



The Development of Moodle-Based Self Assessment to Measure Students' Metacognition Ability

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Abstract

This study aims to test the feasibility and analyze the characteristics of the instrument, as well as measure the metacognition ability's profile of each student and generally using a moodle-based self assessment instrument. The research model used is ADDIE. The research data were obtained through expert validation, student responses, and student answers on metacognition ability test questions and the MCA-I questionnaire. Data were analyzed using the descriptive percentage technique. The results showed that the moodle-based self-assessment instrument was declared very feasible to measure students' metacognition abilities with a percentage of 92.14%. The self-assessment developed has general and specific characteristics. The general characteristics are; 1) valid; 2) reliable; 3) have a proportional level of difficulty; 4) has good discrimination index, while the specific characteristics are: 1) based on moodle; 2) able to measure students' metacognition abilities by assessing themselves; 3) able to encourage students to use knowledge and metacognition strategies; 4) questions are contextual, clear, concise, and firm; 5) accompanied by pictures, graphs, and tables that make it easier for students; 6) the media is creative, interesting, and can motivate students; 7) objective; 8) economical and flexible; 9) practical; and 10) communicative. Based on the question test of metacognition ability, the profile of students' metacognition abilities, among others: 3 students are at level 1 with a percentage of 10.71%, 1 student is at level 2 with a percentage of 3.57%, and 8 students each at the ability level metacognition 3, 4, and 5 with a percentage of 28.57%. Based on the MCA-I Questionnaire, it was found that students generally had a well-developed metacognition profile with a percentage of 81.81%. The conclusion of this research is that self-assessment development products are found to be valid and reliable and able to measure students' metacognition ability profiles well.

How to Cite

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INTRODUCTION

Metacognition is one of the important indicators of 21st-century skills of ways of thinking (Griffin et al., 2012). According to Haryani (2012), the metacognitive ability is an ability or mental activity in the cognitive structure that is carried out by individuals to regulate, control, and examine their thinking processes.

Metacognition is used to see how cognitive activities such as remembering, learning, and problem-solving are carried out effectively (Asy'ari et al., 2018). Metacognitive ability and its implications have become an important issue in the world of education, especially in the learning process (Zohar & Dori, 2012).

The government has implemented the 2013 Curriculum which provides opportunities for students to play an active role in finding, processing, constructing, and using the knowledge that has been obtained, so that students will be better able to develop their abilities. This is reinforced by the existence of a juridical basis in the form of the formulation of graduate competency standards according to Permendikbud No. 20 of 2016 concerning Standard's Competency for Elementary and Secondary Education Graduates which require students to master the four dimensions of knowledge, including metacognitive knowledge.

A student's success in completing a task depends on awareness of what is known and how to apply it (Murti, 2012). Metacognition plays a very important role in the learning process because it must be done before, during, and after teaching (Wen, 2012). Students' metacognition abilities can be known through appropriate assessments, namely assessments that are oriented towards metacognition abilities themselves (Asy'ari et al., 2018).

The observation conducted at MTs Negeri 3 Pati, found that there was no tool to measure metacognition ability in the learning process at the school, so it was not clear whether the students' metacognition profile was known.

The results of observations also show that in several materials of science subjects are considered difficult by students, one of which is the material of heat transfer. This is because in studying heat material and its transfer, students are not only required to understand factual concepts such as understanding examples of changes in form and heat transfer and their application in everyday life. Students must also understand theoretical concepts such as the process of change of form and operation, as well as the characteristics of heat transfer in solving a problem.

The results of these observations are in line with the research by Linanti et al. (2017) stated that students tend to use the teacher as the only source of learning that affects the lack of independence of students in learning. Dewi et al. (2017) also have examined metacognition competence and science materials in junior high schools. It turns out that the teacher does not have the right knowledge about metacognition competence yet.

An assessment that can be integrated into active learning by measuring metacognitive and cognitive abilities is self-assessment (Pantiwati, 2015). The application of self-assessment refers to two dimensions. First, self-assessment can affect positive attitudes and perceptions towards learning. Second, self-assessment expands knowledge, because students do not just understand but have arrived at analysis, synthesis, evaluation, and metacognition (Pantiwati, 2017).

