Formative Evaluation as Efficient Strategy for Learning Mathematics

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Abstract

Evaluation always was problem for teachers and or instructors in present educational systems. Teacher yet did not know whether formative evaluation is proper or summative formative. Obviously formative evaluation has efficiency than summative evaluation. In this study, quasi-experimental method is used and via simple sampling method, formative evaluation is applied in two forms such as multiple-choice evaluation and essay formative evaluation among girl students of Shahrekord at first grade of high school. 67 girl students are chosen as three separate groups; group 1, 2, 3 that group 1 and 2 are applied multiple-choice evaluation and essay evaluation as the formative forms versus group 3 who is used of summative evaluation only. The results of ANOVA and Scheffe tests have indicated that there are differences among three groups which are considered as multiple-choice evaluation, essay formative evaluation and summative evaluation respectively. Finally it is showed that multiple-choice evaluation has not significant difference versus summative evaluation. Therefore essay formative is the best the kind of formative evaluation.

Keywords: Teaching mathematics, formative evaluation, multiple-choice evaluation, essay evaluation, summative evaluation, learning.

1 Introduction

One of the important activities in the improvement and development of educational systems is evaluation. Evaluation can determine weakness and ability points of educational systems or any programs of schools. Evaluation can define as process that studies performances and feedbacks of learners or users in learning process. The aim of education in any country is to change circumferences of teaching-learning procedures in institutes or schools. Evaluation can help instructor or teachers that analyzed the changes and differences between previous and next status in learner(s). Through this method, real performances will be indicated and teacher can study to self-teaching status. Yarmohammadian (2006) [4] indicated main evaluation functions as following:

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- Determine: determination can have efficiency for teacher in order to recognition of factors and difficulties fields of students in particular learning problems of them. This function can do via class exam or final exam.
- Review of curriculum: review of curriculum can improve and promote the results of education systems and its curriculum. Therefore testing curriculum firstly can do to end constantly.
- Compare: the comparison of program, teaching methods and other educational aspects can help to replace modern and tested teaching methods.
- Predicate: Through collecting data of the needs of learners, educational personnel and people can determine the needs of education systems.
- Realization of aims: This traditional method has the most advantage for curriculum. In this method, it emphasizes on the elements of aims in education systems.

Evaluation has two categories generally. Category one; formative evaluation is the skill that evaluates a particular part of textbook. The performance of students will be studied step by step. In this evaluation, teacher or instructor has to exam learning process in detail till weakness of student(s) determined in detail. In category two; summative evaluation, the aim is to study the whole performance and feedback of students. This evaluation can perform in the final step of teaching process. If several skills are taught for learner(s), this evaluation evaluates all skills in one time. We can show the summary of these categories in Fig.1. It seems that most schools applied summative evaluation. This kind of evaluation may not meet personal needs of learner(s). Summative evaluation is important for general goals. But formative evaluation will indicate latent capacities while summative evaluation will show general capacities. In formative evaluation, learner can improve personal needs and develop hidden abilities. In this research, it is tried that studied formative evaluation in other view point. We have tried that studied formative evaluation in two formats among learners for learning mathematical concepts.

Figure 1: The summary of main evaluations functions
2 Formative Evaluation Features

After instruction, formative evaluation is to study of results for learning process and makes improve to learning. Formative evaluation includes of exact question based on instructional goals in each teaching units that after teaching that unit and performing its drill via learner(s), will be implemented. The results of formative will be made to inform of one to one of instructional goals. Two formative evaluations implement equally. One of these, perform before teaching next unit and its goal is the recognition of learning difficulties. Second formative evaluation will be performed after corrective evaluation (see Fig.2). In corrective instruction, teacher can improve learning and remove difficulties. This process is ongoing until learner(s) will be mastered. Webb [3] (2010) in his research, he indicated a model that integrated content, assessment, understanding of students that help teachers. Involving the process of improving a learning line improves teacher mind of important representations for a context field which could support discourse-based, embedded assessment and formative assessment. Brown et al. (1997) [1] states that “any assessment system has certain weaknesses: overstressing students and the staff; too many tasks with the same deadline; insufficient time for students and teachers; inadequate or superficially provided student feedback; diffuse or inexistent assessment criteria; large variations in grading the requirements of various modules. Continuous summative assessment highlights even more the aforementioned weaknesses. There is even the danger that assessment will dominate teaching and learning, and there will be no more time for students and teachers for anything else”. Formative evaluation can include of several forms. All forms of formative evaluation can have general goal. Here two forms of formative evaluation will be studied in mathematics education. Multiple-choice evaluation has features as follows:

