

IMPLEMENTATION OF ASSESSMENT FOR LEARNING TO IMPROVE STUDENTS' COGNITIVE LEARNING OUTCOMES IN THE CONCEPT OF CHEMICAL BONDING

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Abstract: The purpose of this study is to describe the implementation of Assessment for Learning-based Learning, student activities, improving cognitive learning outcomes, and student responses after applying Assessment for Learning-based education. The type of research is a pre-experimental research design with one group pretest-posttest design. The research subjects were 39 high school students. The Assessment for Learning-based Learning implementation during the first, second and third meetings was very well carried out with 93.6%, 94.9%, and 98.6%, respectively. The students did suitable activities for three meetings by assessing learning principles with 94.9%, 92.9%, and 97.0%. After implementing Assessment for Learning-based Learning, the increase in student learning outcomes was as many as 92.3% of students in the high n-gain category. 7.7% of students in the medium n-gain category and 94.8% passed classical learning completeness. Student responses to Assessment for Learning-based Learning get a good response with a percentage of 89%. In conclusion, Assessment for Learning-based Learning can improve the learning outcomes of 10th grade students on the chemical bonding material.

Keywords: *Assessment for Learning, Learning Outcomes, Chemical Bonds*

INTRODUCTION

The quality of education is influenced by the quality of learning and the quality of assessment. The quality of knowledge can be determined if the teacher evaluates student learning outcomes. Review is critical to assess whether learning is effective or not [1]. As in the education and culture regulation number 23 of 2016, it is stated that in improving education, it is also necessary to improve the learning process through an assessment process to produce an evaluation of the learning program [2]. The accuracy of selecting a suitable assessment method will significantly affect the assessment results, which can be used as information for teachers to improve the quality of education [3].

Assessment in learning plays a role in measuring students' understanding during the learning process. The teacher knows what is known and what is not known to the students. Assessment in learning is divided into formative assessment and summative assessment. Formative assessment is an assessment during the learning process where students get feedback to improve their knowledge [4]. Summative assessment assesses the achievement of student learning outcomes as a determination of graduation or grade promotion [5]. The current learning assessment is still prioritizing the final assessment without considering the process assessment. The final assessment is only used during the exam at the end of the lesson so that students do not get feedback to improve their learning. In the assessment, it is not only giving a final score and making rankings, but feedback from the teacher is very influential in

improving students' learning process. Where students can use the input given by the teacher to enhance the learning process in achieving the goals to be achieved [6]

Based on observations and interviews, teachers still use summative assessments that only give scores without feedback. Constraints experienced by teachers due to limited time during the learning process and changing learning systems make it difficult for teachers to determine periodic assessments. The effects of the Covid-19 pandemic and the large number of students being taught so that teachers find it challenging to carry out the overall assessment process. Based on the problems that have been disclosed, efforts and actions are needed to improve the learning process for students. Therefore, one solution to improve student learning outcomes is assessment for learning.

Assessment for learning is an assessment during the learning process that provides feedback used to find out information about the extent to which students are in learning to determine the best steps for further learning in improving learning outcomes [7]. Assessment for learning emphasizes more on feedback in learning. This feedback can be used as a tool for students to reflect and interpret learning concepts to gain correct knowledge [8]. Assessment for learning is often equated with formative assessment, but the two assessments have differences [9]. Assessment for learning can be formative when the information used as evidence of learning can be used in learning adjustments to meet the needs of students [10]. The constructive assessment approach includes more

frequent tests, evidence of more effective learning, and Assessment for Learning. It can be assumed that Assessment for Learning is a collection of formative assessments in learning [9]. Assessment for learning is an assessment carried out in the learning process that involves finding and collecting evidence of decisions about what teachers and students need to do next to improve the quality of learning [11]. Assessment for learning can be used as an alternative assessment that schools can use to face the next learning stage [12]. Assessment for learning is an assessment to improve the quality of learning. Educators can use the assessment results as a basis for enhancing the learning process according to the needs of students.

In this study, learning activities during the learning process refer to the strategies in the Assessment for Learning according to the Team (2014), namely (1) confirming learning objectives and success criteria. (2) engineering practical class discussions and other tasks that provide evidence of student understanding (3) providing feedback that leads students to be better than before. (4) activate students as a source of teaching for other students. (5) activate students as owners of their learning [13].

