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Application of Formative Assessment to Measure Students' Self-Regulation in Physics Lessons

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Abstrak – In the world of education, formative assessment is critical because it is to know the growth of students when doing a lesson and get an idea regarding the way the teacher develops learning methods that occur. The purpose of the study was to determine the application of formative assessment to measure students' self-regulation. This study's data collection methods used questionnaires and test questions with data analysis techniques using qualitative descriptive. Respondents in this study amounted to 35 students of class XI IPA 4 SMA Negeri 14 Surabaya. The results showed that self-regulation or the ability to regulate oneself in students could be known and measured using the application of formative assessment. The self-assessment results on students are more striking when measured using a questionnaire. They can use seven categories of self-regulation to assess and observe their expertise, skills, competencies, and performance presented in the form of a questionnaire. Self-regulation ability that can measure is undoubtedly beneficial for the future orientation of students in motivating and controlling their learning process. In addition, with the application of formative assessment, teachers get feedback on the learning process that is being developed to monitor the progress and growth of students during the learning process.

Keywords: formative assessment; physics lesson; self-regulation

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I. INTRODUCTION

Education plays a significant role in life because education is one of the foundations for improving the quality of human resources (William, 2011; Beekman et al., 2016). In line with national development policies that emphasize the development of human resources, efforts to improve the quality of education are significant (Supardi, 2013). Along with time, learning is constantly faced

with growth, modification, and even change by the current era of globalization. Educational reform emphasizes applying principles, concepts, and everyday life through the learning process (Saptono et al., 2013). Changes and improvements in education often include curriculum arrangements, quality of teaching staff, quality of learning, more innovative educational strategies, existing facilities, and

infrastructure. With the emergence of improvements in the academic field, a nation is expected to become a quality, superior and civilized nation.

In education, student feedback is needed to measure how well these students understand the lessons that have been delivered. An assessment or evaluation is needed using the application of formative assessment. Assessment is a term that is often defined as a process that must take to obtain information (Pertwi, 2016). It is usually used to make decisions about students, curriculum, educational programs and policies, methods, or other educational instruments by an official body or agency that organizes education—a specific activity (Pertwi, 2016; Sahriani et al., 2016). Formative assessment is intended to monitor student learning progress during the learning process in specific learning programs, for example, at each completion of certain essential competencies in specific learning programs (Ismail, 2015).

Formative assessment is defined as an assessment or evaluation step that can apply during the learning process to measure student growth while studying and collect data on how teachers can improve teaching, continuing education, and culture during learning (Tanner & Allen, 2004). The application of this formative evaluation or assessment step can also support teachers to get feedback on the educational process that is being developed to monitor the progress and growth of students. Lam (2013) explains

that there are at least five aspects of success in the application of formative assessment: learning progression, self-assessment, peer assessment, descriptive feedback, and collaboration between teachers and students.

Assessments are used at all levels of education, from kindergarten, elementary, junior high, high school to higher education. Each education group has a different assessment system and a different assessment level. Higher education is the highest level of education. It should have an assessment system that is by students' abilities and evaluate the extent to which they apply their learning outcomes. It is expected to realize the goals of higher education. Assessment always plays an essential role in effective teaching through the evaluation process. After the evaluation, it is hoped that it will obtain feedback used to improve and revise teaching materials or methods (Nurlina et al., 2019). The intensity of formative assessment per subject, which is a way the provision of formative assessment is carried out through an assessment process after a specific subject matter has been taught in one or several meetings (Supardi, 2011). Formative assessment is how teachers collect and use instructional assessment information for children's individual needs. Swallowing information from a variety of sources and analyzing it according to children's individual learning needs can support where all children continue to learn and develop (Simanjuntak et al., 2019).

Formative assessments can produce helpful feedback for teachers and students (McLaughlin & Yan, 2017). One method to improve the educational process is to try a student tutoring program. Formative assessment is the right thing to use because direct assessment can connect students with the learning process (Panadero et al., 2018) and help students understand concepts. Formative assessment feedback in education wants to join these students as groups or individuals to trust education to increase focus and enthusiasm for learning. Formative assessment is carried out during the learning process, which aims to check whether the learning process can direct students to achieve learning objectives (Adawiyah & Nofisulastri, 2020). Regarding teacher training, it takes a lot of time to consider student learning success to provide feedback to students during the teaching process. Therefore, feedback is urgently needed to empower students to learn independently because formative assessment schemes can foster an evaluation of self-regulation. Formative assessment in learning has not been carried out optimally due to several problems, for example, planning and implementing formative assessments require skills, while not all teachers have received professional training to carry out formative assessment techniques (Kamar et al., 2016) or the development of formative tests require time while the workload of teachers (Rizal et al., 2020).

