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EFFECT OF FEEDBACK IN FORMATIVE ASSESSMENT IN THE STUDENT LEARNING ACTIVITIES ON CHEMICAL COURSE TO THE FORMATION OF HABITS OF MIND

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ABSTRACT

The aim of this study was to find the impact of feedback in formative assessment in the learning process activity and students learning outcomes on learning chemistry. The method used on this study was quasi experiment research with non-equivalent control group design. The result showed that the application of feedback in formative assessment has a positive impact toward students learning process activity. Students become more enthusiastic, motivated, and more active on the learning process. Thus in this study can be conclude that feedback in formative assessment have a positive impact toward the learning process activity to form a habits of mind.

Keywords: Feedback; FormativeAssessment; Learning process activity

INTRODUCTION

Formative assessmentis believed to increase the activity of the process and learning outcomes of students. An analysis toward 580 articles from more than 160 journals in the 9-year period concluded that formative assessment has a positive impact on student learning outcomes and student motivation (Yin, et al., 2008). Formative assessment can also support the expectation that all students can engage in high level learning and trigger those who have low performance and capabilities to invest in the further learning (Mehmood et al., 2012). Rustaman, Saptono and Widodo (2013) also revealed that the application of formative assessment helps teachers to get feedback to the developed learning process, so that students' academic improvement can be monitored.

Researchesrelated to the feedback on formative assessments have been carried out and published in various journals, both international and national (Aydeniz and Pabuccu, 2011; Lawrie et al, 2013; Doan, 2013; Ryan and Hemmes, 2005; Purnomo, 2013; Sunandar 2008). Those studies shows that feedbacks in formative assessment in general can encourage student learning, motivate the students to be more interested in the topic, improve the process and outcomes of the learning and lead to optimism, confidence and appreciation of students.

Overall objective of this study aims to reveal the effect of feedback in the formative assessment to thestudents' processand outcomes of the learning towards the formation of habits of mind in chemistry especially in solubility and solubility product and colloids. This paper will reveal the effect of feedback on formative assessment to the students' learning process of chemistry in solubility and solubility product. While the effect of feedback in the formative assessment to the learning outcomes and students' habits of mind will be presented in other papers.

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METHOD

The method in this study is a quasi-experiment with pretest-posttest control group design. The pretest was given to students to determine students' prior knowledge before the application of the formative assessment feedback to students' learning process for the experimental group and the implementation of formative assessment without feedback to the control group. The application of the formative assessment feedback was conducted by applying the formative tests in the form of quizzes and homework. Verbal and written feedback is given on student quiz results. The control class was only given quizzes without any feedback and homework during the learning process. The results of the quizzes in control class wererevealed to the student by the end of the last meeting. After participating in the learning process regarding the subject matter of the solubility and solubility product, students were given posttest to determine the improvement of students' achievement. From those data the, the effect of the application of the formative assessment feedback on the process andthe outcomes of learning can be concluded. Subjects in this study were students of class XI IPA at SMAN 2 Sukabumi with samples of classes with 32 students in bothexperimental and control class. The research instruments used was written test, interview, questionnaire, and observation sheet.

RESULT AND DISCUSSION

Results of research on improving student learning process are mainly divided into two parts, the description of the results of quizzes per meeting and a description of the student's learning process through the formative feedback in learning. During the learning process atend of both classes, teacher gave quizzes related to the material. For the experimental class, quiz results were returned at the next meeting in the written form containing comments and corrections. The correction given to the students was related to the errors at each question and motivating comments regarded with the quiz results. After that, at the beginning of the next meeting, before the learning began, students wouldreceive verbal feedback from teachers to provide reinforcement and improvement to the students about theprevious materials that they had not fully mastered or to straighten the occured misconceptions. Meanwhile,students in the control classwere also given a quiz at the end of each lesson, but theydid not get the feedback on their quiz results. Quiz results were given cumulatively at the meeting of last sub-material. In other words, the control class was given a traditional formative assessment and the experimental class received formativefeedback. Results of quizzesof every meeting in both calsses are presented in Figure 1.