There are several supporting studies in this study. Research conducted by Mansyur, (2011) states that based assessment learning for learning can increase learning effectiveness [14]. The results of this study are supported by research conducted by Ardiansyah and Diella, (2019) which states that there is a positive influence from the use of Assessment for Learning in providing feedback on students' cognitive learning outcomes [15]. Assessment for learning is one way of assessment in chemistry learning. The main principle in implementing the Assessment for Learning is to evaluate the whole from the planning process to the end of education.

The implementation of-based Assessment for Learning is used to determine when an increase in student learning outcomes in chemical bonding material can be ascertained from the results of-based Assessment for Learning learning. Student activities are used to ensure that students are active by the principles of Assessment for Learning. Based on the description above, the study focus on the analysis of implementation-based learning Assessment for Learning to improve student learning outcomes on the concept of chemical bonding.

RESEARCH METHOD

The method used in this research is pre-experimental. This study uses the One Group pre-test and post-test design, which is carried out without a comparison class. In this research design, the observations used are pre-test and post-test, which are assumed to be the effect of the

application of-based Assessment for Learning learning. The subjects of this study were 39 students of 10th grade MIPA 3 at SMA Al-Islam Krian Sidoarjo, Indonesia. The learning tools used in this study include the Syllabus, Learning Implementation Plan, Student Worksheets based on Assessment for Learning, Guiding Books.

The research instruments used include observation sheets on the implementation of Assessment for Learning-based Learning, student activity sheets, test sheets for learning outcomes, and student response questionnaires to apply-based assessment for learning. The process of collecting data in this study uses observation, giving tests to students, and giving response questionnaires.

Data analysis techniques in this study include data analysis on the implementation of-based Assessment for Learning learning, analysis of student activities, analysis of test questions, and student responses. Three observers observed the implementation analysis by the specified criteria. This implementation analysis used an observation sheet for teacher activities in carrying out learning by the learning implementation plan based on the principles of Assessment for Learning. Learning is said to be carried out well if the percentage of implementation reaches 61%. The data obtained is then calculated using the following formula:

$$\% \text{ implementation} = \frac{\sum \text{Observed score aspect}}{\sum \text{s total o score aspect}} 100\%$$

The results obtained were converted using a Likert Scale in Table 1.

Table 1. Criteria for Implementation of Assessment for Learning-based Learning

Percentase	Criteria
0% - 20%	Poor
21% - 40%	Less
41% - 60%	Moderate
61% - 80%	Good
81% - 100%	Excellent

[16]

Analysis of student activities during the learning process based on Assessment for Learning. Students' actions during learning were observed every 3 minutes for 100 minutes. Said to support the application of the principle Assessment for Learning Student activities if they have a relevant percentage of student activities reaching 61%. Find out the rate of activity time can be calculated using the formula :

$$\text{Activity time}\% = \frac{\sum \text{Apprearing activity time}}{\sum \text{Study time}} 100\%$$

Analysis of the test questions, namely the pre-test and post-test questions. Test questions are used to determine the increase in student learning

outcomes before and after implementing-based *Assessment for Learning*. Learning Outcomes have increased 61% of students who have achieved an n-gain score in the medium or high criteria. An increase in student learning outcomes can be calculated using the N-gain formula.

$$n\text{-gain \%} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

The results obtained are then converted to the criteria in Table 2.

Table 2. Criteria for n-Gain Score

<g> score	Criteria
<g> ≥ 0.7	High
0.7 > <g> ≥ 0.3	Medium
<g> < 0.3	Low

[17]

Classically it can be said to be complete if 75% of students score 75. To find out the percentage of completeness classically can be calculated using the formula.

$$\% \text{Classical Completeness} = \frac{\text{The number o students who completed}}{\text{the number o student}} 100\%$$

Student response data were obtained from response questionnaires distributed to students after the Assessment for Learning-based learning process. Student responses are said to be good if they get a percentage of 61%. The results of the student questionnaire were then analyzed using the formula:

$$\text{Percentage of student response} = \frac{\sum \text{yes answer}}{\sum \text{respondent}} 100\%$$

Furthermore, the research procedure is described in Figure 1.