Furthermore, the development of assessments for 21st-century skills has the greatest challenge, namely ensuring measurable processes and results. 21st-century skills require innovative assessment models that provide measurable and valid results (Griffin et al., 2014), and apply authentic principles that accommodate student diversity and are actually in line with global dynamics (Milligan et al., 2015). The use of ICT-based assessments is very relevant in skills development efforts in the 21st century (Wulan et al., 2018).

One of the applications used to support self-assessment and peer assessment is Moodle. Moodle (Modular Object-Oriented Dynamic Learning Environment) is an open-source software used to create free online learning, collaborative interactions, and student-centered online learning environments with various learning support features (Bariah, 2017). Moodle can make it easier for teachers to develop instruments in assessments and check the results effectively (Pratama & Salirawati, 2018).

Pantiwati & Husamah's research (2017) states that there is an influence of self and peer assessment in active learning on students' metacognition awareness and cognitive abilities. Bariah (2017) stated that through due diligence, evaluation and online assignments based on e-learning with Moodle were feasible to use with very good qualifications so that it could be interpreted that online evaluation and assignments based on e-learning with Moodle were feasible to use. Based on several previous research studies, the use of moodle and self-assessment will have the potential to measure students' metacognition abilities.

The research entitled "Development of

Moodle-Based Self-Assessment to Measure Students' Metacognition Ability" needs to be carried out. The development of a moodle-based self-assessment is expected to be an alternative assessment in the learning process and an opportunity to create 21st-century skills assessments that can measure students' metacognition abilities.

METHOD

The research that has been carried out is a type of development research. The research model used is ADDIE's development research, consisting of (A) analysis, (D) design, (D) development, (I) implementation, and (E) evaluation. This research was conducted at MTs Negeri 3 Pati, which is located on Jl. Gembong Pati KM 10, Wonosekar, Gembong District, Pati Regency, Central Java in the odd and even semesters of the 2020/2021 school year. The subjects of this study were students of grade 8 E at the trial stage as many as 30 students and grade 7 B students at the implementation stage as many as 28 students.

This study's data collection methods included questions test of metacognition ability and questionnaires (expert validation, use response, self-assessment, and MCA-I). Data analysis in this study used a descriptive percentage technique. Analysis of the data in the form of (1) product feasibility by assessment experts and media experts; (2) product characteristics based on expert questionnaires and student use responses; and (3) the profile of students' metacognition abilities based on questions test and questionnaires.

RESULT AND DISCUSSION

Product Feasibility by Assessment Expert

The results of the product feasibility test by the assessment expert showed that the moodle-based self-assessment instrument to measure students' metacognition abilities was declared very feasible to use because it obtained a percentage of 92.19% of the average score for each indicator and 92.45% of the average score for every aspect of the assessment, including aspects of presentation, construction, quality of content, and utility.

Aspect of utility is said to be very feasible, because it gets the highest percentage of 97.92%. This aspect consists of two indicators, the first is objective. The objective indicators get the percentage of achievement of 100% as shown in Figure 1. with very good criteria.

Objective means to conduct an assessment based on educational standards and not influenced by the subjectivity of the assessor (Juhairiy-

ah, 2017). This is in accordance with the scoring system on the Moodle-based self-assessment instrument which is clear and has provisions on the scoring system.

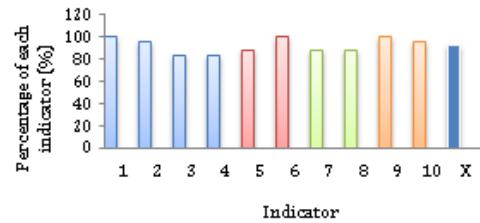


Figure 1. Feasibility's Percentage of Each Indicator by Assessment Expert

The second indicator from the aspect of utility, namely economical and flexible, obtained an achievement percentage of 95.83% with very good criteria. Self-assessment developed is based on Moodle so that all assessment work is carried out by accessing the website using a browser (web-based) and is done from home because learning during the pandemic is carried out online.