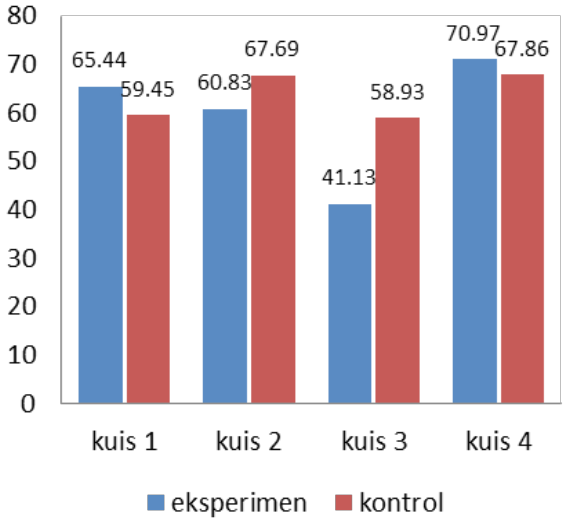

Figure 1. Results of Quizzes of both Experiment Class and Control Class

From Figure 1 we can see the results of the quizzeson both classes. From the table we can identify that the experimental class' average quiz score at the second meeting was lower from the first meeting of 65.44 into 60.83. The average quiz score still declined in the third quiz and finally it raised in the fourth quiz. The average score is 41.13 on the third quiz, and on the fourth quiz they achieved an average score of 70.97. In the control class, the average score was 59.45 at the first meeting, 67.69 at the second meeting, 58.93 of the third meeting and they scored 67.86 at the fourth meeting. Based on these data it can be seen that the average score of the experimental class were not always higher than the control class. At the first quiz, the average score of the experimental class is higher than the control class. Then on the second and third quiz, the control class obtained better average scores than the experimental group. Later in the fourth quiz, the experimental class got higher average score than the control group.

The results of the quiz at each meeting proved that both students in the experimental class and control class experienced difficulties and lack of understanding of some concepts implied in the quiz. Therewere some questions that were able to be answered correctlyby the same amount of students of experimental class and control class. The following is the percentage of quiz results of each