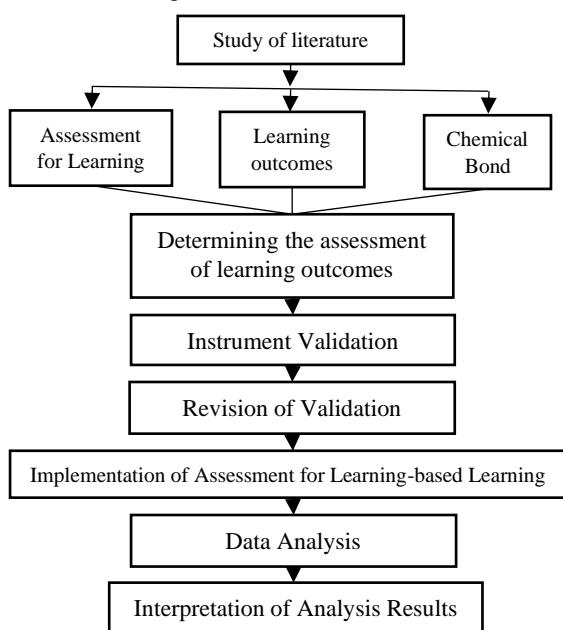


Figure 1. Research procedure

Before implementing assessment for learning, all research tools and instruments were validated. The evaluation of the validity of the research instrument was carried out by two validators, namely expert lecturers from the State University of Surabaya. The following results of the validation of learning devices and learning instruments can be seen in Table 3

Table 3. Validation Results of Learning Tools and Research Instruments

Aspect	% average	Criteria
Syllabus Learning	94.0%	Very Valid
Implementation Plan	93.3%	Very Valid
Student Worksheets	87.8%	Very Valid
Grid pretest and posttest	95.0%	Very Valid
Observation Sheet	92.5%	Very Valid

Based on Table 1, the validation of learning tools and research instruments is valid. Learning tools are applied after being revised based on input and suggestions from the validator so that research instruments and learning tools are suitable for learning.

RESULTS AND DISCUSSION

Implementation of Assessment for Learning-based Learning

The implementation of learning based on assessment for learning was carried out for three meetings. The data from the observation of the assessment performance for learning-based learning is presented in Figure 2.

Figure 2 shows that it can be seen that the average percentage from the first meeting to the third meeting implementation of assessment for learning-based learning was 93.6%, 94.9%, and 98.6%, respectively, in the outstanding category. The results of implementing Assessment for Learning-based Learning can be described as follows.

The first phase is to clarify learning objectives and to learn success criteria. In this phase, students are asked to determine learning objectives and measures for learning success, and then the teacher leads students to determine the correct learning objectives. The implementation of the first phase at the first meeting until the third meeting in a row had an average percentage of 98.1%, 98.9%, 100%. It showed an increase in the implementation of learning based on assessment for learning in the first phase. It proves that the first phase was carried out very well.

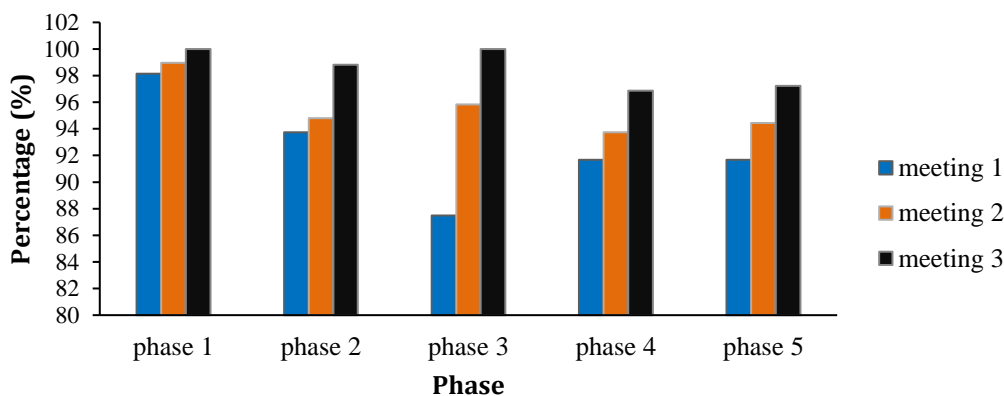


Figure 2. The percentage of the implementation of assessment for learning

The second phase is to engineer practical class discussions and provide other learning tasks evidence of student understanding. In this second phase, students are asked to discuss the solution to each question given. The results of these answers are used as evidence of how students understand the material taught. The implementation of the second phase at the first meeting to the third meeting in a row had an average percentage of 93.7%, 94.7%, and 98.8%. It shows an increase in the implementation of assessment for learning-based learning in the second phase. This proves that the second phase was carried out very well.

