring & Ramirez, 2012), social and academic skills (Mhlauli & Kgosidialwa, 2016). In addition to having advantages, portfolio assessment also has disadvantages, including requiring more time than the usual teacher assessments because there is feedback on assigned assignments, causing boredom in students because the tasks they are doing must be repaired (Surapranata & Hatta, 2006), no have certain standards so they are considered less reliable and sometimes require quite high costs (Mokhtaria, 2015).

The learning process is not only determined by the assessment, but what is no less important is the approach used during the learning process. The learning approach influences the procedures and assessment approaches used (Fourie & Van Niekerk, 2001). One learning approach that can support the learning process is the dimension of learning approach. Dimension of learning was developed by Marzano (1992) with 4 stages, namely attitude and perceptions', acquiring and integrating knowledge, extending and refining knowledge, using knowledge meaningfully and habits of mind. The stages in the dimension of learning are not isolated from one another. Each stage describes a different cognitive process and all need the attention of the teacher during the teaching and learning process. According to Marzano (1992), the most important step is to change students' attitudes and perceptions of learning. If the teacher is successful in doing this, whatever learning objectives are expected to be achieved. The stages contained in the dimension of learning approach correspond to the purpose of portfolio assessment, which is to record all the processes that students go through during learning and not only on assessments that focus on recalling information. Another positive impact of the dimension of learning approach is that it affects students' mastery of concepts, thinking skills and attitudes in science subjects (Abedl & Alrababah, 2017; Javed, 2012). The research results of Abdulrab and SridharSingh (2012) show that the dimension of learning approach can improve student achievement in the field of science because this approach emphasizes active learning.

Referring to the explanation described in this section, this research aims to improve conceptual mastery among high school students in Pekanbaru City, Indonesia using a portfolio assessment with the dimension of learning approach. The research hypothesis states that using portfolio assessment with dimension of learning approach has a significant influence on students' mastery of concepts.

Method

The research design used was The One-Group Pretest-Posttest design. The application of the use of portfolio assessment is applied to four experimental class. The measurement of students' habits of mind and concept mastery was carried out through pretest and posttest. The design in this study does not have a control class because it is very difficult to find a strategy that is compatible with portfolio assessment. In addition, research with the application of portfolio assessment requires more time and effort so that the procurement of control classes will make the application of the assessment not optimal.

During the research implementation, we used a sample of 140 students. Determination of the sample using purposive sampling technique by taking into account the normality and homogeneity of the sample. These students come from four different state senior high schools with the following details; W state senior high school (37 people), X state senior high school (33 people), Y state senior high school (37 people) and Z state senior high school (33 people).

The instrument in the form of a test question in the form of an essay was used to collect data on students' mastery of concepts after implementing a portfolio assessment using the dimension of learning approach. The essay test was used as a current evaluation test in each experimental class. The concepts that are used as standards in the preparation of this essay test consist of excretory structures and organs, physiological processes, excretory organ abnormalities and the excretory system in animals. The concept of mastery of the concept was validated in a construct by evaluating experts and then tested empirically using

the ANATES V.4.0.9 program. From the validity test, it was obtained 20 valid questions with the reliability of 0.61 in the high category. After being validated, 20 questions were obtained consisting of 5 questions for the concept of structure and excretory organs, 9 questions for the concept of physiological processes, 4 questions for excretory organ disorders and 2 questions for the concept of excretory system in animals. In addition to the test instrument, a questionnaire was also used in this study to determine student responses to learning. The indicators of student responses to learning are: the benefits of written feedback and self-assessment as well as tracing student responses to the learning process scenario.

