The Use of Open-Ended Questions with Giving Feedback (OEQGF) for Effective Mathematic Learning

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Abstract. Feedback deals with giving information to students related to their task which is done through score of their achievement, reaction, and comments. Considering its hierarchy, task difficulty level consists of low, middle and high levels. The difficulty level of open-ended questions is middle to high. Open-ended question is a good way to train students’ knowledge. This research is a descriptive research which aims at describing teacher’s learning management, students’ activities, students’ learning achievement, and students’ responses in mathematic learning using OEQGF. The subject was a teacher of mathematics who teaches eighth graders, and students themselves. The research design used is one shot case study. The result shows that: management learning has been very well implemented by the teacher; every students’ activity has been carried out by students; the students’ learning achievement have reached the criteria of completeness, and the students’ responses can be considered as positive. Therefore, it can be concluded that mathematic learning using OEQGF is effective.

1. Introduction
Assessment does not only deal with documents that are done by the students. It can, moreover, affects their learning process as well as their interest in learning [1]. Score is not the most important thing. How the learning activity in the field is implemented is also an important thing to consider. Assessment which results students’ learning achievement is used by teachers continuously to monitor the process and the progress of students’ learning and to improve the learning to be more effective. A learning is not only about the final score but also about the process of the students in finding out the new knowledge. In other words, learning is a process of gaining knowledge. Somebody learns through a certain process until he finds something which takes them from not knowing to knowing. The open-ended question is a question that is created to provide opportunities to emergence various answers through various strategies. It can be an individual way to develop intellectual potential and experience in finding something new [2]. For learning, the task with moderate to difficult level of difficulty is better than an easy task [3]. It means that a person learns better if the level of difficulty of the tasks also increases gradually. The use of open-ended questions needs to be cultivated in mathematics learning in order to optimize the development of students’ potentials [4].

So far, evaluating students’ achievement progressively is rarely done. Nevertheless, it is important for teachers to evaluate student learning in order to provide feedback for students as well as consider the
effectiveness and efficiency of the learning process carried out [5]. Open-ended and closed questions are frequently discussed by several researchers. Most students preferred to use closed questions because it is easier to answer. However, students will have more opportunities to use their math knowledge and skills in a comprehensive manner in open-ended questions [6]. It means that giving continuous feedback and open-ended questions are important to improve the effectiveness of the learning.

Therefore, the purpose of this study is to describe the effectiveness of teacher’s learning management, students’ activities, students’ learning achievement, and students’ responses in mathematics learning using OEQGF. This research is a descriptive research involving 34 junior high school students. The research design used was one-shot case study. In this research, teachers’ learning management in the mathematics lesson using OEQGF was good, the students were actively involved in mathematics learning using OEQGF, the students’ achievements in mathematics using OEQGF have completed the criteria, and the students’ responses towards mathematics learning using OEQGF were positive.

2. Theory
The conceptual framework in this study focused on the effectiveness of the open-ended question and the feedback.

2.1. Open-Ended Questions
The open-ended questions are an instrument that is formulated in such a way in order to provide opportunities to emerge several different answers. It encourages a variety of strategies or ways to develop their intellectual potential and experience in discovering something new [2]. Open-ended question is a problem that is formulated to encourage multiple correct answers [7].

Learning with the problem (the problem), or open learning, deals with presenting problems with various ways of problem-solving (flexibility) and the solution can also be varied (fluency) [8]. The main purpose of the open-ended question provision is not to get an answer, but it emphasizes on how the students reach an answer that is not direct one. Then, the indirect way to reach the answer have be collected to the teacher [9]. Moreover, it is also explained that the “openness” of the problem is considered lost if the teacher only gives an alternative way to answer these problems. Therefore, it can be stated that there are many approaches or method sin getting answers, not only one.

The aspects of transparency dealing with the open-ended questions can be classified into three types, namely: (1) opening the process of completion, if the question has various ways of settlement, (2) opening the ending result, in which it has a lot of correct answers, and (3) opening the development of the sequel, in which students have completed something then they are expected to be able to develop new problems by changing the terms or conditions on a point or item that has been resolved [4].

Based on several opinions, this research dealing with open-ended question is a math question having more than one answer which can be gotten through a variety of strategies of completion or having one answer which can be gotten through various strategies of completion or having more than one answer gotten through completion strategy.

2.2. Feedback
Evaluation is a process in education and teaching activities to obtain data of the results of the learning experienced by students and to process or interpret it into a qualitative or quantitative data types according to a certain standard [10]. Furthermore, the assessment does not only document what the students know and what they can do, but it affects the learning and their motivation [1]. The evaluation should be done fairly and wisely in accordance with the progress of learning done by the students.