The third phase provides feedback that moves students towards a better direction. In this phase, it is related to the feedback given by the teacher to students. So that it can be used as an opportunity for students to improve their learning, teachers must ensure that students receive the feedback given. The results of the observation of the implementation of the third phase at the first meeting until the third meeting in a row had an average percentage of 87.5%, 95.8%, and 100%. There was an increase in the implementation of assessment for learning-based learning in the third phase of this. Proved that the third phase was carried out very well.

The fourth phase is activating students as learning resources for each other. In this phase, students are asked to submit responses, rebuttals, or questions to other students. Then the teacher will reinforce the activities carried out by students. The results of the observation of the implementation of the fourth phase at the first meeting until the third meeting in a row had an average percentage of 91.6%, 93.7%, and 96.8% of the percentage results showed there was an increase in the fourth phase this proves in the third phase done very well.

The fifth phase is activating students as owners of their learning. In this phase, the teacher guides students to understand learning strategies that are suitable for themselves through reflection activities on the learning strategies that have been used by students so far. The implementation of the fifth

phase at the first meeting until the third meeting in a row had an average percentage of 91.6%, 94.4%, and 97.2%. It showed that there was an increase in the fifth phase. It proves that the fifth phase was run very well.

The implementation of each phase in the Assessment for Learning learning was carried out well. So that it can be ascertained that the increase in student learning outcomes in chemical bonding is the result of the application of assessment for learning-based learning. Evaluation for education must be integrated with learning activities. All activities in Assessment for Learning, such as determining learning success criteria, providing feedback, seeking information, asking, responding, and reflecting, can improve learning outcomes and improve the quality of learning according to the Assessment for Learning objectives [11].

Student Activities

The activities of the students were observed to find out that the students were active by the principles of assessment for learning. The activities carried out by students were observed through the activity sheet instrument. Three observers followed the activity sheet. They were observed every three minutes for 100 minutes. Data on the results of student activities are presented in Figure 3.

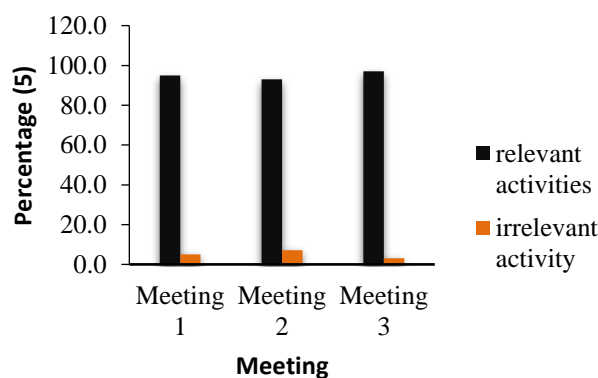


Figure 3. Percentage of observations of student activities

Figure 3 shows the activity of students during learning has increased. The relevant activities obtained from each first meeting to the third meeting in a row are 94.9%, 92.9%, 97.0%, and the effects of irrelevant activities from the first meeting to the third meeting in a row are 5.1%, 7.1%, 3.0%. The data from the observation of student activities showed that relevant activities were higher than irrelevant activities for three meetings. It can be used as evidence that students' actions during the learning process are by the principles of assessment for learning. Assessment for learning is effectively used to improve student learning outcomes [18].

Student Cognitive Learning Outcomes

This research measures students' cognitive learning outcomes on-based Assessment for Learning—data analysis to measure student learning outcomes obtained from the results of the test instrument questions. The question instruments developed in this study have different cognitive levels. Based on Bloom's taxonomy, there are six levels of mental levels, namely remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), creating (C6) [19]. The question instrument consists of 20 items in multiple-choice questions. The question instrument that has been developed in this study uses three levels of cognitive level, namely mental level C2 as many as seven questions, Cognitive Level C3 as many as three questions, Cognitive Level C4 as many as ten questions. The n-gain values for each cognitive level are presented in Table 4.

Table 4. Average n-gain values for each cognitive level

Dimensions of Cognitive Process	Pre test	Post test	n-gain	Criteria
Understand (C2)	15	33.6	0.92	High
Applying (C3)	5.3	14.1	0.91	High
Analyzing (C4)	16.5	45.9	0.89	High

Based on Table 4, it can be interpreted that each cognitive level has an n-gain value of more than 0.7 or has increased in the high category. At the mental level C2 (understanding), the n-gain value of 0.92 is obtained in the high criteria or has improved learning outcomes. This increase is because students have understood and understood the intent of the questions given so that they can search for information to find knowledge independently related to the initial ability they already have. The value of n-gain at the cognitive level C2 experienced the highest increase in achievement. Improved learning outcomes can be

influenced by providing feedback from the teacher in the form of comments to direct students to the correct answers to encourage students to enhance and improve their learning process. Students can use the feedback provided by the teacher to improve their learning so that they are more focused on the material that has been delivered [18].