The data from the research results were processed using descriptive statistics and inferential statistics. For concept mastery data and student responses to learning are processed descriptively using the percentage formula (Sugiyono, 2015).

$$MC = \frac{As}{Ms} \times 100\% \dots\dots\dots (I)$$

Information:

- MC : Mastery of concepts
- As : Acquisition score
- Ms : Maximum score

The percentage yield categories are described as follows, namely 86 - 100% Very Good, 76 - 85% Good, 60 - 75% Pretty Good, 55 - 59% Poor and < 55% Very Poor category. The increase in students' mastery of concepts after learning was analyzed using the N-Gain formula (Hake, 1999).

$$NGain = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score} \dots\dots\dots (II)$$

The results from N-Gain were categorized based on the following ranges, namely > 0.70 (high), 0.31 - 0.70 (moderate) and < 0.30 (low). To determine the significance of this increase, the one sample t test was used with a value of 0.31 (moderate N-gain range). The test uses a formula one sample t-tests (Sunarto & Riduwan, 2013).

$$t_{count} = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}} \dots\dots\dots (III)$$

Information:

- t_{count} = The scores are computed and show the value of the standard deviation of the t distribution (Table t)
- \bar{x} = The average score obtained from the results of data collection.
- μ_0 = The hypothesized score.

s = The sample standard deviation is calculated.
 n = The number of research samples.

H₀ = using portfolio assessment with dimension of learning approach have no significant influence on students' mastery of concepts

H₁ = using portfolio assessment with dimension of learning approach have significant influence on students' mastery of concepts.

With the test criteria, reject H₀ and accept H₁ if Asymp. Sig (2-tailed) is less than 0.025 (½ α).

Results and Discussion

The learning process that takes place using portfolio assessment with the dimension of learning approach can improve students' conceptual mastery of the excretion system material. The value of students' mastery of concepts on this material varies from one school to another which is used as the research sample. Students' mastery of concepts in each school can be seen in Figure 1.

Figure 1 describes the mean score of students' masteries of concepts on the excretion system material after the application of the portfolio assessment. This can be seen from the increase in the mastery of concepts between pretest and posttest. At the time of the concept mastery pretest, students were still in the low category with a percentage of 43.08. After being given treatment using portfolio assessment through the dimension of learning approach, the students' mastery of concepts increased to 74.11 with an N-Gain of 0.55 in the moderate category (Table 1). Portfolio assessment emphasizes the development of students' views on learning providing follow-up material from

a task that has been carried out by students so that students are given the opportunity to develop their abilities and in the end this process will improve students' conceptual understanding.

Mastery of concepts is a cognitive ability and is an important aspect of measuring the success of learning, including learning science. According to Maxwell (2004) the characteristics of science learning emphasize a process approach. This approach encourages students to discover facts, build concepts, theories and scientific attitudes. The process of mastering scientific concepts can be successful if students can simplify abstract material to be easier to understand, provide interpretation and can be applied in everyday life (Baumfalk et al., 2019). Mastery of the correct concepts will be able to increase mastery of higher-order thinking such as critical thinking, creative thinking and problem solving (Cherif et al., 2016; Roy, 2016).

Increasing understanding of the concept in this study cannot be separated from the application of the dimension of learning model and portfolio assessment. Mastery of science lesson concepts can be improved with various approaches, learning strategies, learning models and methods (Baumfalk et al., 2019; Wehmeyer et al., 2012) including through the dimension of learning model. The use of the dimension of learning and portfolio assessment in learning is adjusted to the characteristics of the material and students and the applicable curriculum. This is in line with the statement of Hines et al. (2019) that in implementing the approach used in the learning process must be adjusted to the characteristics of the material/concept and students. To determine the effect of portfolios on increasing concept mastery, Table 2 can be used as a reference.