Product Feasibility by Media Expert

The results of the product feasibility test by media experts showed that the Moodle-based self-assessment instrument to measure students' metacognition abilities was declared very feasible to use because it obtained a percentage of 92.08% of the average score for each indicator and 91.42% of the average score for every aspect of the assessment, which includes aspects of presentation, content design, language, and use.

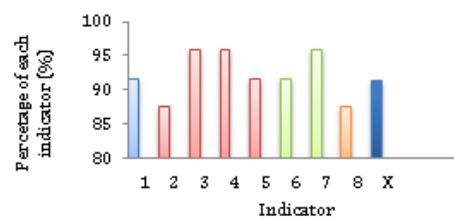


Figure 2. Feasibility's Percentage of Each Indicator by Media Expert

The linguistic aspect is said to be very feasible because it gets the highest percentage, which is 93.75%. Language is one of the things that have an important urgency to be considered in the development of assessment instruments. The usefulness of the developed instrument will be higher if the achievement of the linguistic aspect is also high. This is because the linguistic aspect can determine the ease of students' understanding in doing the assessment (Setiawan &

Sa'dijah, 2017).

The success of the linguistic aspect of the moodle-based self-assessment instrument is evidenced by the achievement of the first indicator of 91.67%. The sentences used in the assessment can facilitate students' understanding because they are in accordance with the level of knowledge possessed by students. As for the second indicator, the percentage of achievement reached 95.83% because the grammar used in the self-assessment instrument was in accordance with EBI.

General Characteristics

a. Item Content Validity

Arikunto (2013) states that a test is said to be valid if the test can measure what it wants to measure. In this study, all of thirty questions were analyzed and declared valid. This is because the value of $V_{\text{count}} \geq V_{\text{table}}$ is 0,78, and there are two questions that get a validity value of 1.00.

b. Reliability

The results of the reliability test analysis using reliability analysis with the Alpha Cronbach technique obtained an r-value of 0.73. The test instrument was declared reliable because $r_{11} \geq 0.361$. Based on the reliability value obtained, the level of interpretation of the test instrument to measure the metacognition profile of students is included in the high category.

c. Discrimination Index

The recap of the results of the discrimination index analysis shows that there are 15 questions used in the implementation phase of data collection on the profile of students' metacognition abilities. Of the 13 questions, 8 questions were in poor criteria for discrimination index (range 0.19 and below), so the questions were not used. Questions can be categorized as having poor discrimination index because they are not able to distinguish between high-ability students and low-ability students.

The questions used in this study were in very good, good, and sufficient criteria. Six questions are used in very good criteria. These six questions have a discriminatory value of 0.40 and above. Seven questions are in good criteria and the other two questions are insufficient criteria. Questions with sufficient criteria, before being used for data collection, are corrected first

d. Level of Difficulty

The questions used in this study were taken from the easy and medium levels, namely as many as 30 test questions which have been reduced to 15 questions in the implementation class to test the profile of students' metacognition abilities. Two questions with difficult categories were

not used in testing students' metacognition abilities. This is because questions that are too difficult will cause students to become desperate and not have the enthusiasm to try again, while easy questions are still used because they can inspire students with low abilities (Arikunto, 2013).

Four questions in the medium category and nine questions in the easy category are not used in the implementation class because they have low discrimination index, while the two questions with difficult categories have enough discrimination index, besides that several questions have been represented by other questions.

Specific Characteristics

The data processed in determining the specific characteristics of the moodle-based self-assessment instrument were obtained from the results of the validator's assessment through validation sheets and questionnaire responses from students.

The results of the analysis show that the Moodle-based self-assessment instrument has very good achievement characteristics. This is because of the 10 characteristics assessed, the average percentage of achievement is 85%. The following are the special characteristics of Moodle-based self-assessment to measure students' metacognition abilities:

a. Moodle-based

The result of the development of this research is a learning site in the form of a moodle-based learning assessment. The self-assessment developed can be said to be moodle-based because all assessment and analysis activities are carried out using the Moodle application (version 3.10). This assessment can be accessed via <https://bit.ly/SelfAssessmentforMetacognitive>.

