ORIGINAL ARTICLE

USE OF FORMATIVE ASSESSMENT AS AN EDUCATIONAL TOOL

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Background: Though formative assessments are popular in medical education, but data to establish their educational benefits are lacking. This study was conducted to determine whether participation and performance of MBBS students in regular formative assessments are associated with positive outcomes and has measurable effects on learning. **Methods:** One hundred and fifty MBBS students of semester II attending Biochemistry classes were studied by dividing into two groups till the completion of a topic. End-of-topic summative assessment marks were analysed with respect to the effect of participation and performance in formative assessments. **Results:** Participation in formative assessments had a statistically significant positive relationship with summative assessment marks. Mean difference in formative and summative assessment marks for group that participated in formative assessments is 1.6 (95% CI=0.9–2.4, p<0.001). The mean difference in summative assessment marks for two groups is 3.4 (95% CI=2.3–4.6, p<0.001). The mean difference in marks obtained by solving case studies given in Summative Assessment for two groups is 1.2 (95% CI=0.7–1.6, p<0.001). **Conclusions:** Formative assessment not only assesses students' achievements but it also enables students to recognise the areas in which they are having difficulty and to concentrate their future efforts on those areas. Adequate frequency of formative assessment with immediate feedback is beneficial as it stimulates meaningful and multifaceted learning. The results of this study encourage the use of formative assessment as an educational tool in all MBBS subjects for they have significant positive effects on learning.

Keywords: Formative assessment, Summative assessment, Performance, Feedback

INTRODUCTION

Assessment of students is an important aspect of learning in medical education and hence deserves attention of medical academicians. The choice of type and proper timing of assessment is a challenge for medical educators. Models of work-based learning identify ongoing assessment as an important intervention in increasing overall performance. Drawing from work-based learning and considering medical education as a form of work-based learning, this paper attempts to study if ongoing assessment during normal work activities can result in better students' overall performance.

Formative assessment (FA) is a part of the developmental or ongoing teaching-learning process as in this type of assessment teachers take a positive approach and employ constructive communication techniques to provide guidance[1] and continuous feedback[2] to the students on their performance. It, feedback given in formative assessments (FAs) informs learners of their present state of learning and provides opportunity to modify learning during the learning process. Thus timely, relevant and supportive feedback provided during FAs can help teachers and students in identifying corrective actions to improve learning[3] and can thus contribute to improved learning outcomes[4]. Students find FA useful[5,6] and it enhances learning[7,8].

In contrast, summative assessment (SA) is done at the end of a term or course and are predominantly utilized for grading and certification at the end of a period of study, often without providing feedback to students on their performance.[9] One of the major weaknesses of most modern higher education programs is failure to provide adequate and timely feedback to students on their learning.[10] Thus, if the purpose of assessment is to foster better learning outcomes, FA is the most important assessment practice. Therefore, education experts have recommended the use of FA in addition to SA.[11–13]

To overcome the ethical issues involved, the term 'summative and formative assessment' used in this study does not refer to an assessment performed to assign students a course grade. The terms FA and SA in this paper refer to an un-graded mid-term assessment (carried out while a topic was being covered in theory lectures) that is not used to evaluate or grade the performance of students in a term but carries meaningful information as an educational tool to aid students' learning. Also, after completion of the study, on ethical grounds similar feedback sessions were arranged for the group of students who did not undergo FAs during the study. The approvals of the LN Medical College ethical committee were obtained prior to conducting the research. The academic standing of students was not influenced by these studies because both the assessments were performed in mid-term (carried out while a topic was being covered in theory lectures) and were not used for grading.

MATERIAL AND METHODS

Study was conducted at LN Medical College and Research Centre in 2012 (March–May). One hundred-and-fifty MBBS students of II semester attending Biochemistry classes were studied by dividing into two groups till the completion of topic-organ function tests. Group-1 included 75 students who underwent formative assessments. These students were selected by simple random sampling (lottery method) to prevent selection

bias of including better and motivated students. Other 75 students did not participate in formative assessments and formed Group-2. Formative assessment tool used in this study was written test since major part of our assessment practice is carried out using it. In order to have an accurate assessment of the impact of FAs on retention of knowledge and on learning by students, a mix of multiple choice questions (MCQs), short answer questions and case studies were employed[14] in 20 marks (formative assessment) question paper. Assessment included questions based not only on factual knowledge but also on comprehension, reasoning and critical analysis of the main topic. All assessments were peer-reviewed by subject matter experts.

To ensure uniformity lectures and discussion sessions were taken by single teacher. All 150 students were simultaneously taught the topic through series of 8 lectures to ensure no extra teaching on the topic is done to Group-1. After every two lectures Group-1 underwent formative assessment on subtopic covered in the lectures. After evaluation of the questionnaire discussions were done with the students of Group-1 in which they were told correct responses of MCQs, most frequent errors were commented on and students were guided on how to approach case studies. This was done to provide immediate feedback to the students on their performance. This sequence of two lectures, FA and discussion was repeated four times till last FA and its subsequent discussion was complete. The progress took about 8 weeks for completion. After this, SA on the same topic was done for all 150 students. This test resembled the format of the FA.[15] However, proper care was ensured so as not to include any question from the FAs in the SA and examination papers were also blinded to avoid bias.

