Development of Assessment for Learning (AfL) model with goformative and pen tablet

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Abstract. The research aims at obtaining the development of Assessment for Learning (AfL) model in mathematics learning using technology such as goformative website and writing tools in form of the digital pen or pen tablet. Goformative and pen tablet are used to make time in using AfL model more optimal. As it is known, AfL is important to implement in learning, but time constraints make teachers rarely use it. The method used in this study is a modification of the ten research and development phases proposed by Borg and Gall. Researchers classify it into three stages: (1) preliminary study, (2) development, (3) evaluation. There are two criteria used in this study to determine the effectiveness of the model that is (1) regarding implementation, (2) regarding learning achievement. The results showed that the application of this model is effective to be used. The questionnaire data on teacher responses, student responses, and data on achievement test results show that this model meets the criteria of effectiveness. Based on the results gained, it can be concluded that this AfL model can be used as an alternative model AfL that does not implement the technology.

1. Introduction

The low grades of mathematics students are caused by many reasons. One of them is a less optimal use of assessment by the teacher. Nowadays, teachers use the assessment only to obtain information on student outcomes after learning or as it is called summative assessment [1]. Whereas teachers should more frequently apply Assessment for Learning (AfL). With AfL, information on student competence and learning needs can be utilized to support students in enhancing their mathematics learning. Madaus and Kellaghan summed it up as the following: "when the cook tastes the soup, that's formative (AfL); when the guest tastes the soup, that's summative"[2]. The parable shows that AfL is done to improve the process when the process is still ongoing so that if the process is not running well, then it can be done immediately. AfL has two important roles in the learning process. First, this assessment can obtain information from students to provide a reference to educators regarding decision-making during the learning process. Second, it can provide feedback; it is one of the most powerful influences on learning to improve their learning process so that based on both roles, this assessment makes the learning process run effectively and optimally [3,4].

Young stated that this assessment if used effectively could improve student achievement [5]. Correspondingly Stiggins and Chapuis also said that this assessment could improve student success [6]. Budiyono, et al. has done the development of assessment for learning model in junior high school
students in Surakarta City and the result concluded that AFL model is quite easy to implement and produce better student mathematics ability compared with if not using AFL [1].

Based on interviews with some math teachers at junior secondary schools who have used AFL. The AFL that teachers use is an AFL with peer ratings. This is done so that students take part in the feedback and assessment can be done immediately. However, when the use of AFL has several constraints. The first obstacle, the class atmosphere becomes rowdy. Due to the factor that students will pass around when students finish working on and exchange them with other students and when students collect them to the teacher. When teachers use self-assessment, students' actually cannot be controlled. The second constraint, the use of AFL is time-consuming, including when giving other colored pens to check answers, exchange answers to other students, collect student answers, and teachers around to check student answers. Therefore there is the need for development to optimize this AFL model so that can be used easily, do not bother the teacher, and make the student more conducive to learning.

One way to optimize learning using this AFL model is by utilizing information and communication technology. Isabwe et al. has undertaken research to develop AFL technology-based model in the form of a mobile web app called A-PASS with existing Apple tablet aids pen [7]. It's just the use of applications for AFL on mobile with Apple tablet that already exist pen will be difficult to do because Apple brand phones that already have the pen of course very expensive. Utilization of technology to optimize AFL models in addition to using A-PASS mobile applications can use goformative. Goformative is a web application for computer devices created by associations of teachers in America. Researchers describe goformative is a tool to use AFL model because by its name can be seen that this goformative resembles AFL (formative assessment). It has the characteristic that is the feedback, in addition to goformative can also add worksheets, pictures, videos and other materials that can use by students to obtain information in learning. The main advantage of this goformative is that teachers can see quickly the results of student work without the need to go around the classroom.

