Strategic Implementation of Assessment "for" and "as" Learning in Science Education

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Abstract

The relatively needed assessments at this time are assessment for learning and assessment as learning. This study discusses the strategy to adopt these assessments in science class. The method used is a literature study by reviewing relevant research results from books and relevant article results. The criteria for the articles discussed are related to assessment of learning, assessment for learning, and assessment as learning. The research findings provide three strategies to conduct an assessment for learning and assessment as learning that are 1) self-assessment, 2) peer-assessment, and 3) feedback. We hope that these results can provide a new perspective for teachers in making assessment schemes.

Keywords: Assessment for Learning; Assessment as Learning; Feedback; Peer-Assessment; Self-Assessment

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INTRODUCTION

Assessment is a term used to refer to the process of gathering information to make decisions. In the context of education, assessment is an important component. Assessment, in addition to being able to provide information about learning outcomes, is also able to display information about the learning process that takes place in the classroom (Harlen, 2007). This information can be used to determine the level of achievement of learning outcomes; it can also be used to improve the ongoing learning process.

The improvement of the learning process can ultimately improve the level of achievement of learning outcomes. In other words, the assessment can determine the level of achievement of learning outcomes. It can also improve the standard of achievement of learning outcomes (Black & Wiliam, 1998). Given the important role of assessment, teachers must be able to carry out assessments in classroom learning professionally.

To carry out professional assessments, teachers can use various assessment approaches. The three approaches are learning assessment, assessment for learning, and assessment as learning (Earl, 2003). The first approach is an assessment of learning. This assessment aims to produce
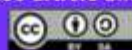
information on student learning outcomes at the end of the lesson in terms of its objectives. This information is used to determine the level of achievement of student learning outcomes. This approach is also known as a summative assessment. The subject of this assessment is the teacher. The teacher assesses with a test tool or the like for further scoring, then proceeds with ranking. This approach is ended by the teacher reporting the learning outcomes to the parents of the students.

The advantage of this assessment is that teachers and parents easily understand and understand student learning outcomes because this approach has been used for a long time in education. The final form of this assessment is generally presented in symbols that make it easier for parents to understand the information.

On the other hand, the weakness of this assessment is that the information generated is still general, not specifically explaining what knowledge students have. The assessment is carried out thoroughly when the subject matter has been completed. In other words, the assessment of learning (AoL) does not display details of student learning outcomes in each learning experience that is followed.

The first AoL has often been done and understood by many teachers or academics. However, in the second and third assessment approaches, namely AfL, assessment as learning AaL still has many misconceptions in its implementation (Triwiyono, 2017). Teachers are still confused in designing assessment processes using AfL and AaL caused of the essence of the assessment process. Therefore, in this paper, we will discuss (1) the characteristics of AfL and AaL assessments and their differences with AoL, (2) AfL and AoL assessment strategies, and (3) the design of the implementation of AfL and AaL in learning.

METHOD

This study is a qualitative study with a library study approach following the research by Habibah et al (2021). Researchers conducted a comprehensive study on implementing AoL, AFL, and AaL in learning in Indonesia. The literature reviewed includes books and relevant articles provided digitally that discuss the implementation of AfL and AaL in learning provided online. The sources analyzed are reputed journals and proceedings, including research articles, meta-analyses, and reviews.

RESULT AND DISCUSSION

One of the formative assessments is assessment for learning (AfL). The principle underlying AfL is to give hope to students and teachers to improve the quality of learning. Assessment for learning is carried out to improve the learning process (Kemendikbud, 2016). Assessment for learning is seeking and interpreting evidence for use by learners and their teachers to dedicate where the learners are in their learning, where they need to go and how best to get there (Assessment Reform Group, 2002). It means that the emphasis is on the process of obtaining information and utilizing information. Information obtained through learning and collaboration between teachers and students is then used to improve and improve the quality of subsequent learning.