- This evaluation has main body, multiple choice, deviance in choices,
- Learner (s) can select proper choice among choices just via viewing without computing,
- In this evaluation, learner (s) did not think deeply and choices help to remember whole contents which have read already,
- Examiner can rectify this evaluation easily and did not focus on deep learning of students,
- The kind of reading in this evaluation will differ of essay exam, because students of learners just focus on key contents and did not read and learn other content.
Essay formative as second form of formative evaluation that learners or students have freedom. This evaluation can help to think and creativity. Students or learners have to response in detail in this evaluation and they need to long-term memory. In this evaluation have different features and principles as follows:

- This evaluation can promote critical thinking,
- The kind of exam needs deep learning and remembering,
- Students or learners improve and modify difficulties while in the multiple-choice evaluation, students or learners did not read exactly and the kind of learning is routine.
- In learning mathematics process, it is better that mathematical concepts learned via essay evaluation because learners or students can find skill for new solution rather old and reminded solution (Saif, 2009) [2].

In teaching mathematics, teachers can apply formative evaluation in both multiple-choice and essay exams. In this study, researcher is going to deep learning in both above evaluation till determined whether multiple-choice is better or essay exam.

3 Methodology

Quasi-experimental method is used for this study. Quasi-experimental method is practical compromises between true experimentation and the nature of the human language behavior to be investigated. This method is susceptible to some of the questions of internal and external validity. Since human did not show real behavior under research. This method has real efficiency for data. Through simple sampling method, one girly high school is chosen among girly high schools (120 students of mathematics) at Shahrekord. Then three classes are selected randomly at first grade among students of mathematics in 2012-2013.
academic years. Each class included 20-25 students. In general, 67 girl students are participated as samples.

4 Procedure

In first term of 2012-2013 academic years, three classes of mathematics strand are chosen that "sets concepts" are taught by teachers. Researchers stated to teachers that teacher 1 did not implement any exams during term in field of "sets concepts" then students participated as group 3 in summative evaluation. Indeed, students of group 3 did not participate in formative evaluation and their knowledge of "sets concepts" is studied in final exam or summative evaluation. In group 2, teacher 2 has taught "sets concepts" then she implemented essay evaluation during term repeatedly. Students of group 2 examined "sets concepts" only till last session. Then they have examined all concepts of math book in final exam in the form of essay evaluation, but they examined "sets concepts" for several times. Finally, Teacher 3 has taught "sets concepts" during term along multiple-choice evaluation. Students have learned "sets concepts" just in multiple-choice evaluation. Then students of this group have for participated final exam in the form of multiple-choice.

5 Findings

Firstly descriptive statistics are studied in Table 1. As it clears, the mean of group 2; essay evaluation is more than other groups (M=8.36). Also, Std of group 2 is less than groups; 1 and 3 that indicates less variant among data (Std=1.83). In addition, the mean of group 3 is less than other groups. This mean shows that group 3 who did not use of formative evaluation, less performance than other groups (See Fig.3).