The Moodle-based characteristics had very good criteria because they obtained an achievement percentage of 88.19%. Self-assessment utilizes various features of e-learning Moodle to support the implementation of the assessment, one of which is to manage metacognition test questions using the main feature of the quiz, while for MCA-I questionnaires using the questionnaire feature.

b. Able to measure students' metacognition abilities by assessing themselves

The characteristics of the moodle-based self-assessment that can measure students' metacognition abilities are categorized as very good because they get an achievement percentage of 86.81%. The achievement of this characteristic is due to the assessment developed can be used by students to honestly assess themselves through

a self-assessment questionnaire, can find out the level of students' metacognition through working on questions test of metacognition ability, and can find out their metacognition development through the MCA-I questionnaire. This is also supported by the research of Sudianto et al. (2019) which shows that learning with the Moodle is effective on students' creative thinking and self regulated learning.

The above is evidenced by the use of the overall feedback setting feature on the quiz. This feature sets different feedback for each student's results based on the range of criteria for achieving metacognition levels so that students will be able to know their metacognition level. Students can also easily see the results of working on test questions through the review feature based on each question. In addition, for the self-assessment questionnaire and the MCA-I questionnaire, students can take advantage of the view response feature on the questionnaire. The view response feature can show the response that has been given by students so that it can be used as material to assess themselves and know the development of their metacognition.

c. Able to encourage students to use metacognition's knowledge and strategies

Self-assessment not only makes students understand but has arrived at analysis, synthesis, evaluation, and metacognition by evaluating themselves continuously to produce productive habits (Pantiwati, 2015). The characteristics of the moodle-based self-assessment that can encourage students to use their knowledge and metacognition strategies have good criteria, this is supported by the results of the achievement percentage of 79.17%. These results are obtained because some students still find it difficult to understand metacognition in learning, so it will be difficult to analyze their metacognition knowledge and strategies.

The metacognition ability test instrument and questionnaire used in the self-assessment have been adjusted to the metacognition indicators at each level, in addition, the MCA-I questionnaire also consists of 27 statements related to metacognition strategies in the form of planning, evaluation, and monitoring. So, when doing the assessment, students will be encouraged to use their knowledge and metacognition strategies.

Moodle-based self-assessment is also equipped with introductory texts and learning videos related to metacognition which are placed on the homepage of the site to make it easier for students to understand the purpose of the assessment process and find out the benefits that will

be obtained.

d. The questions are contextual, clear, concise, and firm

Moodle-based self-assessment has the characteristics of the questions used are contextual, clear, concise, and firm with very good criteria. This is due to the acquisition of the percentage of achievement of 84.72%. The characteristics of contextual questions are based on the fact that practice questions generally only touch the theoretical aspects of the science being studied, resulting in students feeling that what they are learning is not relevant to their goals. Problems should be contextual to allow students to connect the content of academic lessons with the context of everyday life to find meaning (Ariani et al., 2014). In this study, the questions in the Moodle-based self-assessment are contextual, meaning that the questions use various contexts to present situations that have been experienced in real life for students. The questions used must be meaningful and useful in their daily lives.

One of the general guidelines for writing multiple-choice test items is that the subject matter and answer choices must be formulated clearly, concisely, solidly, and firmly (Kadir, 2015). In this moodle-based self-assessment, the material to be asked is clear, does not cause a different interpretation of the meaning of the question, and only contains one problem for each number. The main formulation of the question is also a statement that is needed only. Thus, the questions used in this study have been formulated in a clear, concise, and firm manner.