End-of-topic SA marks were analysed with respect to the effect of participation and performance in FAs. Performance of students in two groups was compared and evaluated using SPSS.

RESULTS

Group-1 included 75 students but only 46 students attended all FAs and their discussion. Group-2 included 75 students but only 72 participated in SA. While compiling results only those students were considered who participated in all FAs and SA. It was found that the participation in FAs had a statistically significant positive relation with SA marks. The comparison of means was carried out using Student's *t*-test and Paired *t*-test.

Table-1 shows the mean marks obtained by Group-1 in FA (average of marks obtained in FAs was calculated) and SA. The *t*-tests were significant showing that students of Group-1 obtained higher marks in the SA as compared to marks obtained by them in FA.

Table-2 shows the mean marks obtained in SA by Group-1 and 2. The *t*-tests were significant showing that students of Group-1 obtained higher marks in the SA as compared to students of Group-2.

Table-3 shows mean marks obtained by group-1 and 2 on solving case studies (maximum marks 4) given in SA. The *t*-tests were significant showing that students of Group-1 obtained higher marks as compared to students of Group-2 on solving case studies.

Table-1: Mean marks obtained in FA and SA by Group-1

Assessment	n	Mean (SD)	Mean Difference (95% CI)	*t*-Score	*p*
FA	46	11.6 (2.6)	1.6 (0.9, 2.4)	4.3	<0.001
SA	46	13.2 (2.8)			

Table-2: Mean marks obtained in SA by Group-1 & Group-2

Group	n	Mean (SD)	Mean Difference (95% CI)	*t*-Score	*p*
1	46	13.2 (2.8)	3.4 (2.3, 4.6)	5.8	<0.001
2	72	9.8 (3.6)			

Table-3: Mean marks obtained by Group-1 and 2 on solving case studies given in SA

Group	n	Mean (SD)	Mean Difference (95% CI)	*t*-Score	*p*
1	46	2.8 (1.0)	1.2 (0.7, 1.6)	5.5	<0.001
2	72	1.6 (1.2)			

DISCUSSION

Our studies indicate that FAs have been effective in promoting learning by students and this has resulted in better performance in SA of the students who took FAs. The discussion and interactive feedback session done after each FA provided feedback to the students on their performance and more importantly the mistakes they had made or are commonly done. Considering the emphasis on both the types of feedback in literature-after performance feedback and concurrent feedback[16], concurrent feedback (feedback during the assessment activities) was also provided. In interactive feedback sessions apart from discussing common weakness of all students[17] specific feedback focused on learners' need was given with an aim to assist them in closing their learning gap[18] and make improvement in future assessments. This was done by showing them corrected answer sheets in which comments were given on mistakes done by them.[19]

Students of Group-1 in our study obtained higher marks as compared to students of Group-2 on solving case studies given in the SA. MBBS students are taught Biochemistry related to diseases in semester I and II but pathology of diseases is usually taught in subsequent years when students are exposed to clinics. Students have difficulty in applying their theoretical knowledge to solve case studies at this stage. Here, constructive and direct supervision through feedback sessions helped students attending FAs to integrate theoretical knowledge gained during lectures into practice by solving case studies.[20] Thus FAs stimulated meaningful and multifaceted learning.

Previous studies[21,22] could not conclude whether there is a causal relationship between

participation in FA and performance in end of course examination marks as students could not be assigned to a 'control group' because of ethical reasons resulting in voluntary participation of students. This resulted in more likely participation of 'better' students, who were highly motivated. Design of our study was such that participation in FA was not voluntary and all the students of a batch whether, motivated or not, better or average equally undertook the FAs. Also as already mentioned assessments carried out were ungraded mid-term assessments and on ethical grounds, after completion of the study similar feedback sessions were arranged for the group of students who did not go through FAs during the study. This study therefore makes a contribution to the literature by establishing a causal relationship between participation in FA and performance in SA.

A possible limitation of our study could be leakage of feedback, as some students of Group-1 might have shared discussion of FAs with other interested and motivated students belonging to Group-2 resulting in their higher marks in SA. This would have reduced the difference in mean marks obtained by the two groups of students. However, the results obtained are statistically significant imparting robustness to our conclusions. Secondly, since our study was done in midterm covering a single topic, it was short and effect of participation in FA on SA results could be measured only once. If such a study could be done over longer period covering various topics then effect of participation in FA on SA results could be measured several times. In this case, it would have additional diagnostic value to know whether students who perform poorly in FAs are performing at the same level in SAs or if there is improvement due to regular feedback sessions.

Based on the results of this study, regular formative assessments on various topics have been planned next year for new batch at LN Medical College. Also feedback obtained from students during formative assessments will be utilised next year to improve teaching.

CONCLUSIONS

Formative assessment carried out along with immediate feedback not only assesses students' achievements but also enables them to recognise the areas in which they are having difficulty and to concentrate their future efforts on those areas thus enriching the learning process. Adequate frequency of formative feedback is beneficial as it stimulates meaningful and multifaceted learning. FAs serve as educational tool to aid students' learning. The results of this study encourage the use of frequent formative assessment as an educational tool in all MBBS subjects.

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