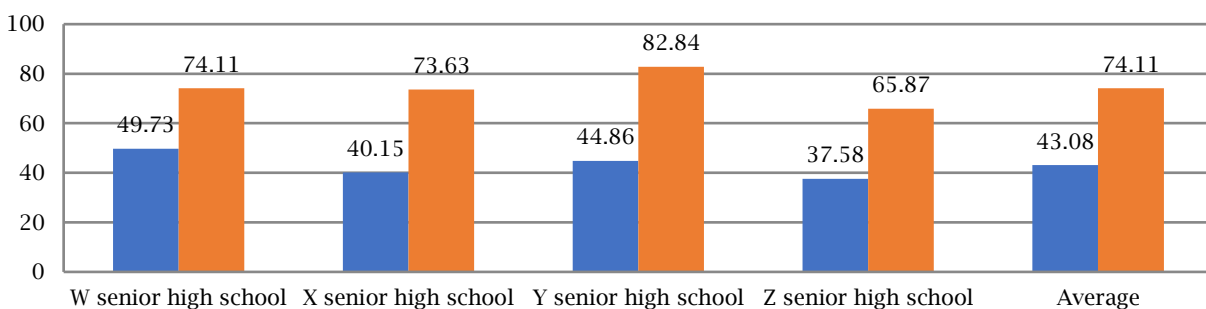


Figure 1. Student concept mastery after portfolio assessment (blue: pretest; orange: posttest)

Table 1. Result of the N-Gain test for mastery of the concept of state senior high school students in Pekanbaru city

	W Senior High School	X Senior High School	Y Senior High School	Z Senior High School	Average
Pretest	49.73	40.15	44.86	37.58	43.08
Posttest	74.11	73.63	82.84	65.87	74.11
N-Gain	0.48	0.56	0.69	0.45	0.55

Based on Table 2, it can be seen that H_1 is accepted, which means that each school using portfolio assessment with dimension of learning approach has a significant influence on students' mastery of concepts with an increase in mastery above 0.31. The dimension of learning model is used during the process of delivering the material while the portfolio assessment is used when giving assignments to students. The learning model of the dimension of learning which consists of five stages, namely attitude and perceptions, acquiring and integrating knowledge, extending and refining knowledge, using knowledge meaningfully and habits of mind (Marzano, 1992) can facilitate the learning process with dense and complicated material, one of which is excretory system material. In this model, students are invited to think independently by providing multiple stimuli until in the end it is hoped that students will have a habit of thinking (Abedl & Alrababah, 2017; Rowais, 2019). Based on observations during the study, students showed a positive attitude during learning activities. Many students responded to giving videos at the beginning of the activity. Changes in student perceptions are the key to the initial success of learning.

The use of the dimension of learning model is in line with the use of portfolio assessment. The use of portfolio assessment aims to determine the development of students' conceptual understanding skills during the learning process. Portfolio comes from two words, namely port (short for report) which means report and folio which means full or complete (Olson, 1991; Stiggins, 1994). Meanwhile, according to Rustaman (2010), portfolio comes from the word portfolio

which is often referred to as rubrics. In Stiggin (1994) it is said that the meaning of the word portfolio is; "A portfolio is a collection of student work assembled to demonstrate student achievement or improvement", in other words that a portfolio is student work that is assessed on an ongoing basis that shows student learning achievement or improvement (Ling, 2016; Popham, 2000).

Data related to student responses were obtained through giving a questionnaire containing students' opinions on the use of portfolio assessment. The components of portfolio assessment that were explored included the benefits of written feedback and self-assessment. In addition, students' responses to the learning process scenario were also explored. Based on the questionnaire analysis data, a graph can be made as shown in Figure 2.

Figure 2 shows that the overall student response to the portfolio assessment is good, this is reflected in the results of the assessment of the portfolio assessment component in the form of feedback in the good category with a score of 79.26%, self-assessment has a good effect on students' conceptual mastery with a percentage of 83.83% and the response to the learning scenario was in a good category with a score of 79.93%. In this study, the use of portfolio assessment has advantages and is in accordance with the characteristics of the excretion system material. The excretion system is one of the biological materials that students consider difficult (Doğru & Özsevgeç, 2018) because the material is dense with complex concepts and processes, is abstract and the process cannot be sensed (Saragih & Tarigan, 2016).