e. Accompanied by pictures, graphs, and tables that make it easier for students

The characteristics referred to in this study are that anything that accompanies a question must be asked clearly, legibly, and can be understood by students. This characteristic has very good criteria because the results of the achievement of its characteristics reach 83.33%. The questions in the moodle-based self-assessment developed in this study have been accompanied by pictures, graphs, and tables that are displayed clearly, legibly, and can make it easier for students. Pictures, graphs, and tables are applied to several self-assessment questions. Sibirian's research (2016) has stated that graphic media is effective in improving science learning outcomes. This is because graphic media (in the form of pictures, graphs, diagrams, charts, tables, and posters) make learning more interesting, presenting ideas more clearly, and facts will be well illustrated so that it will further increase students' absorption in understanding messages of learning.

f. The media is creative, interesting, and can motivate students

The assessment criteria for the characteristics of creative, interesting, and motivating media include 1) creative media packaging; 2) the appearance of the application is attractive, the color selection in the application is appropriate and good; 3) the position of the menu layout presented is balanced, and 4) can motivate students. The moodle-based self-assessment developed in this study is known to have met the aforementioned criteria.

The statement above is evidenced by the acquisition of an achievement percentage of 82.64% with very good criteria. Self-assessment in this study uses the Moodle application as a medium of delivery. This characteristic is supported by Moodle with its multimedia integration feature, meaning Moodle has been integrated with various types of media with supported formats. In this study, Moodle-based self-assessment was equipped with pictures and videos so that students had an interesting, comfortable, and not boring learning experience. In line with this, Herbimo (2020) stated that Moodle is very good and interactive in online learning so that it makes students motivated and not bored in learning during this pandemic. Moodle offers a fun learning atmosphere, so students are trained to cultivate curiosity, responsibility, honesty, and activeness in learning.

The colors used in the application display are bright, namely a combination of blue, white, and orange. The color of the font used is black so that it is clearly legible by the user. The main menu display is located on the left side of the application. It can be said that the Moodle application is easy to customize according to your needs and desires. This is following Sugiarta's research (2017) which states that Moodle can make teachers able to develop their learning media to be more interesting and relevant and can make it easier for students to learn independently.

g. Objective

The objective characteristics have very good criteria because they get an achievement percentage of 84.72%. The moodle-based self-assessment that has been developed has objective characteristics because the assessment has met the predetermined criteria. The criteria include 1) the scoring system on the self-assessment instrument based on a clear moodle; 2) Moodle-based self-assessment has provisions on the scoring system; 3) giving the score as it is, without being influenced by the subjective rater or other factors beyond what is available.

The objective characteristics of the Moodle-based self-assessment are supported by the question behavior and review features. The question behavior feature functions to regulate access time, randomization of questions, scoring questions, the number of opportunities for students to answer and choose answers, as well as setting feedback (Riyanto, 2018). In addition, students can immediately find out the score and level of metacognition after working on the questions for each number. Moodle-based self-assessment will provide a review of the questions that have been done through the review feature. The review of the Moodle assessment results will display the duration of the exam, the start date and time of the exam, test scores, and the scoring results of each question, feedback, as well as marking the correct and incorrect answers.

h. Economical and Flexible

Economical and flexible characteristics are the characteristics with the highest percentage of achievement and have very good criteria. This is because the percentage gain reached 88.89%. Moodle-based self-assessment has economical and flexible characteristics because the learning is carried out at the school where the research uses an online system, so students do all the assessments from home. The Moodle application used also affects the economical and flexible characteristics.

Moodle is a platform that can be downloaded and accessed for free or is open-source. This advantage makes Moodle can perform cost-effectiveness. In addition, Moodle can also be accessed anywhere and at the time the user wants (Muazizah et al., 2016). Takaendengan & Santosa's research (2018) states that Moodle can increase students' learning flexibility to optimize their learning potential through active and collaborative activities during the learning process.

i. Practical

Practicality is important for an assessment instrument. The practicality of the assessment instrument is the convenience that exists in the instrument both when preparing, using, interpreting the results, and storing them (Dimiyati & Mudjiono, 2013; Rogier, 2014). The practicality of the instrument in this study has several criteria. The moodle-based self-assessment in this development research has met the aforementioned criteria, so it can be said to have practical characteristics.

