Enhancement Student Achievement on Basic Chemistry Course Through Assessment as Learning Implementation

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Abstract. This paper described student achievement on Basic Chemistry Course through assessment as learning implementation. The research method used one shot case study. Matter of Basic Chemistry Course consist of Stoichiometry, The Periodic Table and Chemical Bonding. The first implementation in the research was assessment as learning implementation on Stoichiometry Matter, then on the Periodic Table Matter and the last on Chemical Bonding Matter. The end of each implementation, students were given assessment. Based on result of assessment, student reflected his/her achievement to enhance their learning. The material learning consist of Lesson Plan, Worksheet and Guiding Book. Instrument of research was Sheet of Student Achievement Test. Based on result of research showed 89.7% of students tended to enhance and 10.3% students tended to go down in student achievement.

Keywords: Student achievement, assessment as learning, Basic Chemistry.

1 Introduction

In assessment as learning, students personally monitor what they are learning and use the feedback from this monitoring to make adjustments, adaptations, and even major changes in what they understand [1]. In assessment as learning, students are engaged in reflecting on and monitoring their progress of learning through establishing their roles and responsibilities in relation to their learning and assessment, and use feedback from reflection and monitoring to make adaptations and adjustments to the learning objectives and strategies [2]. Assessment as learning is assessment that necessarily generates learning opportunities for students through their active engagement in seeking, interrelating, and using evidence [3].

Theoretically, the implementation of assessment as learning has the potential to improve student learning outcomes. Several researchers have proven that this theory is true. Implementation of assessment as learning in the class can improve student learning outcomes as reported by Lee & Mak [4], Davies et al. [5], Lam [6], Sudiyanto, et.al. [7], Budiyono and Mardiyana [8], and Muchlis, et.al. [9]. However, there are not many learning practices that apply assessment as learning [1], [7].

Implementation of assessment as learning has conducted by Muchlis, et.al [9] on Inorganic Chemistry III lectures at Chemistry Department of Surabaya State University, Indonesia. Therefore, we implemented assessment as learning on Basic Chemistry at Chemistry Department of Surabaya State University, Indonesia. Implementation is carried out to overcome dissatisfaction with student learning outcomes on Basic Chemistry lectures. Besides, implementation assessment as learning aims to increase evidence that assessment as learning can improve student learning outcomes.

2 Research Methods

Research subject is 29 students of Chemistry Department of Surabaya State University. These students are 2021 generation and it is taking Basic Chemistry lectures.

Research design is one shot case study. It was illustrated the diagram as follow. Students are given

Students → X_1 → O_1 → X_2 → O_2 → X_3 → O_3

Explanation:

X_1 = implement assessment as learning on Stoichiometry lecture
O_1 = learning outcomes test of Stoichiometry
X_2 = implement assessment as learning on Element Periodic System lecture
O_2 = learning outcomes test of Element Periodic System
X_3 = implement assessment as learning on Chemical Bonds lecture
O_3 = learning outcomes test of Chemical Bonds

The learning tool used are semester lecture plan, worksheets base on assessment as learning, and guiding book to helps implement assessment as learning. Instrument of research used is learning outcomes test.

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Generally, learning outcome of the Basic Chemistry Lecture is have knowledge and can apply of the Basic Chemistry include Stoichiometry, Atomic Structure & Element Periodic System, Chemical Bonds, Solutions, Colloidal System, Energetic, Reaction rate, Chemical Equilibrium, Redox & Electrochemistry, Organic Chemistry, and Green Chemistry [10]. But, in this research include only Stoichiometry, Element Periodic System, and Chemical Bonds.

Steps implementation assessment as learning which consists of 6 steps, such as 1) describing the strategies that have been used in learning; 2) describe the results of the SWOT analysis; 3) describe the target to be achieved regarding the final ability of a particular topic in the Basic Chemistry lecture; 4) describe planning for improving learning with the help of Guide Book; 5) describe the questions and answers according to the final ability in the Inorganic Chemistry III course for a particular topic as a self-assessment or peer-assessment activity; and 6) describe questions and answers related to learn activities as self-assessment or peer assessment activities [9].

Before Stoichiometry lecture, students are given worksheet of Stoichiometry based on assessment as learning. In the end of Stoichiometry lecture, students are given learning outcome test. After several days, result of the test is shared to students. Based on result of the test, students act monitoring and reflection toward their learning activities. Next given worksheet of Element Periodic System. The same way for Element Periodic System and Chemical Bonds lecture.

3 Result and Discussion

Result of learning outcomes test for Stoichiometry, Element Periodic System and Chemical Bonds respectively is shown on Table 1.