Table 2. Hypothesis Testing Concept Mastery of State Senior High School Students in Pekanbaru City

Senior high school	t-count	t-table	Sig value	α value	Conclusion
W	03.12	1.687	0.004		H_1 is accepted
X	06.27	1.692	0.000		H_1 is accepted
Y	11.83	1.687	0.000	0.05	H_1 is accepted
Z	03.40	1.695	0.002		H_1 is accepted
State senior	10.67	1.656	0.000		H_1 is accepted

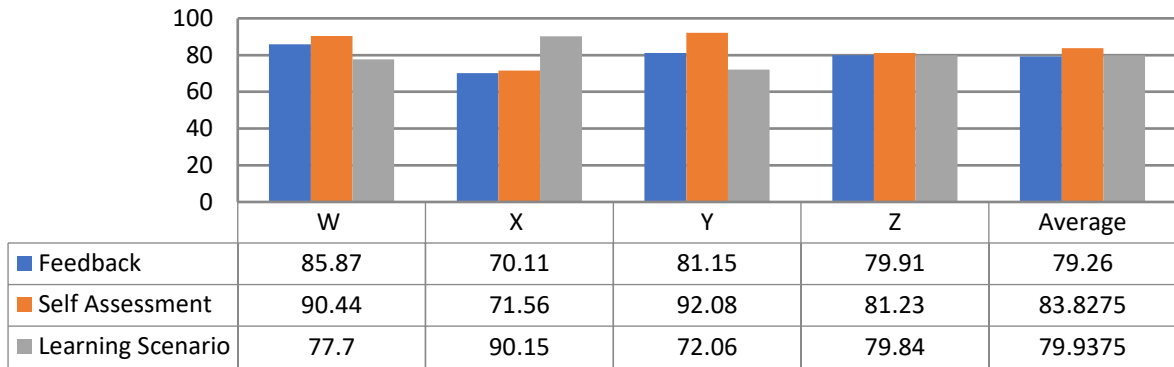


Figure 2. Result student responses to questionnaire about of use the portfolio assessment

Through portfolio assessment, students are trained in developing conceptual knowledge about the relationship between structure, organ function, and processes and disorders/diseases that can occur in the excretory system in humans. Portfolio assignments also train students to have a sense of responsibility, and instill awareness to improve their abilities (Patni et al., 2018). Portfolio assessment facilitates teachers in accessing the development of students' conceptual understanding, in addition, knowing the abilities students have will be motivated to learn so that it will instill an understanding in students. Furthermore, how much influence the assessment component has on students' mastery of concepts is informed through Figure 3.

Based on Figure 3, it is known that on average, the portfolio assessment components in the form of feedback and self-assessment have the same impact on concept mastery with a score of 59.71%. Students think that examples of feedback given to students can be seen in Figure 4.

Whereas students who think that written feedback contributes to mastery is greater than self-assessment (18.79%) than students who think that self-assessment provides a greater impact than written feedback. Some of the assignments that are used as portfolio assignments are essays and practicum reports. Students who have submitted their assignments are given the opportunity to improve their assignments after being given feedback by the teacher. Based on the research results, it shows that the value of the assignments given has a big increase after being given feedback and the opportunity to improve it. Providing feedback and opportunities to correct student mistakes in their assignments is one example of a teacher in creating a positive environment in authentic assessment (Subban & Round, 2015). From this research shows that all feedback in the form of self-assessment and written feedback either individually or collectively has a positive effect on the students' mastery of concepts.