The advantages of goformative will not be meaningful in mathematics subjects that contain special symbols so that the workmanship of the students will be longer because if still writing using a regular keyboard. Therefore need a tool in the form of a pen tablet. A pen tablet is stationery of digital pen, a pen that can be used to write on a computer screen. Carrillo et al. suggest that pen tablet is a tool for teaching that combines the best features of traditional and new media and enables progressive development and interactive lectures [8]. This tool is also facilitates backtracking, the redefinition of ideas, the refinement of solutions and investigation of alternate paths [9].

This is what encourages researchers to develop AFL models with goformative and pen tablet. The development of this model is expected to maintain the benefits of AFL, easy to implement, minimize the problem and can improve student's mathematics learning achievement.

2. Experimental method

This research is research and development (R and D). The educational development research model begins with the results of the research which is then used to design new products that are systematically tested, evaluated and improved to the effective stage to be applied [10]. The development procedure of AFL model with goformative and pen tablet refers to the research and development procedure proposed by Borg and Gall with some modifications to facilitate the researcher.

This research procedure includes three stages, namely: (1) stage I: the Preliminary study that includes literature study, needs analysis, model planning. In this stage, I researched to find out the learning model used, the use of AFL field and the constraints faced by teachers in applying it. Data were obtained through field observation and teacher interview through Focus Group Discussion (FGD). In this FGD, the researcher explains the prototype design of the initial model for the FGD participants. (2) Phase II, the development includes Creation of model prototype, Testing and revision model, and Model set. At this stage, the researchers create prototype models based on suggestions and inputs from FGD participants to then be tested. Tests were conducted in several meetings to get a good final model. A good final model is obtained after going through a revision process in the form of responses from teachers, observers, and students through a questionnaire. A questionnaire was given to teachers and
observers in the form of questions whether the new AfL model is easy, sufficient, or difficult to implement and questionnaires for students in the form of questions about the ease of use of goformative and pen tablet, whether students have received feedback that helps them or not. The data obtained from the questionnaire is used to correct deficiencies in previous learning. Tests were conducted in 4 lessons until final revision and ready to use without revision. (3) Stage III, the evaluation includes Model Effectiveness Test. after obtaining a good new AfL model without revision, the researchers used the model on different classroom learning with the test class. then the researchers tested the effectiveness of the model to compare which model gave better performance between the classes using this AfL model or the class using the current teacher-used learning model. Testing the effectiveness of this model using t-test that has previously been done a prerequisite test in the form of normality test and homogeneity test.

The final goal of this research is to get the AfL model with goformative and pen tablet that meets the criteria for the effectiveness of the model. There are two criteria used in this study to determine the effectiveness of the model that is (1) in terms of implementation, this model should be easy to be implemented, the timing of the implementation is more optimal, and simplify in giving feedback to students, the students get to benefit from this AfL model such as knowing the mistake in doing the question, more daring in asking, and learning more fun, (2) in terms of learning achievement, student achievement which uses learning with this model better than those not using this model.

### 3. Result and discussion

The researcher made a tutorial on the use of goformative and pen tablets. Tutorials are made in detail covering what teachers and students need to do. The following responses of teachers and students about the implementation of the AfL model with the use of goformative and pen tablets in learning.

**Table 1.** The teachers’ responses to the implementation of AfL by using goformative and pen tablet.

| Aspect                                                                 | Average |
|-----------------------------------------------------------------------|---------|
| Difficulty in providing direct feedback with goformative (1-5 Likert scale, 5-very easy) | 4.5     |
| Difficulty in providing indirect feedback with goformative (5-very easy)          | 4.0     |
| Difficulty in creating questions in goformative (5-very easy)                   | 4.0     |
| Difficulty in checking students’ work after the students finish their self-assessment in goformative (5-very easy) | 4.0     |
| Difficulty in using the pen tablet (5-very easy)                              | 4.0     |
| Difficulty in giving motivation on student work in goformative with a pen tablet (5-very easy) | 4.5     |
| Usefulness of goformative to optimize learning time (5-very useful)           | 4.0     |
| Usefulness of the pen tablet (5-very useful)                                 | 3.5     |
| Difficulty in using goformative in general (5-very easy)                     | 4.0     |
| Difficulty in carrying out AfL with goformative and pen tablet in general (5-very easy) | 4.0     |

Base on table 1, Generally the teacher stated that the AfL model with goformative and pen tablet could be performed easily and it makes learning time more optimal.