Assessment for learning is a collaborative process, including the teacher and the student collaborating to structure their learning. It is founded on a foundation of shared learning objectives and success criteria. The criteria for success are presented to students and the support they will need to attain that accomplishment. If students are to know what extra has to be done to ensure future learning, they must receive feedback either during or after the work is completed. Pupils are given

opportunities to participate in self or peer evaluation to build a sense of personal responsibility in their learning. (Pearson Education, 2006). This indicates that AfL is a collaborative process that includes both teachers and students and pupils who are interconnected in their learning (Pang, 2020). It is based on common learning goals and success criteria. Learners are given the criteria for success and the support they require. If students know what to do to ensure ongoing learning, they need feedback during and after task performance. Students are offered the option of participating in self- or peer assessment because it might help them build a sense of personal responsibility in their learning (Jaafar & Lin, 2017).

The objective of assessments for learning is to provide teachers and students with the knowledge they need to make decisions that will lead to additional learning along the way during the learning process (Stigins & Chappuis, 2005). This means that in AfL, the purpose of the assessment is to provide the information needed by teachers and students during the learning process and make decisions that will result in more improvement in the learning process. From some of these opinions, assessment for learning (AfL) is an assessment during the learning process that is used to obtain information as material and reference in improving the following learning process.

As a solution for implementing AfL and AaL in learning, this study recommends using self-assessment, peer assessment, and feedback. Thus, researchers can provide solutions to improving the assessment process, namely through AfL and AaL.

Assessment As Learning
the Assessment as Learning (AaL) assessment approach has the same function as AfL, namely formative (Kemendikbud, 2016). This means that

this assessment approach has the function of improving the learning process. This AaL is also carried out during the learning process, as with AfL. However, there is a difference between the two; AaL actively involves students in self-assessment and peer assessment activities. In addition, this AaL also involves students in formulating assessment procedures, criteria, and assessment rubrics/guidelines.

AaL is a form of assessment based on the principles of constructivism learning and is most emphasized through a self-assessment process (Fletcher, A., 2016). Self-assessment in learning activities where students reflect on what they have learned and identify strengths and weaknesses in learning when making plans for progressing learning objectives. AaL can affect the motivation and interest of students because the AaL process integrates the involvement of students to contribute to learning (Fletcher, A., 2016).

From this opinion, assessment as learning (AaL) is an assessment that focuses on the role of students as critical connectors between assessment and learning, which can be developed through a process of self-assessment, peer-assessment, feedback, and self-reflection on the success criteria that have been set. . assessment as learning as an assessment approach has various characteristics that support this approach. The characteristics of AaL are presented in Table 1.

Tabel 1 Characteristic of assessment as learning

Items	Explanation
Why Assess?	to aid and encourage each student's learning monitoring and critical reflection, as well as the selection of next actions
Assess What?	Each student's approach to learning, including the strategies he or she uses to support or challenge it, as

Items	Explanation
	well as the methods he or she uses to modify and improve it.
What Methods	several tactics for eliciting learning and metacognitive processes in pupils in various ways
Ensuring Quality	a student's interest in evaluating and criticizing the correctness and consistency of his or her self-reflection, self-monitoring, and self-adjustment Students are responsible for keeping track of their progress.
Using the Information	provide clear, precise feedback to each student to help form independent learning habits. Ensure that each student is focused on the work at hand and his or her learning (not on getting the right answer). Make recommendations for modifying, rethinking, and articulating each student's learning. Establish an atmosphere conducive to a conversation between the instructor and the student about possible alternatives. Students report on their progress

From Table 1, it can be seen that there are five characteristics of assessment as learning. The five characteristics relate to objectives, goals, methods, quality assurance, and use of information.

The first characteristic relates to purpose. The purpose of AaL is to guide and provide opportunities for students to monitor and critically reflect on their learning and identify the next stage. The second characteristic relates to goals.

The goals of AaL are students' thinking about their learning, the strategies used to support or doubt their learning, the mechanisms by which they adapt, and advance their learning. The third characteristic relates to the method. The AaL method is a variety of methods in different patterns to obtain information about students' learning and metacognitive processes. The fourth characteristic relates to quality assurance. AaL quality assurance is the accuracy and consistency of self-reflection, self-monitoring and self-adjustment of students, involvement of students in considering and doubting their thinking, and students taking notes on their learning. The fifth characteristic relates to the use of information. The use of AaL information is to provide descriptive and accurate feedback to students to help develop independent study habits, to ask students to focus on assignments and their learning, to give students ideas for adapting, rethinking and articulating their learning, providing conditions for teachers and students to discuss alternatives, and for student reports on their learning.