Formative assessment is a planned process used by teachers in managing continuous learning procedures and is used by students to regulate their learning strategies (Lukitawanti et al., 2020). Feedback can be a shortcut for students who do not understand or have difficulty understanding concepts (Andrade & Brookhart, 2016). According to Sulistyowati et al. (2017), students have difficulty studying physics because they do not receive feedback quickly after finishing working on the questions. When learning takes place, self-regulation has an indispensable role in the standards of students so that they can control themselves orient themselves towards the goals to be achieved. An essential aspect of achieving this goal is helping students take more responsibility for managing their learning by training them to become more strategic learners. Self-regulation is defined as one component closely related to formative assessment (Ismail, 2012). Self-management is a very significant part of the social cognitive theory (Fitriya & Lukmawati, 2016). According to Roth et al. (2016), self-regulation is the self-regulation of cognitive methods to learn to achieve their goals. Ormrod (2016) argued that self-regulation is students' learning style independently through their learning ambitions in improving behavior, cognition, and metacognition. So it can interpret that self-regulation is a way to support students when regulating mindsets, behavior, and

moods to meet success in students' learning process successfully.

Self-regulation plays an essential role in student learning, including that study habits and student skills grow in self-regulation (Prasetyo, 2015). Self-regulation is used to maximize students' learning techniques because, through these techniques, they can assess themselves, observe their abilities and provide learning responses (Hawe & Dixon, 2016). Students with effective self-regulation will more easily control themselves (Febrianela, 2013). Due to a lack of determination in the learning process, students are often lazy to learn (Panadero & Jonsson, 2013). On the other hand, students do not have big ambitions, find it challenging to cultivate enthusiasm for learning, and cannot even "self-regulate" when the learning process occurs (Panadero et al., 2016). A study conducted by Granberg et al. (2021) shows that formative assessment practices significantly influence students' motivational beliefs and behavior. Self-regulatory behavior also undergoes a marked change. Most students engage in teacher-initiated learning activities and are not involved in the thinking, performance, or self-reflection phases. This is also conveyed in research by Ediyanto, (2016), that the feedback generated is very good and by the needs of students in a short time by formative assessment model. Therefore, this study aims to measure students' self-regulation in physics lessons using the application of formative assessment.

Thus, students can assess themselves, observe their abilities, monitor, plan, motivate and control their learning process.

II. METHOD

The research method used in this study is a descriptive method using a qualitative approach to collect, describe and analyze the application of formative assessments to measure students' self-regulation. The following are the steps in research :

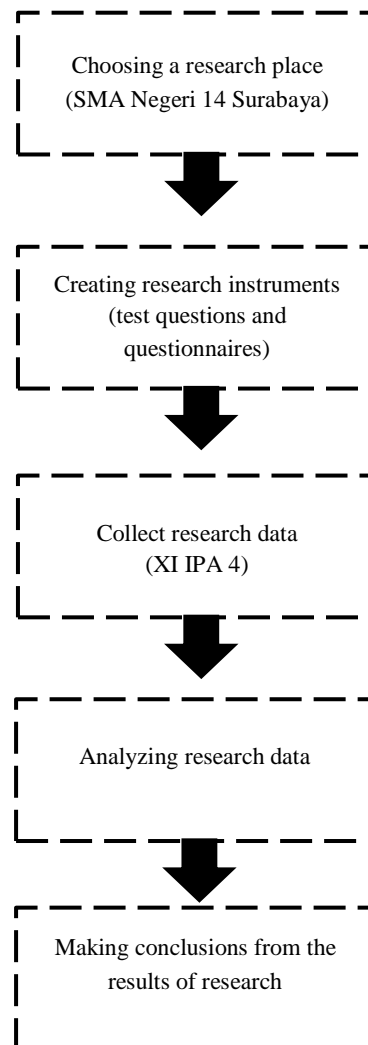


Figure 1. Steps for conducting research

Respondents in this study were 35 students of class XI IPA 4 SMA Negeri 14 Surabaya. Respondents have participated in physics learning on static fluid material taught by the tutor—data analysis techniques in questions and questionnaires. The question instrument in this study consisted of five items of inert fluid material using the level of metacognitive knowledge to determine decision making and the resulting performance. It measures self-regulation or learning control efforts that will affect the interchange of the student's actions. In addition, we added three self-regulation categories: time management, anxiety, and concentration (Haught et al., 1998). On each item to measure the level of self-regulation of students.