**Table 2.** The students’ responses to the implementation of AfL by using goformative and pen tablet.

| Aspect                                                                 | Average |
|-----------------------------------------------------------------------|---------|
| Usefulness of goformative and pen tablet (1 to 5 Likert scale, 5-very easy) | 4.4     |
| Difficulty in working on the questions with goformative and pen tablet (5-very easy) | 4.1     |
| Difficulty in getting the feedback from teachers who give direction on how to do it right from/or getting notes on the questions from goformative (5-very easy) | 3.9     |
| Usefulness of the self-assessment with goformative and pen tablet (5-very useful) | 4.2     |
| Usefulness of the feedback, and notes that teachers give to your questions in general (5-very useful) | 4.2     |
| Your enjoyment of learning math increases compared to the past (5-very enjoy) | 4.4     |

Table 2 shows that students feel the usefulness of goformative and pen tablet, of the feedback when working on the questions, and feel that goformative and pen tablet are easy to use, students feel helped
when getting feedback. In addition, students also feel that it is more fun to learn math after the application of AfL with goformative and pen tablet.

Teachers and students' responses to AfL learning with goformative and pen tablet have fulfilled the first criterion in this study to determine the effectiveness of the model regarding implementation. The students' responses of the test class are also directly proportional to the responses of the experimental class students. The students found that the goformative and the pen tablet are easy to use, the instant feedback understood the material more because they knew their mistakes and knew how to correct them from the rubric, the function also helped them not to be shy to ask the teacher.

Table 3. Duration of time, teacher activities, and student activities in AfL.

| No | Time    | Teacher activities                                             | Student activities                                                      |
|----|---------|----------------------------------------------------------------|------------------------------------------------------------------------|
| 1  | 5 minutes | Explaining learning objectives and success criteria to students | Understanding the learning objectives and success criteria by the teacher |
| 2  | 45 minutes | Implementing appropriate learning activities based on the lesson plan | Implementing the learning experience according to the lesson plan prepared by the teacher |
| 3  | 15 minutes | Provide questions of stage 1                                  | Working on stage 1 questions in the class                                |
| 4  | 10 minutes | Checking the student's answers for stage 1 and provide feedback on the student's answer paper | Discussing with friends about the questions on stage 1 and some students write answers on the board |
| 5  | 10 minutes | Providing feedback orally and solving the students’ difficulties in working on the questions | Listening and taking note of the feedback given by the teacher and expressing the difficulties that students experience in working on the questions. |
| 6  | 5 minutes | Providing the questions of stage 2                            | Writing the questions of stage 2                                         |

Table 3 is a step learning step using AfL model which has been done by Budiyono, et al. The researchers modified some of the learning steps using goformative and pen tablets to optimize the learning time. Based on table 3, the modification of AfL with the use of goformative and pen tablet can be done in step 4 and 5, with instant feedback feature on goformative, the teachers can see and give feedback [1].

Figure 1. Instant feedback feature.
Based on figure 1, *instant feedback* feature can be used in step 4 and 5 to help students and teachers to communicate easily so that the teachers can easily provide feedback while students are still working without waiting for all students to finish. Students can also easily ask the teacher about their difficulties in working on the questions; students also do not need to write answers on the board, the teachers only need a screenshot of one student's answer to then displayed on the LCD. The use of goformative and pen tablet in steps 4 and 5 can save up to half of the time spent in a learning activity without using goformative and pen tablet.