<table>
<thead>
<tr>
<th></th>
<th>Group (1)</th>
<th>Group (2)</th>
<th>Group (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>18</td>
<td>22</td>
<td>27</td>
</tr>
<tr>
<td>Mean</td>
<td>6.77</td>
<td>8.36</td>
<td>5.66</td>
</tr>
<tr>
<td>Mode</td>
<td>9</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>2.36</td>
<td>1.83</td>
<td>2.43</td>
</tr>
</tbody>
</table>

For selecting of proper test, normality and homogeneity of variances of data are studied via One-Sample Kolmogorov-Smirnov and test of homogeneity of variances respectively. Data were normal and have homogeneity of variances (P>0.05).
For studying the difference between three groups, it is used of ANOVA test in meaningful level of 0.05. The results of this test has indicated that there are differences among three groups which are considered as multiple-choice evaluation, essay formative evaluation and summative evaluation respectively (P<0.05) in Table 2.

Table 2: ANOVA test for three groups

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>88.3</td>
<td>2</td>
<td>44.15</td>
<td>8.82</td>
<td>0.00</td>
</tr>
<tr>
<td>Within Groups</td>
<td>320.2</td>
<td>64</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>408.5</td>
<td>66</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The differences among three groups are tested through Scheffe test in meaningful level of 0.05. The results of this test have shown that there are differences among three groups separately. As it obvious in Table 3, there is difference between groups 2 and 3 and inversely (P<0.05). But there is not difference between groups 1 and 2 also groups 1 and 3 and inversely (P>0.05). Therefore, it can claim that there is significant difference between group 2 and group 3 that group 2 has used of essay formative and group 3 has applied summative evaluation only. But multiple-choice evaluation has not significant difference versus summative evaluation.

<table>
<thead>
<tr>
<th>(I) VAR2</th>
<th>(J) VAR2</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (1)</td>
<td>Group (2)</td>
<td>-1.58</td>
<td>0.71</td>
<td>0.09</td>
<td>-3.36</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group (3)</td>
<td>1.11</td>
<td>0.68</td>
<td>0.27</td>
<td>-0.59</td>
<td>2.81</td>
<td></td>
</tr>
<tr>
<td>Group (2)</td>
<td>Group (1)</td>
<td>1.58</td>
<td>0.71</td>
<td>0.09</td>
<td>-0.19</td>
<td>3.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group (3)</td>
<td>2.69</td>
<td>0.64</td>
<td>0.00</td>
<td>1.08</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Group (3)</td>
<td>Group (1)</td>
<td>-1.11</td>
<td>0.68</td>
<td>0.27</td>
<td>-2.81</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group (2)</td>
<td>-2.69</td>
<td>0.64</td>
<td>0.00</td>
<td>-4.30</td>
<td>-1.08</td>
<td></td>
</tr>
</tbody>
</table>
6 Conclusion

The evaluation can consider means that recognize capacities and scientific fields of students and doing next educational activities. Through evaluation, we can characterize educational goals in teaching process. Informing weakness points in teaching-learning process can improve previous views of teachers. The evaluation divides two main categories: formative and summative evaluation. In present schools and universities, most teacher use of summative evaluation in order to evaluate final learning process and less time also do not let him/her that implemented formative evaluations. But it is important that teachers noted to the advantages of formative evaluations. Formative evaluation is studied versus summative evaluation in this study with new view. Formative evaluation can perform in different forms, that multiple-choice and essay evaluations are performed in this study versus summative evaluation. The results indicated that group which used of essay evaluation as formative evaluation was better than summative and multiple-choice evaluations. The reasons of this matter were the following cases:

- Essay evaluation makes to learning deeply,
- Students read context in detail and exactly in essay evaluation,
- Students noted to weakness points in essay evaluation and deep informing of self-learning process in mathematics,
- Mathematical concepts need to exact comprehension that multiple-choice cannot meet understanding capacities,
- Teachers can design questions which promote critical thinking capacities for mathematical concepts,

Therefore it seems that formative evaluation helps to meet the needs of educational systems rather summative evaluation. But it is important that teachers selected proper formative evaluations. It obvious that essay formative evaluation can better results for learning. Then it suggests that teachers have to following points for formative evaluations:

- Note to individual needs for learners,
- Consider circumferences of classes and learners,
- Match self-teaching procedure to the methods of learning for each student.

References