Feedback is the provision of information obtained from tests or other measuring whether there is improvement on the students’ learning achievement [11]. In the process of teaching and learning, feedback is frequently given to boost the students' motivation. Assessment of learning outcomes will make students be able to find out how far they have managed to follow the lessons taught by the teacher [12]. Giving judgment or commenting on the students’ achievement in a sustainable manner will encourage them to learn because every child has a tendency or potential to get good results [13]. The
Feedback given makes students always have challenges and problems that must be faced and solved. Therefore, it encourages them to learn more thoroughly and carefully.

Feedback is considered very influential in the students’ learning activities. Responding to the teacher’s feedback, the student will soon be able to find out whether the answer they have done is right/wrong, appropriate/inappropriate, or there is something needs to be fixed [14]. Feedback can be both positive reinforcement and negative reinforcement. Through positive reinforcement (excellent, good, right, and so forth), it is expected that the students will do the same activities regularly. Instead, through negative reinforcement (less precise, one needs to be improved, and so on), it is expected that the students will not repeat the same error.

Based on the explanation above, in this study, the feedback is considered as a gift in the form of a score information or comments or responses given on an ongoing basis to avoid any shortcomings or errors that can possibly occur as well as maintain the things that have been already correct.

2.3. Effective Mathematics Learning Using Open-Ended Questions with Gift Feedback

Learning is stated as effective when it fulfils two criteria: (1) Needs analysis of students’ learning activities done by observing the correlation between students’ capabilities and expectations of the learning process; (2) A description of the test system used which is based on the students’ learning needs [15].

There are four aspects to determine the effectiveness of learning [16] which are described as follows:

- The quality of learning, which is the quantity of the presentation of information by teachers and teachers' skills in helping students to learn the material easily.
- Compliance, in relation to the learning rate, which measures the ability of teachers to ensure that students are ready to learn the new material by linking some related knowledges or experiences
- Motivating, which measures the ability of teachers in giving encouragement to the students to understand the material being taught and the tasks given.
- Time, which measures the teacher's ability to allocate time for students to learn the material or work on a job in a certain period of time.

Learning is effective when the students are actively involved in organizing information discovered [17]. Assessment of student learning achievement used to determine the effectiveness[18]. Moreover, as some description of it can be seen, Slavin emphasizes on learning effectiveness in the teacher’s management of learning, Eggen and Kauchak emphasize on the effectiveness of learning in student activities, and Sudjana emphasizes on the learning effectiveness on student learning achievement.

In this study, the effectiveness of learning is stated to be able to help students improve their abilities to correspond to the objectives achieved. Learning mathematics using OEQGF is considered effective in terms of four aspects, namely the teacher’s learning management, students’ activities, students' test results and students’ responses.

2.3.1. Teacher’s Learning Management. In this study, the teacher’s learning management includes the skills of teachers in implementing instructional activities which is appropriate to the lesson plan of mathematic learning using OEQGF. Learning management using OEQGF is stated as good if the average score totally obtained minimum score included in the range $3,00 \leq \text{Score} < 3,50$. Learning management assessment using the score and the assessment categories is presented at Table 1 [19].

| Table 1. The Category of Learning Management. |
|---------------------------------------------|
| Total Average Score | Categories     |
|---------------------|----------------|
| $1,00 \leq \text{Score} < 2,00$ | Not Good |
| $2,00 \leq \text{Score} < 3,00$ | Less Good |
2.3.2. Students’ Activities
In this study, the students’ activities include learning activities in which students listen/ pay attention to the teacher’s explanations; ask questions related to the materials / tasks submitted, understand the given problem or the teacher’s explanation; express their opinions; work on a given task; discuss with friends; present the results of the task group discussion. In addition, it involves the students to listen, pay attention, ask questions, or give feedback related to assigned presentation results done by other groups; engage in activities that are not relevant to learning, such as sleeping, eating, making noise in class, and so on. In this study, the highest activity rates show a trend of students’ activities. If the amount of the average percentage of the first to the second meeting of all the activities of more than or equal to 60%, then the students’ activity during learning can considered active.

2.3.3. Learning Achievement
In this study, the learning achievement is assessed only in the realm of knowledge gained through worksheets and tests of student learning achievement. Classical learning completeness is achieved if at least 80% of the students completed it individually. The percentage was adopted from [20].

2.3.4. Students’ Responses
The students’ responses of study are the responses of students towards the learning process which are obtained through the questionnaire. Questionnaire consisted of ten statements including five favorable statements and five unfavorable statements. The students’ responses use OEQGF are considered positive if students’ responses in the questionnaire during the course of the first meeting to the last meeting achieved minimum criteria included in the positive (strong) category. The students’ response assessment using the score and the assessment categories are presented at Table 2 [19].

| Percentage of Score | Categories      |
|---------------------|-----------------|
| 0% ≤ Score < 20%    | Very Weak       |
| 20% ≤ Score < 40%   | Weaker          |
| 40% ≤ Score < 60%   | Strong          |
| 60% ≤ Score < 80%   | Stronger        |
| 80% ≤ Score < 100%  | Very Strong     |

3. Methodology

3.1. Participants
The subjects of this research are one teacher teaching eight grade mathematics and 34 eighth graders of Junior High School. All students were invited to fill the learning achievement test and questionnaire. Then, 4 students in 1 group were randomly selected to be the subjects of students’ activities.