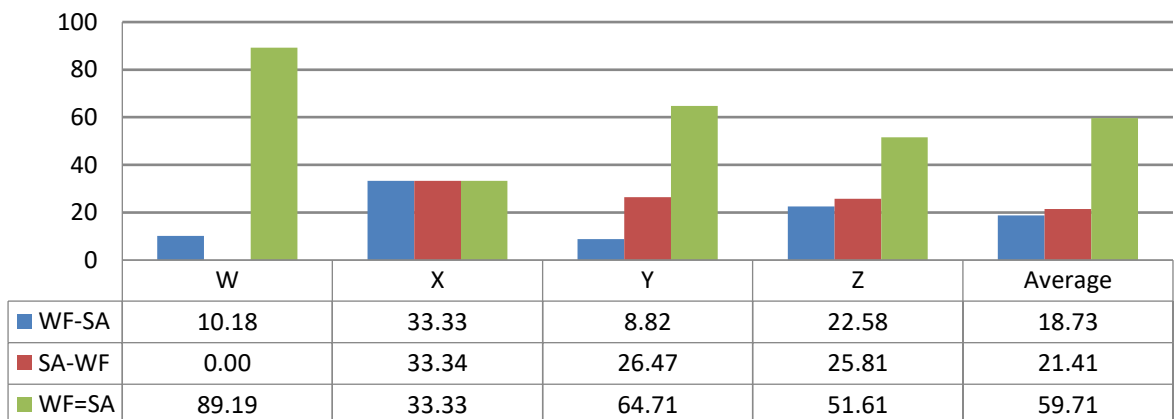


Figure 3. Assessment component that has an influence on students' mastery of concepts (WF: Writing feedback; SA: Self-assessment)