Differences AfL and AaL with AoL
These three techniques all help students learn, but they do it differently. Table 2 summarizes the key characteristics of each strategy (Earl, 2003). The three assessment approaches have their respective places in learning. The key is to get the balance right. At its current position, almost all classroom assessments in traditional settings are summative Learning Assessments, focusing on measuring learning after the fact and used to categorize learners and report these assessments to others. Some teachers use assessment to carry out diagnostic - formative assessments and provide feedback on stages in learning.

Table 2 Important components of AoL, AfL and AaL

Approach	Purposes	Source	Judge
AoL	Ratings about placements, promotions, ratings, etc.	Apart from students	Teacher
AfL	Information for teacher instructional decisions	External standards or expectations	Teacher
AaL	Self-monitoring and correction or adjustment	Personal goals and external standards	Student

AfL and AaL Assessment Strategies

The assessment aims to determine learning outcomes. So far, the dominance of assessment is used to measure learning outcomes, even though what is more important than that is to improve the learning process. Constructivism learning theory requires students to be actively involved and have responsibility for themselves in the learning process to assess what has been done. In this section, the assessment techniques studied are self-assessment and peer-assessment. These assessment strategies are characteristic of the AfL and AaL assessments used to obtain information to improve the learning process.

AfL serves various functions in the educational system, including sharing learning aims and achievement criteria, asking and answering questions, and facilitating classroom discussion. Learning intents or success criteria can be discussed with students, such as putting on the whiteboard that students are allowed to identify an object inside a sentence by the end of each lesson (Kippers et al., 2018). Unfortunately, According to Kippers, most teachers do not share their learning aims or success criteria with their pupils, instead merely telling them what subject they would be working on during the session and why. Teachers stated that they do not feel compelled to disclose learning intents or that revealing learning objectives can intimidate pupils as reasons for not doing so. (Kippers et al., 2018).

AfL, which is based on questioning and classroom debate, appears to be more effective when used by teachers. Teachers claimed they obtain insight into students' prior knowledge and if they understand the learning subject through asking questions or having classroom discussions (Kippers et al., 2018).

In performance subjects, there is a possible type of implementation AfL (Chng & Lund, 2018). Scenario 1: The teacher observes the students' performances and provides verbal criticism of them. The teacher uses the students' performances to determine whether or not to move on to the next stage in the learning process. Scenario two: Students record the number of times they do distinctive kinds of abilities on the recording sheet. The students turn in the recording sheet after class, and the teacher compliments them for their efforts. Furthermore, Scenario 3: Students observe their peers and note their performance. Students are not permitted to view what their companions wrote on the recording sheet, so they have no idea how they performed. In this paper, we recommended that high school teachers use self-assessment, peer assessment, and feedback.

Self-Assessment

Self-assessment is an assessment technique carried out by individuals to monitor and find their strengths and weaknesses. This aligns with what was stated that self-assessment makes it possible to monitor one's learning progress (Basnet et al., 2011). In addition, self-assessment monitors one's knowledge, performance, abilities, thinking, behaviour and strategy. Self-

assessment is an activity to monitor oneself at knowledge, performance, ability, thinking, behaviour and strategy (Wilson & Wing Jan, 1998).

A learner's self-assessment is a process in which he gathers information about himself and comments on his or her progress. Reflective exercises in which students are encouraged to analyze the merits and flaws of their work are included in student self-assessment (Shatri & Zabeli, 2018). This means that self-assessment is a process where students can gather information about themselves and reflect on their learning. Self-assessment includes self-reflection activities in which students are encouraged to consider the advantages and disadvantages of what they are doing.