Goformative and pen tablet can also be a solution to problems in the use of AfL with peers as mentioned in the introduction. The solution offered by researchers with goformative and pen tablet is to replace the answers checking by peers with self-assessment, thereby saving time for activities such as swapping students' answer sheets and handing in the answer sheets back to the teacher. Self-assessment in this study means that the answers checking is done by the students themselves. Self-assessment has advantages such as students are more confident, and they do not need to be embarrassed if their work still has a lot of mistakes, by self-assessment method, the students will better understand their weaknesses, and it trains students to be honest [11]. Additionally, self-assessment may help students to become more independent learners as well as more reflective regarding their understanding of the subject [12].

Based on figure 2 and figure 3, the teacher can see the students' honesty with the technology, in this case, with the goformative, student answers that have been completed can be screenshot and saved on the PC. The teachers can see students' answers before they are checked (figure 2) and after they are checked (figure 3), whether they are same or there is something that has been replaced by the students.

The second criterion used in this study is to determine the effectiveness of the model in terms of learning achievement. To fulfill this criterion, the written test was conducted to get data on student achievement. Proven data obtained with Normality test by Lilliefors test and proven homogeneous test by Bartlett. After all the prerequisites are tested, the hypotheses were proven using t-test.

| Class   | N  | Average | $t_{obs}$ | $t_{a}$ | Decision          |
|---------|----|---------|-----------|---------|-------------------|
| Experiment | 23 | 81.64   | 2.66      | 1.68    | $H_0$ is rejected |
| Control  | 24 | 76.80   |           |         |                   |
Based on table 4, shows $t_{obs} > t_{table}$, so $H_0$ is rejected. This can be interpreted that the AfL learning model with goformative and pen tablet is better than the teacher's usual learning model. These results are by the results of the studies [1][6][5] that learning using the AfL model provides better performance than the other learning model without using the AfL model.

4. Conclusion

Based on the results obtained, it can be concluded that the AfL model with goformative and pen tablet can be used as a complement to the existing AfL. It is because the model meets the effectiveness criteria of the model that is easy to use, have good students' response, have more optimal learning time, and give better achievement than the usual learning that the teachers usually do.

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References

[1] Budiyono, Triyanto, Sutopo, Kurniawati I and Ekana H 2009 Pengembangan Model Assessment for Learning (AfL) Mata Pelajaran Matematika pada Sekolah Lanjutan Tingkat Pertama di Kota Surakarta Lapan Penelitian. unpublish. Surakarta: FKIP UNS

[2] Loch B I and Donovan D 2006 Progressive teaching of mathematics with tablet technology. Australia Journal of Educational Technology 9(2) pp 1-6

[3] Hattie J and Timperley 2007 The Power of Feedback Review of Educational Research 77 pp 81-112

[4] Wiliam D and Black P 1996 Meanings and Consequences: a basic for Distinguishing Formative and Summative Functions of Assessment? British Educational Research Journal 22(5) pp. 537-548

[5] Young E 2005 Assessment for Learning: Embedding and extending

[6] Stallings V and Gascoigne C 1996 Student Self-Assessment and Self-Evaluation The Mathematics Teacher 89 pp 548-554

[7] Isabwe G M N, Reichert N, Carlsen M and Lian T A 2014 Using Assessment for Learning Mathematics with Mobile Tablet-Based Solutions iJET 9(2)

[8] Carrillo A, Cejudo J M, Dominguez F and Rodriguez E 2013 Graphics Tablet Technology In Second year Thermal Engineering Teaching Journal of Technology and Science Education (JOTSE) 3(3) pp 102-112

[9] Madaus G F and Kellaghan T 2002 Evaluation models: Viewpoints on educational and human services evaluation second edition (Newyork: Kluwer Academic Publishers)

[10] Borg W R and Gall M D 1983 Education Research: An Introduction (Fourth edition) (New York: Longman)

[11] Jihad A and Haris A 2013 Evaluasi Pembelajaran (Yogyakarta: Multi Pressindo)

[12] Stiggins R and Chapuis J 2006 What a difference a word makes: Assessment for Learning rather than Assessment of Learning helps students succeed Journal of Staff Development 27(1) pp 10-14