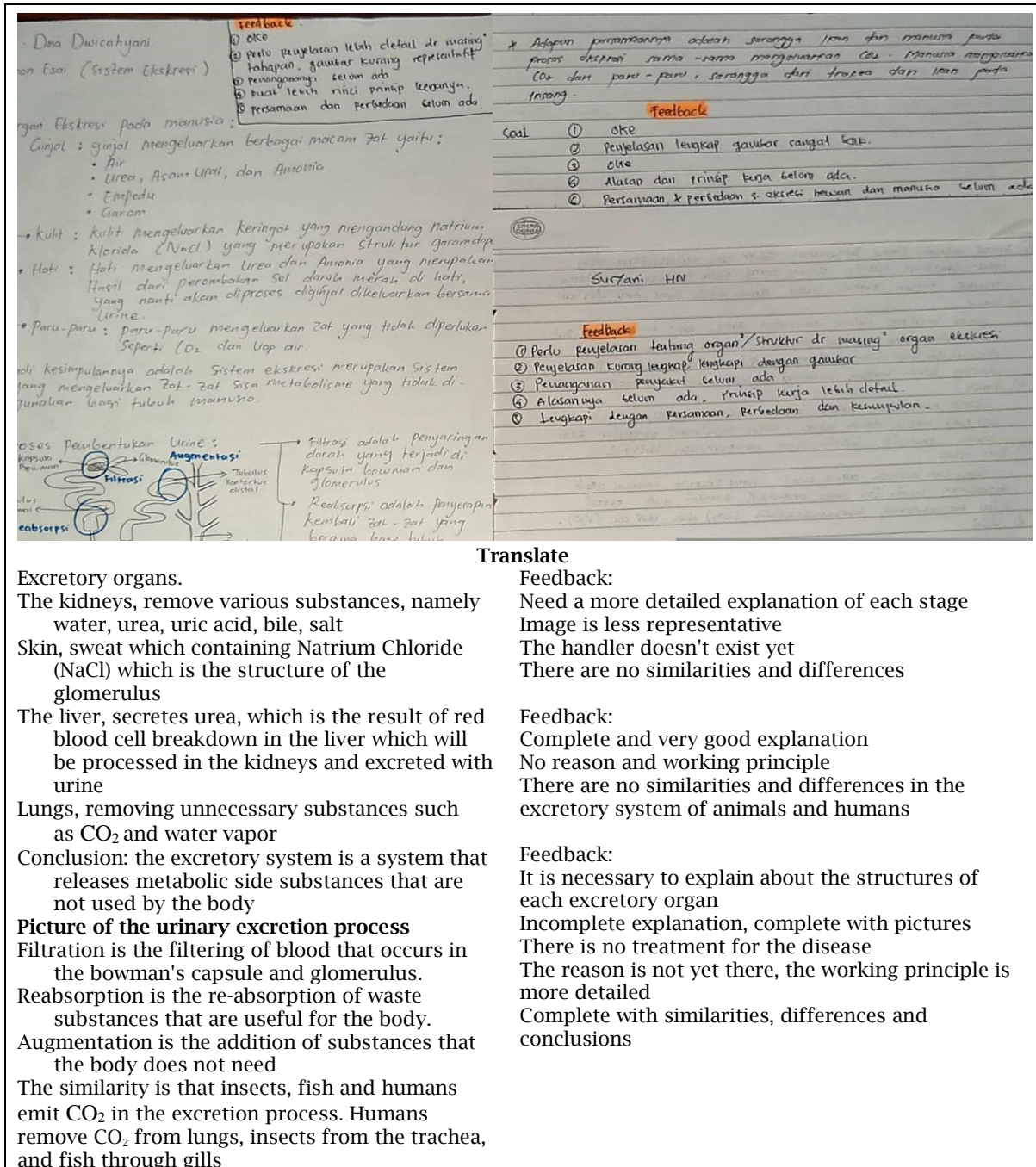


Figure 4. Example of feedback on student assignments

Student responses to the learning scenario are seen through four indicators, namely: student enjoy learning, student portfolio assessment, they are obstacles during learning and the task given are useful (Figure 5).

Based on Figure 5, it can be seen that 90.27% of students enjoyed the learning that was carried out and all students thought that the assignment given was beneficial for increasing their knowledge. The key element in learning is to create and form positive attitudes and perceptions

Translate

Feedback:
 Need a more detailed explanation of each stage
 Image is less representative
 The handler doesn't exist yet
 There are no similarities and differences

Feedback:
 Complete and very good explanation
 No reason and working principle
 There are no similarities and differences in the excretory system of animals and humans

Feedback:
 It is necessary to explain about the structures of each excretory organ
 Incomplete explanation, complete with pictures
 There is no treatment for the disease
 The reason is not yet there, the working principle is more detailed
 Complete with similarities, differences and conclusions

assignment that had been done by students would then be subject to feedback.

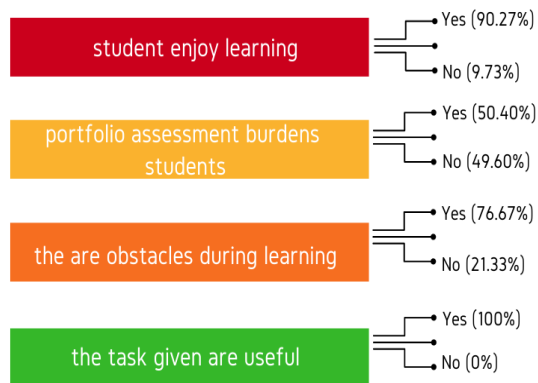


Figure 5. Student response after implementing the portfolio assessment

Based on interviews with students, giving feedback on assignments both on essays and practicum reports helps them understand the mistakes they made and can correct these mistakes and not repeat the same mistakes at a later date. The results showed that the use of portfolio assessment was able to improve learning outcomes and better attitudes. In addition, students also think that portfolio assessment makes learning more meaningful (Cakani et al., 2010). In line with that research by Gunay and Ogan-Bekiroglu (2014) explains that portfolio assessment not only provides clues to students' cognitive development but can also improve students' understanding abilities because portfolio assessment includes self-assessment, self-reflection, and feedback that facilitate student learning activities. However, the assignments given should be considered so that students are not bored and burdensome (Kılıç & Mathews-Aydinli, 2009; Tiwari & Tang, 2003).

Conclusion

Based on the research that has been done, it can be concluded that the mastery of the concepts of SMAN students in Pekanbaru City increased in the medium category with an average n-gain of 0.55. The use of the dimension of learning approach with portfolio assessment has a very significant effect on the improvement of students' mastery of concepts with an average t-count of 10.67 and an increase in concept mastery exceeding 0.31. In

addition, students also gave good responses to the use of the dimension of learning approach with portfolio assessment as evidenced by 90.27% enjoying the learning process. Further research can be carried out for deepening of research on the effects of the portfolio in other aspects besides concept mastery. In addition, other studies can use the control class to apply the traditional methods and to use the factor rotation technique.

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