3.2. Data Collection

3.2.1. Observation
In this research, the observer of students’ activities is a research associating fellow mathematics education students of Universitas Negeri Surabaya which has been discussing the procedures to fill the observation sheet. The observers of students’ activities were two students namely observer 1 and observer 2 who are denoted B1 and B2. The observers of teachers’ learning management are researchers. The observation sheet was adapted from an instrument that has been developed by [21].
3.2.2. Learning Achievement Test
The test used is an open-ended test description that was done individually. The tests given to students at the third meeting. The test was prepared by researchers.

3.2.3. Questionnaire
The type of questionnaire used is closed questionnaire because it contains statements, the answer of which have been provided answers. Filling in the questionnaire does not affect a student's score. The questionnaire sheet was prepared by researchers to determine the students’ response to the learning, their understanding of materials, learning activities, and their interests.

4. Results and Discussion

4.1. Learning Management, Students’ Activities, Learning Achievement, and Students’ Responses
The learning is done at the first meeting and the second meeting. Based on the observation, the teachers’ learning management obtained the results on Table 3.

Table 3. The Results of Learning Management.

| Learning Management Result | Students’ Activity Result |
|----------------------------|--------------------------|
| Total Averages Score | Categories | Percentage (%) | Categories |
| First Meeting | 3.53 | Very Good | 100 | Active |
| Second Meeting | 3.40 | Good | 90.63 | Active |

In general, the assessment of teacher’s learning management got a score of 3 and 4, while for score 2 was obtained twice in the first meeting and in the second meeting. The score 2 at the first meeting was obtained when the teacher motivated the students and guided them to study the material further. It is because the teachers conveyed the motivation that did not match the learning at the first meeting. At the second meeting, the teachers conveyed the overall motivation. The score 2 at second meeting was obtained when the teacher responded to the discussion in the presentation. Nonetheless, the average of the first meeting and second meeting included both discussions which involved 10 skills assessed by the excellent category, 4 abilities rated good and 1 other categorized as adequate. Therefore, the learning management criteria of the first and second meeting are good, then the management of learning mathematics using OEQGF can also be stated as good.

The subject observation for students’ activities was done at the second meeting with the same subjects observed at the first meeting. Based on the observation of student’s activity, the results on Table 3 was obtained. The students’ activity in the first meeting and second meeting are respectively 100% and 90.63%. Overall, the students’ activities during the first meeting and the second are good enough. It is as stated by the observer on Observation Sheet for Students’ Activities during the study. Based on Table 3, the average number of students’ activities reached more than 60%, that is 95, 31%. Thus, the students’ activities in mathematics learning activities using OEQGF can be stated as active.

Based on the scores obtained from the worksheets and the test scores of students’ learning achievement are quite varied as mathematics learning using OEQGF applied. Based on the worksheet scores and the test scores obtained classical learning completeness in which percentage reached 94.12% (32 students scored ≥75). Therefore, we can conclude that classical learning completeness has been reached.

Based on students’ response result, the lowest percentage of students’ responses is 74.75%, while the highest percentage of student responses is 95.96%. The lowest percentage of students’ response that is when the students are asked to respond whether the applied learning is better or not compared to the other study. Meanwhile, the highest percentage of student responses obtained when students were asked to respond to a pleasant atmosphere in the classroom when the mathematic learning using OEQGF was applied. The average of the entire ten statements obtained is equal to 81.62%. From the point, it can be seen that the average percentage of students’ responses towards mathematics learning using OEQGF
was relatively strong. Thus, the students’ response in mathematics learning using OEQGF can be stated as positive.

4.2. The use of OEQGF for Effective Mathematic Learning

Based on the analysis of the data obtained, it can be concluded that the use of OEQGF for effective mathematics learning is reviewed through four aspects. There are (1) teacher’s learning management in the learning of mathematics using OEQGF included in both categories with an average score of 3.47; (2) students’ activities in mathematic learning using OEQGF is stated as active with the average number of activities undertaken students range from activity 1 to activity 7 reached more than 60%, that 95.31% exactly; (3) The results of student learning in mathematics using OEQGF is considered complete in the classical with the percentage of completenessmore than 80%, that is 94.12% exactly; (4) Students’ responses in mathematics learning using OEQGF stated as positive with the number of responses for each statement in the questionnaire which obtained 50% in the strong category and 50% in a very strong category. Based on the initial agreement, it can be concluded that the study of mathematic learning using OEQGF can be stated as effective.

5. Conclusion

Based on the analysis and discussion results, the study of mathematic learning using OEQGF can be considered effective. Moreover, it can be concluded that the use of open-ended questions with gift feedback can reached all of effectivity learning aspects.

6. Implication

Based on the result, the learning model can be applied and developed in a teaching and learning activities considering the level of difficulty of the task and the feedback given.

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