The statement above is proven from the results of the acquisition of characteristics that have very good criteria and a percentage of 86.11%. Moodle-based self-assessment is easy to manage

and easy to access. By default, Moodle provides as many as 1677 plugins to add special functions and features, including in terms of communication, administration, assessment, and so on. Thus, Moodle is easily managed by users by making the desired customization according to the access rights they have. A video tutorial on using Moodle-based self-assessment has been added to make it easier for students to access and understand the menu and application navigation.

Questions that have been done by students can be analyzed automatically using the quiz structure analysis feature. The descriptions presented include the number of students, facility index, standard deviation, randomization scores, intended weight, effective weight, discrimination index, and discriminative efficiency. Moodle will also give a red mark for questions that have weak question structure analysis. This makes the process of assessing and analyzing student results easy.

Schweighofer et al. (2019) state that the development of a quiz application that is integrated with Moodle can build interactive and random quizzes, allows students to self-assess their performance, and teachers can automatically assess student learning success. This is also in line with the research results of Gamage et al. (2019) which states that the use of statistics on moodle provides information to make decisions regarding how to improve quiz results effectively.

The moodle-based self-assessment in this study is supported for mobile device displays. Moodle compatibility has also been adjusted and supports a more responsive display. Moodle can be opened on a variety of existing devices although accessed in different browsers. This makes Moodle-based self-assessment efficient.

j. Communicative

The communicative characteristics in this study have several criteria, including 1) the sentences used are effective; 2) the sentences used are easy to understand; 3) the language used is following the students' knowledge level; 4) proper sentence structure; 5) using standard terms and per EBI rules. Moodle-based self-assessment has met the aforementioned criteria, so it can be said to have communicative characteristics. This characteristic has very good criteria because it has an achievement percentage of 85.42%.

Chung & Ackerman's (2015) research shows that moodle is considered very helpful in communicative learning, both from educators to students and students with themselves. This characteristic is also assisted by the selection of the language used. The moodle-based self-assess-

ment in this study did not use the local language but used a language that was following the Indonesian language rules. This is because language can help students achieve learning goals, such as the effectiveness of communication in learning on the character of student curiosity, creativity, and responsibility (Wulandari et al., 2013). Communicative learning assessment is made to make it easier for students to learn independently by utilizing a menu of instructions that can guide and assist users in operating Moodle.

Communicative characteristics are also used to convey messages in the form of learning materials and assessments that can make students interested and motivated by the presence of communicative media. In addition, Moodle is supported by many languages. Moodle is equipped with platform translation features into various languages (localization). This is an important factor in the credibility of the learning media.

Student Metacognition Abilities Profile
1. Student Metacognition Abilities Profile Based on Questions Test

The metacognition ability test instrument was developed through a test guided by "thinking awareness" or "thinking about thinking". The questions developed are questions that have metacognition level indicators with open-ended multiple choice questions. Students are required to be aware of the thinking process and how to solve a problem, develop thinking strategies, connect and apply understanding concepts to one another through working on this problem. Thus, students' metacognition abilities can be known when solving problems and can be measured through the answers given as solutions in solving existing problems.

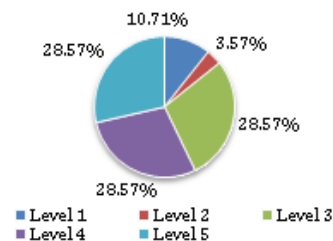


Figure 3. Percentage of Student Metacognition Profile Based on Questions

The results of the achievement of students' metacognition ability profiles through moodle-based self-assessment in Figure 3 show that students have the most metacognition abilities at level 3, level 4, and level 5, with the distribution

of each level being 8 students. The percentage of achievement of the metacognition level is 28.57%.

Metacognition ability at level 3 is the ability to reflect on evaluative procedures. Indicators representing level 3, including indicators compiling and interpreting data with an achievement of 60.71%; indicators evaluate the procedures used with the highest achievement of 72.62%. The achievement of students with level 3 metacognition abilities is due to learning activities carried out by working on questions that have been equipped with pictures, tables, and graphs. Questions are also presented clearly, concisely, and firmly.