Table 1. Self-regulation indicators used in the test question

Category self-regulation	Indicator
Time management	Learners can manage time in working on each item that has been determined by the time
Anxiety	<ul style="list-style-type: none"> – Learners are vigilant in choosing information and detailing the quantities and units of the equation – Students are alert in solving arithmetic problems correctly
Concentration	Learners can concentrate on reading the questions presented

Table 1 above is a table of self-regulation indicators used in the question

instrument. It aims to identify and measure students' self-regulation during formative assessment. The formative evaluation can be done using the question and answer method, observation, quizzes, and tests. In carrying out formative assessments, students' self-regulating ability can be known and measured. An essential aspect of achieving this goal is helping students take more responsibility for learning, whether direct classroom learning, quizzes, observations, or tests conducted. So that students can train themselves to become more strategic learners in self-regulation.

Table 2. Categories of self-regulation in the questionnaire

Category self-regulation	Number of questions
Attitude	4
Motivation	4
Concentration	4
Anxiety	4
Time management	4
Self testing	4
Information processing	4
Total	28

Table 2 represents the seven categories of self-regulation developed by Haught et al. (1998) regarding the Learning and Study Strategies Inventory (LASSI). There are 28 points consisting of two types of statements, namely positive and negative, with each group into four questions according to each category. The seven categories in this research questionnaire include attitude,

motivation, alertness, concentration, timing, self-testing, and finding learning resources.

Table 3. Criteria for obtaining scores

Average score	Self-regulation criteria
1,00 – 1,49	Bad
1,50 – 2,49	Pretty good
2,50 – 3,49	Good
3,50 – 4,00	Very good

Table 3 above is a table of criteria for obtaining the average score, the total score from the seven self-regulation categories, including attitudes, motivation, alertness, concentration, timing, self-testing, and finding learning resources. The scoring table was adapted from [Haught et al. \(1998\)](#).

III. RESULTS AND DISCUSSION

Test questions

The instrument questions in this study consisted of five items of inert fluid material using the level of metacognitive knowledge to determine student decision making and performance. It measures self-regulation or learning control efforts that will affect the interchange of the student's actions. In addition, three self-regulation categories were added, namely timing, alertness, and concentration on each item. The three self-regulation categories are developed in indicators for each item.

Table 4. Obtaining the average score for the self-regulation category on the question instrument

Category self-regulation	Average score learners	Ability criteria of Self-regulation
Time management	3,45	Good
Anxiety	1,42	Bad
Concentration	2,48	Pretty good

Based on the results of the research in table 4 above, students tend to have good ability criteria to work on questions by the allotted time in the timing category. While in the type of vigilance, some students have a bad ability level. Students are not careful when working on arithmetic problems and are less alert in choosing important information from the questions presented. Hence, students are wrong in answering questions according to the indicators that have been given. In the concentration category, students tend to have a pretty good concentration level.

Questionnaire

Based on research conducted by [Rahmawati et al. \(2015\)](#), the formative assessment component is closely related to self-regulation, including feedback and self-assessment from the students themselves. Therefore, this study used a questionnaire developed by [Haught et al. \(1998\)](#) on the Learning and Study Strategies Inventory (LASSI). The seven categories in this research questionnaire include attitude, motivation, anxiety, concentration, time management, self-testing, and information

processing. The results of the average score for the self-regulation category in this study can be seen in Figure 2.

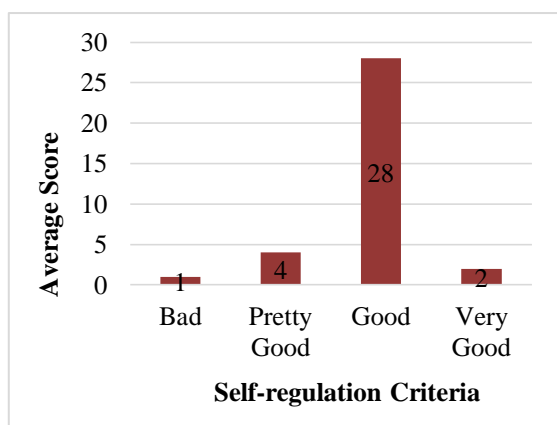


Figure 2. The results of the average score for the self-regulation category of students

Based on figure 2, it can be concluded that of the 35 students in class XI IPA 4 at SMA Negeri 14 Surabaya, there is one student who has self-regulation skills with bad criteria. Four students have pretty good self-regulation abilities, 28 students have

good self-regulation abilities, and two have very good self-regulation abilities. Of the seven categories, five students have bad criteria in attitude and anxiety, and three students have inadequate standards in the category of time management and concentration.