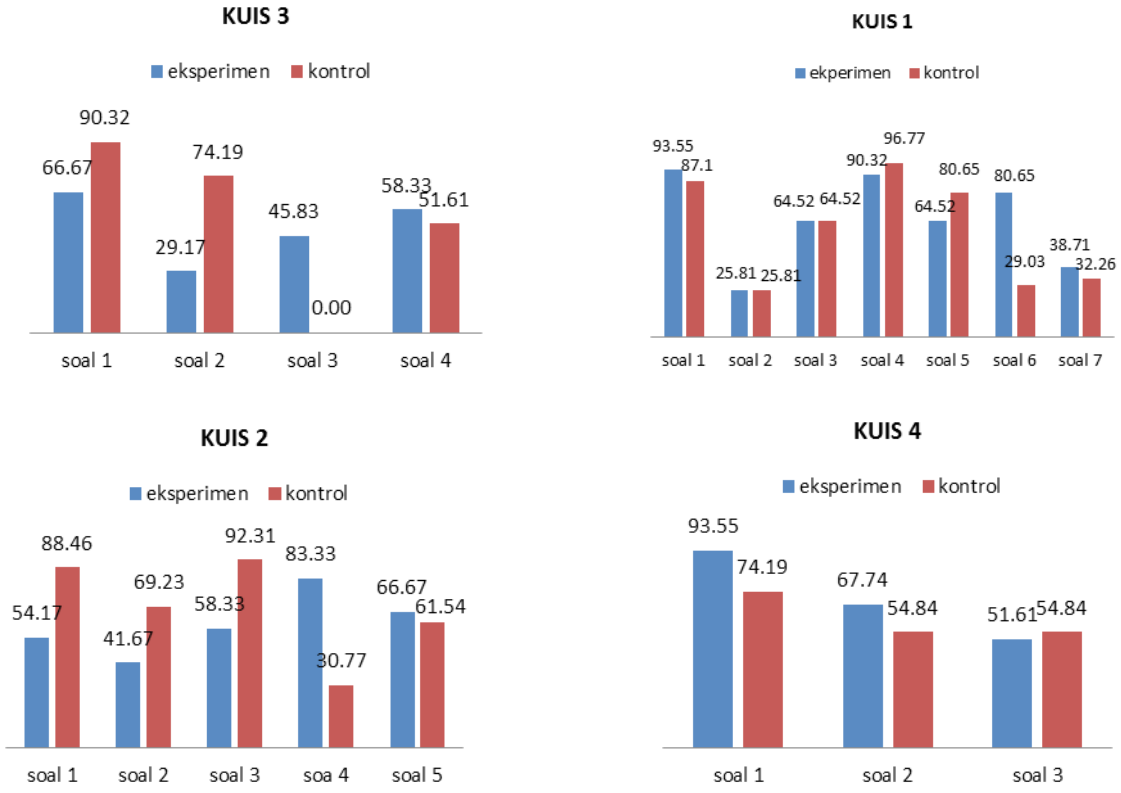

Figure 2. Percentage of Quiz Results of Experimental Class and Control Class

meeting in both control and experimental classes.

From Figure 2 it can be seen that the percentage of students who answered correctly in both experimental class and control class in each quiz question. At the first quiz we can conclude that students in both experimental class and control class experiencedsimilar difficulties in each question. The questionnumber 6 is the only question when experimental class students got better score than the control class students.

In the second quiz, the percentage of students of control group answered correctly was higher than the experimental class. It meant that the difficulties experienced by the experimental class in second quiz is greater than the control class. Similarly, in the third quiz control class result is superior to the experimental class in conceptuall question number 1 and 2, but experimental class got a better score in applicative question number 3 and 4. Later on the fourth quiz, the percentage of students answering correctly on the experimental class was higher than the control class. Based on the data, we can conclude that in both experimental and control classes had same difficulties in understanding the solubility and solubility product.

Description data of the student's learning process during the implementation of formative feedback was through the observation during the learning process. Observations were carried out related with students'activities during the learning process. Student activieswere observed using observation sheet and recording during the learning process.

At the beginning of the meeting teachers providedthe information about the steps in learning the solubility and solubility results. The teacher informed the students about the quiz in the final 10 minutesrelated to the material being discussed. Students whogave wrong answers would be given homeworks, but for those who answered correctly did not need to do the homework. The teacher also explained to the students that the homework was given solely to repair and reinforce the concept that had not been fully mastered during the learning process.

Based on the observation of student activity from the first meeting to the last meeting in the experimental group, there wasvarious student behaviorsrequired further study. In each meeting almost all the students listened to the teacher's explanation well. Some students even took notesof the important information. This was possibly because students were motivated to achieve the best quiz results that would affect the learning process in the classroom. In addition, based on the inter-

views conducted to some students in the experimental class, they claimed that the quiz done in the end oflearning made them more eager to follow the teaching and learning process in the hope that they could better understand the concepts and were ultimately able to complete the quiz problems correctly.

At the first meeting,teacher started teaching solubility and solubility product with a demonstration of salt solubility in water. During the demonstration, question and answer session took place. That probing process was as follows :

Teacher: "Ihave put salt into the water in a beaker, what will happen?"
Student: "soluble"
Teacher: "Then I add more salt, what will happen next?"
Student: "still soluble"
Teacher: "when more salt added, Whatwill happen?"
Student: "insoluble"
Teacher: "all are insoluble"
Teacher: "Do you know why salt cannot dissolve anymore?"
Student 1: "because the solution is too saturated to receive more particles"
Teacher: "nice, what is saturated solution?"
Student 1: "tolerance limit of water to dissolve the salt particles"
Teacher: "only salt?"
Student 1: "no"
Teacher: "so what he just said was correct, does anyone elsewant to add something?"
Students: quiet

Then the teacher gave a description about the solubility of a substance in water that when any substanceis dissolved in water, with theconstant addition of that certain substance, the water cannot dissolve the substance because the water becomessaturated. Then the teacher asked the students to define the notion of solubility based on the previous demonstration. This time the teacher together with the students defined the notion of solubility.

After that the teacher encouraged students to recall the concept of molarity in relation with the concept of solubility and solubility product. In this process, there wereseveral students who still had notundersood or forgotten about the concept of molarity. Therefore, the teacher reviewed the molarity concept.