Table 1. Result of Learning Outcomes Test for Stoichiometry (1), Element Periodic System (2) and Chemical Bonds (3)

No.	Name	1	2	3
1	NAS	50	60	60
2	RPI	60	90	100
3	DDP	60	90	100
4	MANT	60	95	30
5	ANA	60	90	100
6	LWS	90	65	100
7	ADA	60	40	90
8	KRP	70	90	100
9	TG	60	40	75
10	RDS	75	70	90
11	NZI	65	85	90
12	SAAP	60	55	90
13	RAH	85	95	95
14	AFS	60	70	85
15	CDF	40	40	100
16	MHA	60	55	85
17	SNHZ	25	40	25
18	AVR	80	65	90
19	MSA	50	40	75
20	AS	60	70	85
21	KR	45	65	75
22	SNA	30	40	45
23	AMS	45	55	90
24	YSR	80	25	70
25	AFM	60	65	70
26	AAH	100	85	100
27	MFT	60	50	50
28	ANRK	50	40	65
29	FMS	60	80	85

Data of Table 1 can be described on Figure 1. Based on Figure 1, show that there are some students experiencing an increasing trend, and there are some students experiencing decreasing trend in score. An increasing trend score is score up – up, up – constant, constant – up, down – up, in three times test. Decreasing trend score is score up -- down and down – constant, in three times test. In more detail, the number of students included in an increasing and decreasing trend in score is shown on the Table 2. Totally, there are 26 students (89,7%) included in an increasing trend and 3 students (10,3%) included in decreasing trend in score.

An increasing or decreasing trend in score traceable from student activity in implementing assessment as learning. Process of assessment as learning implementation can be known based on student activity that have been written in worksheet.

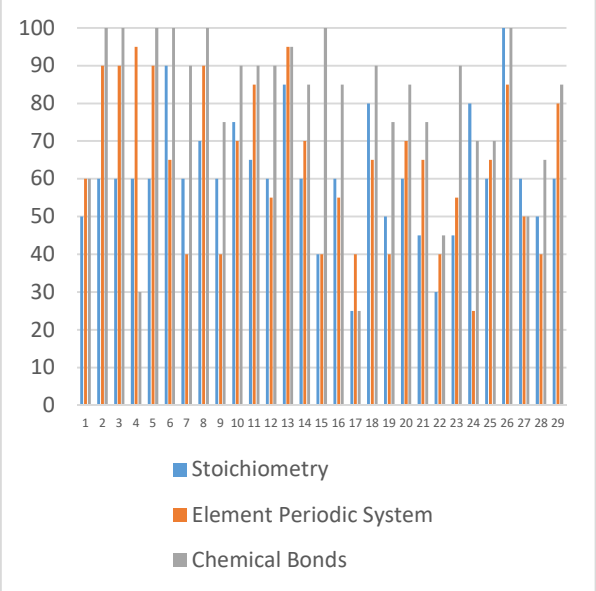

Fig 1. Result of Learning Outcomes Test for Stoichiometry, Element Periodic System and Chemical Bonds

Table 2. Student Name that included in an increasing and decreasing in score

Group	Specific Group	Student Name
An increasing in score	up - up	RPI, DDP, ANA, KRP, NZI, AFS, AS, KR, SNA, AMS, AFM, FMS.
	up – constant	NAS, RAH.
	constant - up	CDF
	down - up	LWS, ADA, TG, RDS, SAAP, MHA, AVR, MSA, YSR, AAH, ANRK.
Decreasing in score	up - down	MANT, SNHZ.
	down - constant	MFT.

Three students included in decreasing trend are MANT, SNHZ and MFT. In the step 2, describe the

results of the SWOT analysis, MANT wrote her weakness as follow:

I am a little weak in counting quickly, easy to feel lazy, do something based on feeling, and likes to procrastinate.

Therefore, related time management, in step 4, describe planning for improving learning with the help of Guide Book, MANT wrote as follow:

In the morning or afternoon, I read material before lecture, in the afternoon review material to understand better and do task, and after 07.00 pm coordinate activity of outside lecture.

After the third test, MANT realized the test result were not as expected. In the step 6, describe questions and answers related to learn activities as self-assessment or peer assessment activities, she wrote as follow:

I have done reading and memorization techniques. Time management has not been done well. I don't focus and concentrate when I understand the
meaning of question, so my answer is less complete than the question command.

In the second and third test, MFT is down-constant. In the step 2, describe the results of the SWOT analysis, MFT wrote her weakness as follow:

I am weak in counting, easily sleepy when studying, difficulty concentrating when studying, difficult to communicate with other people, and not confident.

Therefore, in step 4, describe planning for improving learning with the help of Guide Book, MFT wrote as follow:

What I want to do to improve my learning ability is focus in the presentation of lecture material. Study harder, and ask a lot of questions about what I don't know.

After the second and third test, MFT realized the test result were not as expected. In the step 6, describe questions and answers related to learn activities as self assessment or peer assessment activities, she wrote as follow:

Result of the second and third test are up-constant because I don't concentrate while studying and lack of preparation when there is test.