The use of moodle-based self-assessment allows students to be able to compile and interpret data through the information presented in the questions. The activity of compiling answers is carried out after students have succeeded in understanding the data that has been provided in the questions. Students first select the important information that will be used. Pictures, tables, and graphs on the questions help students understand and direct students towards problem-solving activities by interpreting existing data.

Students who can reach the level of metacognition ability level 3, meaning that these students can overcome errors in solving problems and identify sources of error from the experiment. Research by Gholami et al. (2016), suggests that the component that can complement the development of metacognition abilities is the ability to reflect or monitor thinking.

Level 4 metacognition ability is the ability to transfer knowledge and procedural experiences in other contexts. Indicators that represent level 4, include using the same operation/procedure for other problems with an achievement of 49.38%; develop procedures for the same problem with an achievement of 42.86%; apply understanding to a situation with an achievement of 67.26%.

The moodle-based self-assessment developed is supported by contextual questions, meaning that the questions presented in this assessment can train students' abilities in connecting conceptual understanding with procedural experience. Learning that connects with the lives of students can improve understanding of concepts (Purnamasari et al., 2016). Based on students' answers, it can be seen that students who are at the level of metacognition ability level 4 have been able to transfer knowledge and procedural experiences to other contexts.

Level 5 metacognition ability is the ability to connect conceptual understanding with procedural experience. The indicator that represents

level 5 is linking the observation data with the discussion with an achievement of 57.10%.

This achievement was obtained by the students because it was associated with the observational data contained in the questions to solve a problem. The data that has been done is then presented through a discussion in the reason column. This makes students able to complete and understand the process of solving problems related to everyday life in the surrounding environment.

Level 5 is the highest in the level of metacognition. Students who can reach the level of metacognition ability level 5, meaning that students can express ideas in writing reasons for answers well. Mastery of level 5 metacognition is influenced by the background and experience of students before carrying out learning activities. Based on students' answers, it can be seen that students can analyze the type of heat transfer that occurs and the purpose of an event.

Students with level 1 and level 2 metacognition profiles generally do not take the assessment seriously and do not apply the process of thinking awareness or metacognition strategies in learning, so that in solving problems they have difficulty. Students with level 3 metacognition skills have begun to be aware of the strategies that must be done in solving problems, can understand the material well, but have not been able to solve problems with more complex analysis. Students with level 5 metacognition skills have been able to analyze and understand information very well, can allocate their time optimally, and have no difficulty in working on problems. Resti et al. (2017) in his research suggests that students with high metacognition abilities have high learning outcomes as well.

2. Student Metacognition Abilities Profile Based on MCA-I . Questionnaire

The MCA-I questionnaire was used to determine the overall metacognition ability scale of students. The metacognition scale used in this study adopts the metacognition indicators from Copper et al. (2008) with a journal entitled "Reliable Multi-Method Assessment of Metacognition Use in Chemistry Problem Solving". Metacognition indicators according to Copper et al. (2008) include 3 main components, namely (1) planning, (2) monitoring, and (3) evaluation. Planning (planning) includes the process of estimating and planning the time needed to learn, the scale of priorities, and the steps to be taken. Monitoring (monitoring) includes the process of observing, contemplating, or experiencing one's own cognitive. Meanwhile, evaluation (evaluating) is an as-

assessment of the conditions that occur throughout the work of the task (Amri & Ahmadi, 2010).



Figure 4. Percentage of Student Metacognition Profile Based on MCA-I . Questionnaire

The results of the achievement of students' metacognition ability profiles through moodle-based self-assessment based on the MCA-I questionnaire in Figure 4. show that students have well-developed metacognition abilities with a percentage of 39% and very well-developed metacognition with a percentage of 61%. Grade 7 B students have an average metacognition ability profile that is well developed with a percentage of 81.81%.