Self-assessment is important in formative assessment, not obtained by conventional assessment (H. M. Wong, 2017). Self-assessment encourages students to consider the quality of their work rather than depending solely on the teacher for evaluation. Assessment as learning stresses the use of assessment to develop and support students' metacognition, where students are a key link between learning and assessment. (Dann, 2014). Based on these differing viewpoints, it can be determined that self-assessment is a self-assessment approach used by individuals in the learning process to identify strengths and faults in their work.
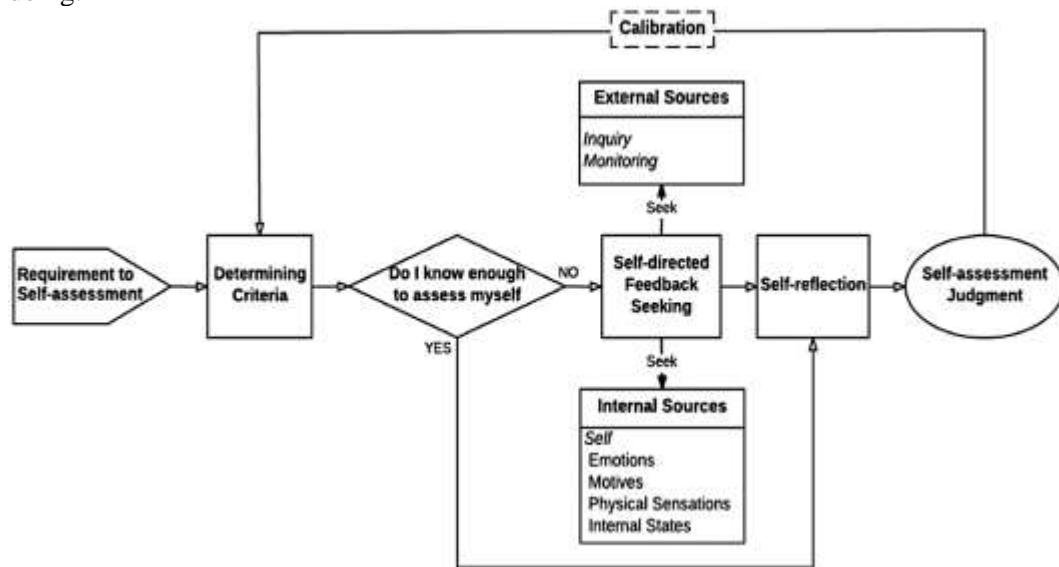

Figure 1 Self-assessment cycle by Yan (Yan & Brown, 2017)

Implementing self-assessment requires teacher guidance and may be performed comprehensively. Self-assessment and feedback are also essential skills and knowledge for pre-service and in-service teachers. More importantly, teachers' and students' perspectives, engagement, and commitment are critical components for the long-term application of self-assessment (B. Wong & Ming, 2020). Li proved that self-assessment might be added to the literature on the validity and

washback of self-assessment in the translation and interpreting classroom by elaborating on the theoretical foundation of employing self-assessment, demonstrating the methods for and instructional design of self-assessment, and adding evidence to the literature on the validity and washback of self-assessment in the translation and interpreting classroom (Li, 2018). The cyclical self-assessment process is seen in Figure 1.

Peer-Assessment

Peer assessment is an alternative assessment that concerns educational learning and educational research. Slavin expressed this in that peer assessment is one of the best and most perfect triumphs in educational history, implying that peer assessment is one of the greatest successes in educational history (Karami & Rezaei, 2015).

According to several experts, peer evaluation is a system that allows learners to examine and specify the degree, value, or quality of a product or performance of other learners of equal level (Topping. K., 2009). Peer assessment is a method for students to consider and evaluate the level, value, or quality of a product or the performance of pupils of similar standing. Peer assessment is an educational arrangement in which students evaluate a peer's performance objectively and/or qualitatively, prompting them to reflect, discuss, and contribute (Karami & Rezaei, 2015). Peer evaluation, in other words, is an educational method in which students evaluate the performance of their peers statistically and/or qualitatively to encourage self-reflection, discussion, and collaboration.

"A spectrum of acts through which individuals evaluate the work of others" is another definition of peer evaluation. A collection of individual actions used to form judgements about the work of others is characterized as peer assessment. Aspects of peer assessment consist of 6 components, namely (1) task engagement, (2) peer analysis, (3) determining feedback (feedback provision), and (4) receiving feedback (feedback reception).), (5) peer conferencing, and (6) revision(Reinholz, 2015). The six components of peer assessment can be seen in Figure 2.

Figure 2 Peer assessment cycle

The six components of the assessment are interrelated and form a cycle that can support student self-assessment. The key aspects of peer assessment are described in Table 3.