Teacher: "how to find the molarity?"
Student 3: "n / V"
Teacher: "n / V was looking for what?"
Student: "moles"
Teacher: "what is n?"
Student: "moles"
Teacher: "meaningthat n / V mole or molarity?"
Student: "molarity"
Teacher: "how to find a mole?"
Student: "mass / Mr"

Next the teacher gave two questions related with solubility. Toresolve this problem, two students voluntered to solve the matter while the others were also worked on the questions. When the two students completed the problems on the board, the teacher gavereinforcement and asked of the other students asked whether their answers matched with theirs. Some students answered the same and some did not. Teacher thengave more reinforcement based on answers they produced.

The concept described next was about the solubility product. The teacher explains the concept by providing applicative questions in which the concept had been explained previously. Teachergave three applicative questions and three students voluntered to solve the questions. One of those three students did not really understand the concept but he wasable to answer correctly with the guidance and assistance of teacher and friends. Similar with the previous solubility questions, when the three students completed the answers on the board, the teacher asked the other students whether they produced the same answer

Table 1. Questions Indicators of Quiz 1

Indicators	Question Number
Writing down the equation for the equilibrium of salt in a saturated solution	1
Explaining the meaning of the solubility	2
Explaining the relationship between solubility and solubility product	3
Writing the equation of salt or alkaline soluble Ksp	4
Calculating the value of Ksp salt or alkaline soluble based on solubility	5
Calculating the solubility of the salt or alkaline soluble based on the value of Ksp	6
Analyzing salt or alkaline soluble in water based on the value of Ksp	7

Table 2. Percentage of Students Respond to Every Problem and Written Feedback Provided

Question Number	Percentage (%)		*The content of written feedback*
	Experimental class	Control class	
1	93,55	87,1	remember, the reaction that occurs in the saturated solution is an equilibrium reaction
2	25,81	25,81	consider the maximum mass of $CaSO_4$ that can be dissolved in 1 liter¬ water
3	64,52	64,52	remember, the coefficient is only squared
4	90,32	90,32	Please check the calculation
5	64,52	80,65	Please check the calculation
6	80,65	29,03	Please check the calculation
7	34,71	32,26	-

and the teacher gave correction and reinforcementtoward their answers.

After all students answered the three questions, all students were given a quiz to be solvedin 15 minutes about solubility and solubility product. There were 7 multiple choice questions. Here is the list of questions given based on indicators.

Based on the quiz results, not all students are able to answer all questions correctly. In the experimental class, there were two students able to answer all the quiz questions correctly and only a student of control class. From the results of each quiz, there were various answers given by students in both experimental class and control class.

In the experimental class, every student who could not answer every question correctly on the quiz was given a written feedback to inform him/her of what should be considered in answering the question. Below is the data of the percentage of students who correctly answered the quiz for each question.

Based on Table 2 it can be concluded that the experimental class and the control class experienced similar difficulties in understanding solubility and solubility product. The experimental class students were given written feedback on the results of the quiz so that theyknew the mistakes they made and they couldimprove their answers. They were also given homework related to solubility and solubility product as a medium to enable them to revise their mistakes.

Verbal feedback on the results of the first quiz was given to students at the beginning of the next meeting. Verbal feedback was given by reviewing students' answers, teacher emphasized on the part where students made mistakes. From the observations, all students enthusiastically listened to verbal feedback given by teacher. The interviews to some of the students resulted on their claim that they remained enthusiastic while listening to verbal feedback from teachers, as it is an encouragement for them to better understand the concepts they had not yet understood completely.

As already explained, students who had not yet been able to master certain indicator measured from the quiz results were given homework that aimed as a medium for student to learn in order to improve and understand the concepts. Next is the results of students' homework each for each materialsas presented in Figure 3.

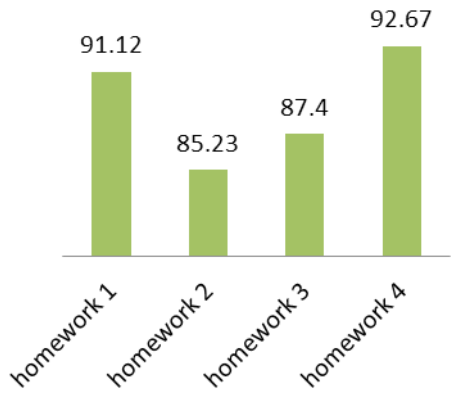

Figure 3. Results of Homework in each Sub-material on Solubility and Solubility Product

If we associated the results of the homework with each meeting quiz results, it was indicated that students had to improve and understand the concepts they could not fully understand when the learning process took place. From these results we could say that the feedbacks from studentswere necessary to improve student learning, becausethrough this process, students could independently determine where they went wrong consciously and they could revise it along with the homework. Based on the interviews with stu-

dents, they revealed that the homework helped them to learnat home, because it eased them to learn to understand the material they had not yet comprehended and the feedbacks given in the quiz results encouraged them tocomplete his homework.