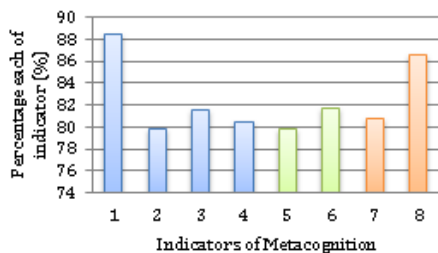


Figure 5. Proportion of Achievement of Metacognition Indicators Based on the MCA-I . Questionnaire

The higher the percentage of achievement indicates the better the metacognition indicators are owned by students as shown in Figure 5, the highest achievement is obtained by indicator 1, namely determine the goal of a problem or determine the purpose of the problem. This indicator consists of statement items 1 and 2 which are included in the planning component. The determined goal of the problem indicator got an achievement percentage of 88.40% with very good criteria. The planning component aims to make plans and determine goals in learning. Students who choose to agree and strongly agree on indicator 1, meaning that the student has been able to understand and determine the problem by reading the statement of a question carefully, students are also able to identify the problem clearly. Students will find it easier to decide the

steps that must be taken during the learning process if they have a well-structured plan. It makes students have a purpose in carrying out learning activities. In line with this, Damayanti (2015) states that strategic planning skills in learning are an indication of the development of good metacognition skills.

Indicator 5, namely self-testing or self-testing, is the indicator that obtains the lowest achievement in this study. This indicator consists of 6 statement items, namely statement items 13-18 which are included in the monitoring component and have an achievement percentage of 79.76% with good criteria. The monitoring component aims to assess the significance of the learning strategies used. Students, who choose agree and strongly agree on the self-testing indicator, meaning that the student has been able to manage/monitor learning by asking himself/herself about several things, such as 1) how do I do it?; 2) am I on the right track?; and 3) how do I proceed?.

The results of the MCA-I questionnaire analysis showed that the agreeable responses had a proportion of 50% on positive statements and 33% disagreed on negative statements. This shows that most students agree with the metacognition statement on the MCA-I questionnaire related to study habits and self-awareness in metacognition behavior.

Students with high abilities are more varied in carrying out metacognition skills activities compared to the medium and low groups. The high group carried out planning, monitoring, and evaluation activities in solving problems. While the medium and low groups only carry out planning and monitoring activities (Aliyah, 2016). In line with this study, the findings of Mawaddah et al. (2021) stated that students with high and moderate metacognition abilities tend to carry out planning, monitoring, and evaluating activities. Meanwhile, students with low metacognition abilities do not carry out planning and evaluating activities, but directly carry out monitoring.

CONCLUSION

Based on the results of the research that has been done, the following conclusions are obtained: The moodle-based self-assessment instrument was declared very feasible to measure students' metacognition abilities with a percentage of 92.14%.

Moodle-based self-assessment instrument to measure metacognition ability has several characteristics. The general characteristics are; (1) valid; (2) reliable; (3) has a proportional level of

difficulty; (4) has good discrimination index. As for the specific characteristics, namely: (1) based on moodle; (2) able to measure students' metacognition abilities by assessing themselves; (3) able to encourage students to use knowledge and metacognition strategies; (4) the questions are contextual, clear, concise, and firm; (5) accompanied by pictures, graphs, and tables that make it easier for students; (6) the media is creative, interesting, and can motivate students; (7) objective; (8) economical and flexible; (9) practical; and (10) communicative.

Profiles of students' metacognition abilities were obtained through questions on the metacognition ability test and the MCA-I questionnaire. Based on the metacognition ability test questions, the following results were obtained: there were 3 students with level 1 metacognition abilities with a percentage of 10.71%, 1 student with level 2 metacognition abilities with a percentage of 3.57%, and 8 students with level 3 metacognition abilities each, 4, and 5 with a percentage of 28.57%. Students with metacognition abilities at level 1 and level 2 have not been able to develop their thinking processes and have poor analytical skills. Students with metacognition ability level 3 have been able to develop their thinking processes and have good analytical skills. Students have metacognition abilities at levels 4 and 5, the ability to develop thinking processes and analysis is very good. In addition to the questions, the profile of students' metacognition abilities was seen through the results of the analysis of the answers to the MCA-I questionnaire. Based on the MCA-I Questionnaire, it was found that students generally had a well-developed metacognition profile with a percentage of 81.81%.

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