While in the self-regulation category in the form of motivation, self-testing, and information processing, students tend to have self-regulation abilities with reasonable criteria; some of them even belong to perfect standards. Students who have self-regulation categories with poor ability levels will find it difficult to self-regulate, so the advice is needed for students who have self-regulation abilities with these inadequate criteria. The following is a table of suggestions for students who have poor self-regulation skills in each category of self-regulation.

Tabel 5. LASSI subscales-low score suggestions offered to students

Scale	Suggestions for students who scored low on this measure
Attitude	Work on higher-level goal setting and reassess how school fits into your future
Motivation	Work on goal setting for individual tasks and assignments
Concentration	Learn techniques to enhance concentration and set priorities by focusing attention on the task at hand and eliminating interfering thoughts, emotions, feelings, and situations
Anxiety	Learn techniques for coping with anxiety and reducing worry so you can focus on the task and not on anxiety
Time management	Learn how to create a schedule and to deal with distractions, competing Management goals, and procrastination
Self testing	Learn more about the importance of self-testing and need to learn specific methods to review school material and to monitor your comprehension
Information processing	Learn methods that you can use to help add meaning and organization to Processing what you are trying to learn

Table 5 above is a table of suggestions for students who get low scores in each self-regulation category. Students can monitor, plan, and control the learning process. In addition, it can also help teachers get feedback on the educational process that is being developed to monitor the progress and growth of students during the learning process. Research has consistently found that self-regulation of cognitive and affective states can support the drive for lifelong learning by increasing motivational dispositions to learn, perfecting meta-cognitive skills, enriching reasoning, and improving performance outcomes. Based on the research results that have been done, it can be concluded that formative assessment can measure student self-regulation. Even in the application of formative assessment, it is also feasible and effective to increase the growth of student self-regulation.

The concept described by [Andrade and Brookhart \(2016\)](#) explains that formative assessment in the form of feedback can be a shortcut for students who do not understand or have difficulty understanding concepts and can help during learning so that self-regulation appears on students. Of course, the setting of each student has an indispensable contribution to student standards so that they can control themselves to direct themselves to the goals to be achieved. The research results that have been carried out are relevant to research from 2012 to 2021, which explains

that student self-regulation can be measured using formative assessment applications and can even be used to improve student self-regulation and influence students' motivational beliefs and attitudes.

According to the results of research conducted by [Granberg et al. \(2021\)](#), the practice of formative assessment is known to have a significant effect on motivational beliefs and attitudes involved in self-regulating learning. Self-regulation learning behavior also experienced a striking change ([McMillan, 2012](#)). At the start of the intervention, most students were engaged in teacher-initiated learning activities. They were not involved in the thinking, performance, or self-reflection phases of any of the four skill levels of setting. This is in accordance with research by [Ningrum et al. \(2018\)](#) that the formative assessment model is feasible and effective to be used to reveal the growth of students' self-regulation through several parts of the instrument developed in the constructive assessment model.

The results of this study are also in accordance with research conducted by [Beekman et al. \(2016\)](#). The use of formative assessment to develop self-regulation among students was believed to be effective for both intervention groups. In addition, motivation can be affected in both intervention groups. Thus, no significant differences were found between the peer-assessment intervention and the self-

assessment intervention on self-regulation, motivation, or self-efficacy. Beekman et al. (2016) explain that the practice of peer assessment increases self-assessment through self-reflection. The assessment feedback cycle as a framework for discussion: engagement tasks, peer analysis, providing feedback, receiving feedback, peer, conference, and revision.

Furthermore, a study conducted by Panadero et al. (2016) concluded that the fields of formative assessment and self-regulation learning had approached the same phenomenon, especially self-assessment, with a different lens. Rahmawati et al. (2015) show that students' self-regulation abilities can be measured and improved using formative assessment. This is also in line with several research results (Kartikawati, 2013; Panadero & Jonsson, 2013; William, 2011) that self-regulation in learning can be improved by using the application of formative assessment. Therefore, the relationship between formative assessment and self-regulatory learning is found in the statement that formative assessment facilitates students to become owners of their education.

IV. CONCLUSION

Based on the research results that have been done, it can be concluded that self-regulation or the ability to regulate oneself in

students can be known and measured using the application of formative assessments in the form of questionnaires and question instruments. However, the self-assessment results on students are more striking when measured using a questionnaire. This is because it can use seven categories to assess and observe their expertise, skills, competencies, and performance presented in a questionnaire. Self-regulation ability that can be measured is undoubtedly beneficial for the future orientation of students in motivating and controlling their learning process. In addition, the application of this formative assessment can also help teachers get feedback on the learning process that is being developed to monitor the progress and growth of students during the learning process.

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