Based on their activity, they have done steps of assessment as learning well. Although their learning outcomes decline, they become rich in learning experiences. Implementation of assessment as learning become, they are able to understand that learning has been done so far, understand the strengths and weaknesses in their learning. This is in line with the Davies et.al. report that the students were quality involved in learning and discovery and enhance their assessment practices [11].

Gong and Tan report the role of assessment as learning in the course as follow:

assessment as learning played an important role in this course design. We attribute the improvement to the skills and abilities acquired during the five process writing activities, especially the peer review where they mutually engaged with each other in a coordinated effort to raise questions and solve problems together [12].

The report of Gong and Tan is the same as the result of our study. As many as 89.7% of student in an increasing score group. One of those students is LWS. She is a student of down-up in second and third test. At the second implementation of assessment as learning, material lecture of Element Periodic System, she wrote her activity on her worksheet. In the step 2, describe the results of the SWOT analysis, LWS wrote her weakness as follow:

I am weak in memorization, easily sleepy when studying, difficulty concentrating when studying, and less thorough in doing assignments.

Therefore, in step 4, describe planning for improving learning with the help of Guide Book, LWS wrote as follow:

The plan that I prepared to take part in material lecture of Element Periodic System is that I will use critical or detailed reading techniques, make notes from the material that has been given by the lecturer, and I discussed with the study groups that had been created. For important material, I will mark the module that has been given. For the memorization technique, I will use the technique of stringing the words you want to memorize, as well as the acrostic technique. In studying, I prefer to study at night because it will be easier to absorb the material, and every day taking time to study.

After the third test, LWS realized the test result were not as expected. In the step 6, describe questions and answers related to learn activities as self-assessment or peer assessment activities, she wrote as follow:

The planning that I haven't done is I haven't studied regularly every night because I haven't been able to divide my time. Result of the test was not as expected, caused when I did the practice questions, I wasn't careful enough, where for question number 3, I wrote the atomic number wrong, which should have been 19, but I wrote 13, so number 3 was wrong for me.

Result of her learning reflection is a good provision for LWS to improve the next learning. Therefore, at the implementation assessment as learning on Chemical Bonds material, in step 4, describe planning for improving learning with the help of Guide Book, LWS wrote as follow:

I prefer to study at night and on weekends because it will be easier to absorb the material, every day take the time to study when all assignments have been completed. Make material notes regularly so that no material is left behind, do the assignments given by the lecturer on time. After understanding the material I will try to summarize the material into a mind map.

Learning experience in implementation assessment as learning on Element Periodic System material, LWS improves it's learning. She studied on weekends, every day take the time to study, and summarize the material into a mind map. Impact of improvement her learning is the third test score LWS higher than the second test score. According to Rowi that assessment as learning guide and provide opportunities for individual student to monitor and critically reflect on their learning and identify next learning [13].

The other student in an increasing score group is RPI. At the second and third test, RPI included up–up. At the second implementation of assessment as learning, material lecture of Element Periodic System, she wrote her activity on her worksheet. In the step 2, describe the

results of the SWOT analysis, RPI wrote her weakness as follow:

I am weak in memorization, easy sleepy if studying, lack of self-confidence, difficulty to mix with new people, easy to panic, and get bored easily.

Therefore, in step 4, describe planning for improving learning with the help of Guide Book, RPI wrote as follow:

I use memorizing technique by remembering one or two keywords from statement and then combining keywords, and reset my time management.

After the second test, RPI realized the test result was as expected. In the step 6, describe questions and answers related to learn activities as self-assessment or peer assessment activities, she wrote as follow:

All my plans went smoothly and the result were in line with my expectation increasing. There are obstacles in realizing my plan that have made namely gets bored easily, so I will be lazy to continue my activities.

The test score range is 0-100. In the second test, RPI get 90. RPI continues to improve her learning. Based on reflection of assessment as learning at Element Periodic System material, so in implementation of assessment as learning in Chemical Bonds in step 4, describe planning for improving learning with the help of Guide Book, RPI wrote as follow:

In memorizing, I use technique like before. In time management, I added break schedule in the afternoon or evening. I will increase my enthusiasm for learning more effective, namely find to new way such as study in quiet place and listen to music.

At the third test, RPI get score 100. Earl and Katz suggest that when students are active, engaged, and critical assessors, they make sense of information, relate it to prior knowledge, and use it for new learning [14].

Result of this research strengthens the theories that assessment as learning is an assessment approach that believes that active involvement student in their learning, monitoring and reflecting on learning will be able to enhancement learning outcomes. Result of this research also strengthens previous research that assessment as learning can enhance learning outcomes.

4 Conclusion

Based on finding and discussion on above text, can be known that there are 89,7% students in an increasing score group and 10,3% students in decreasing score group. Therefore, can be concluded that implementation of assessment as learning can enhance the learning outcomes.

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