Furthermore, at the cognitive level C3 (applying), the n-gain value is 0.91 in the high criteria. There is an increase in learning outcomes because students can connect their knowledge and then apply it to other concepts. The increase in learning outcomes at the C3 cognitive level occurs because students have used the knowledge in other concepts [4].

Cognitive level C4 (analyzing) obtained an n-gain value of 0.89, included in the high criteria. At the mental level C4, there is an increase in analytical ability. This increase occurs because students can solve problems and connect by applying previous knowledge so that repetition and recall of concepts will occur [22]. C4 gets a lower n-gain than other levels at the cognitive level because this level is included in high-level abilities. Students feel they do not understand a given phenomenon's problem, and they have difficulty connecting phenomena that occur with certain concepts.

The increase in student learning outcomes can be analyzed using the calculation of n-gain and classical completeness. Learning outcomes are said to increase if the n-gain value is medium and high criteria. Classically, it is said to be complete if students score >75 according to the Minimum completeness criteria (MCC) in the Al-Islam Krian Sidoarjo High School. The students' pre-test and post-test scores can be seen in Table 5.

Table 5. Pre-test and Posttest Student learning outcomes

No	Number of students	Average n-gain	Criteria
1	36	0,9	High
2	3	0,5	Medium
Overall average	39	0,9	High

Table 5 calculates the pre-test and post-test scores where 92.3% of students or 36 students are in the high n-gain category. 7.7% of students or three students are in the medium n-gain category. Based on the post-test score, 94.8% of students completed classically.

Cognitive learning outcomes can be improved after applying assessment for learning-based learning. The presence of feedback can influence improved learning outcomes. Giving feedback to

students is very important. Feedback provided by the teacher must be in the form of constructive comments [21] because remarks given by the teacher can increase students' motivation, confidence, and enthusiasm. The feedback provided by the teacher can offer the opportunity to discuss the learning experiences of students. So that students know which parts have not been achieved optimally to improve their learning. Feedback can help students evaluate students' work and improve student learning [22]. In line with research by Gerritsen-van et al. (2019) that feedback in learning will improve student learning outcomes [23]. Giving feedback is done by teachers and students to enhance the learning process better than before [24]. In addition to providing feedback, improving student learning outcomes can also be influenced by the learning styles of each student. Teachers also assist In-based Learning, Assessment for Learning students to find suitable learning strategies. An appropriate learning strategy will make it easier for students to understand better what they have learned. Students can recognize the advantages and disadvantages of the learning styles they have done so far so that students can determine good learning strategies for themselves [25].

Student Response

Analysis of student response data was obtained from the response questionnaire sheet. After implementing-based assessment learning for learning, this response questionnaire sheet is given to students. Participants' responses are said to be good if they get 61%. Based on the questionnaire results obtained, an average of 89%. So it can be said that-based Assessment for Learning learning gets a good response from students.

The results of the questionnaire show that students feel that assessment-based Learning for Learning is a new thing for them, so students are very interested in this learning. The feedback from the teacher is used as an opportunity to improve the learning process even better and make students more motivated in improving their learning outcomes. Through-based Assessment for Learning learning, students can find out the advantages and disadvantages of the learning strategies that have been used to find learning strategies that are suitable for themselves. Positive responses can also be seen during the learning process, where students are more active in class and are more diligent in studying to achieve the targets. The results of this study are in line with research conducted by Karimah and Aliyah (2020), which stated that students' response to the use of assessment for learning in learning showed a positive reaction [18].

CONCLUSION

The study results indicate that Assessment for Learning-based Learning can improve student learning outcomes. It is indicated by 92.3% of students in the high n-gain category and 7.7% of students in the medium class, and post-test completeness of 94.8% of students classically complete. During three meetings, the Assessment for Learning-based Learning had been implemented very well. Student activities during the learning process have been by the principles of Assessment for Learning, and student responses after the implementation of assessment for learning-based learning received good responses from students. This research implies that it can be used as an Assessment for the concept of chemical bonding. The results of this study serve as empirical evidence that student learning outcomes can be improved through Assessment for Learning.

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