Table 3 The components of peer assessments

Components	Explanation
task engagement	Students articulate their views as part of their performance awareness. Closure of the gap: improvement during the engagement/problem-solving process.
peer analysis	The goal is to gain expertise in analyzing different cases.
Feedback provision	Explaining concepts and receiving feedback on explanations is an example of performance awareness. Closing the gap entails providing helpful feedback to enhance work rather than simply criticizing it.
Feedback reception	Performance awareness: students can see themselves through the eyes of someone else.
peer conferencing	Peer analysis, providing feedback, and receiving feedback can benefit from more opportunities to

Components	Explanation
	communicate analysis and comments.
revision	Students use analysis and feedback to enhance their work and close gaps.

Peer assessment aims to develop students' cognitive abilities because, in these activities, students get positive feedback. The main purpose of peer assessment is to provide feedback to students. Friend feedback can be confirmatory, suggestive, or corrective. Feedback can reduce errors and positively affect learning when taken seriously and positively (Topping. K., 2009). The point is that the feedback received from the results of peer assessment will have a positive effect if students accept and carry out peer assessment activities seriously.

From these various opinions, it can be concluded that peer assessment is an alternative form of assessment that involves each individual in deciding the value of the results of other students' performance, either quantitatively or qualitatively, which aims to trigger students to reflect on themselves to improve the quality of learning.

Feedback

Feedback is information given to a learner regarding their performance on a learning assignment, usually to improve their performance (Ur, 1996). This means that the teacher must give his objective view following the problem's request when giving feedback. Feedback isn't only about pointing out flaws. Students will respond positively if teachers encourage them while also allowing them to make mistakes, develop new skills, and provide suggestions for future learning (Roger, 2011). In addition, feedback is all information related to output and transformation. This feedback is needed to improve input and transformation (Arikunto, 2008). Input here is defined as students who have just entered learning. The output is the student after going through the learning process, while the transformation is the processor itself or, in this case, the learning. Feedback in learning activities is an occurrence that informs students whether or not learning activities have met their objectives. The provision of information collected from exams or other measuring tools to students to promote the accomplishment of learning outcomes is known as agreeing with feedback (Suke, 1991).

From the opinions expressed above, it can be concluded that feedback is a technique or method of returning students' work or test questions that are expected to motivate students towards improvement and improvement in student learning achievement. Feedback will be useful if the teacher and students review the answers to the test questions, whether answered correctly or incorrectly, and students are allowed to correct the wrong answers.

Giving feedback helps students know the truth of their answers, helps students correct conceptual errors and motivates students' interest in learning. Feedback tells students about their results in a test they take after completing a learning process (Slameto, 2001). Feedback will not be useful if it is not accompanied by a second or subsequent learning process that includes students' efforts to correct mistakes or fill in deficiencies by utilizing the feedback information.

In order to accomplish optimum learning objectives, this feedback is required during the learning process. Students can utilize feedback to evaluate themselves, identify mistakes made throughout the problem-solving process, identify their limitations, and build motivation and self-confidence in learning to improve their ability to master the topics covered in the curriculum.

Direct and indirect feedback are the two types of feedback available. Direct feedback is a method of correcting pupils' errors by plainly stating the correct answer. While the teacher provides indirect feedback by merely remarking on a student's incorrect answer, pupils also can address their problems (Ferris, 2002). While direct feedback is feedback when the correct form/answer is written on the student's answer sheet, and indirect feedback is given if the teacher shows the location of the error indirectly by showing the parts where there is an error but without giving the correct form/answer. (Lee, 2005).

CONCLUSION

Based on the results of the discussion, it can be concluded several things, namely: 1) Characteristics of the AfL assessment approach, namely the assessment is carried out during the learning process which is used to obtain information as material and reference in improving the following learning process. While AaL is an assessment that focuses on the role of students as critical connectors between assessment and learning, which can be developed through a process of self-assessment, peer-assessment, feedback, and self-reflection on the success criteria that have been set. 2) Strategies used in AfL and AoL include self-assessment, peer-assessment, and feedback. 3) Teachers must professionally carry out assessments in classroom learning, both AoL, AfL and AaL according to their respective portions.

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