Based on feedback and the developmentof the students' learning as we had analyzed, it can be concluded that the application of formative assessment feedback in learning enabled teachers to identify the difficulties faced by students in the learning process and it helped students to overcome those learning difficulties.

Based on observations to the student activities,it showed that the experimental class was more interactive than the control class. This was due to the effect of the formative assessment feedback on the experimental class. As expressed by Gallagher (2007) that the continuous and integrated application of formative assessment during the teaching process will bring positive changes in the classroom environment. Ramaprasad, Sadler (in Yin et al, 2008) added that the formative assessment is an effective strategy to close the gap, causing expectationin which formative assessment will improve students' learning process and achievement.

In addition, the application of formative assessment feedback in learning enabled teachers to identify the difficulties faced by students in the learning process and helped them to overcome their learning difficulties. This is consistent with the statement that feedback is a two-way process in which teachers provide information about students' learningprogress and they can apply teachers' comments for directing or improving their learning (Dowden, Pittaway, Yost, & McCarthy in Doan, 2013). In this study, information about students learning progress was given in the form of written feedback given to each student along with the quiz results and verbal feedback in the beginning of next meeting. Students could improve their learning progress through homework given to those who had not fully grasped the materials.

Based on the results of interviews conducted to several students in the control and experimental class, the experimental class students claimed that the assessment process related with solubility and solubility product made them enthusiastic because of their desire of being able to answer the quiz well. Students alsofelt happy on written feedback (comments) by teachers so that they knew for sure which part was wrong and how to fix it. In addition, when they were asked about the benefit of verbal feedback by teachers, students responded that it was very useful. Although they had been given written feedback by the teacher, they needed more reinforcement to the response. Based on this we can conclude that the verbal feedback and written feedback help students to develop the ability to monitor, evaluate, and regulate their own learning.

In this study, the quiz given to students were returned to students along with written feedback from teachers and students also got verbal feedback at the beginning of the next meeting. Those who had not mastered the indicators set out in the previous meeting weretasked with homework which serves as a medium for students to change the mistakes they made.

Based on the results of the study, we found out that in the first and the fourth meeting the average scores of the experimental class quiz were better than the control class. While in the second and third meetings,the average quiz score for control class is higher than the experimental class despite the similarity of each quiz in both control and experimental class. This evidencedthat the application of formative assessment feedback in learning did not sustainably improve student learning outcomes at each meeting,butwhat important was that students were given the opportunity to know the exact place of their errors and the lack of understanding and revised it, so that students were more aware of what to do whenfaced the same problem with different types.

If we observed results of the quiz results of each meeting, the experimental class' students did not necessarily always get better result than the control class. The distribution of difficulties faced by students in each material could be said to be almost similar or sometimes even the difficulties faced experimental class was higher than the control class. It was proven in the second and third quiz scoresthat the control class resulted higher score than the experimental class. This occured due to a variety of factors, ranging from school fluctuations in the day the experiment conducted, they were having a lot of activity, also the learning time that would soon come to an end due to the upcoming exam, the great number of students who were absent at the meeting because some of the students would participate in the school activities on the next day, to the students' believethat the material was difficult.

CONCLUSION

Formative assessment with feedback brings impact on the activity of students' learning process. This is demonstrated with some indications

during the learning process. Based on the results of interviews with some of the experimental class students, they claimed that they were very enthusiastic during the learning process because they could be more enthusiasm in participating in learning, motivated to better understand the material being studied and solved the quiz.

Based on the results of questionnaire, students gave a positive outlook towards the implementation of formative assessment with feedback in learning. According to the students, the application of formative assessment with feedback in learning is very important for learning, helping them to know what is not yet understood, boost their confidence and help them to understand the mistakes and fix it. In addition, the application of formative assessment with feedback significantly increases the interest and motivation to learn.

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