Enhancing Students Learning and Assessment through Positive Reinforcement

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Abstract

Students' understanding of class material, and knowledge retention are assessed through homework, exams, and a host of other methods. None of these forms of assessment is intrinsically paramount to the others; however, the benefits depend on how well they are used. A good assessment depends on the purpose and learning objectives, and one way of maximizing the benefits of assessment is to involve students in the assessment methodology. This paper evaluates the benefits of having students prepare some of the questions for their final exams. Generally, students put in more effort when they understand that they are in charge. Each student in a class of 28 was asked to prepare five questions each, which must be multiple-choice, true or false (not more than 2), or fill-in-the-blanks. They were made to understand that 75% of questions for the final exam will entirely be from the questions prepared by the class. It was hypothesized that this will strengthen students' engagement with class material, and their colleagues, which may aid them to achieve a better exam score. The instructor, acted as the expert system in this case to ascertain the quality of the questions. Unlike the orthodox exams, which are entirely prepared by faculties, it is believed that this may serve as positive reinforcement for students. Thus, knowing that the bulk of the exams questions were prepared by their colleagues, the desire to get a good score will be high, and ultimately translate to better material engagement and better exam score.

Introduction

For academic purposes, Hanna & Dettmer define assessment as a process of data gathering related to teaching and student's learning[1]. This data can then be used to evaluate teaching effectiveness and knowledge retention. Students understanding of class material, and knowledge retention are assessed and evaluated through homework, exam, and a host of other methods. However, no single approach is deemed superior to the other. It all depends on the objective of the assessment. Assessment can be summative or formative. Summative assessments are periodic and help to identify the level of students' knowledge or material retention[2]. These could be in the form of an end of semester exam. Summative assessment does not provide the timely information to adjust teaching since they usually occur at the end of a "cycle." For example, the knowledge gained from an end of semester exams can only be used to improve teaching during the next semester. This means that the students assessed may not be direct beneficiaries of any adjustment that it may have necessitated. For this reason, formative assessments provide the timely feedback for instructors to take actions to remedy a situation.

Unlike summative assessments, formative assessments are not "snapshots," rather, a continuous improvement approach. It forms part of the teacher-student interaction process[2], providing timely

feedback that instructors can use to improve upon the instructional process to benefit the students from whom the assessments were conducted[3-9]. This also aids instructors to provide students with timey feedback which may help them to improve on their learning. Formative assessments are normally not used to assign grades to students[2]. Grades are assigned with summative assessment; therefore, these two widely known forms of assessments, complement each other, with formative assessment serving as an ingredient to a better outcome during summative assessment. Figure 1 shows the various stages of formative assessment as portrayed by Margaret Heritage[10–12].

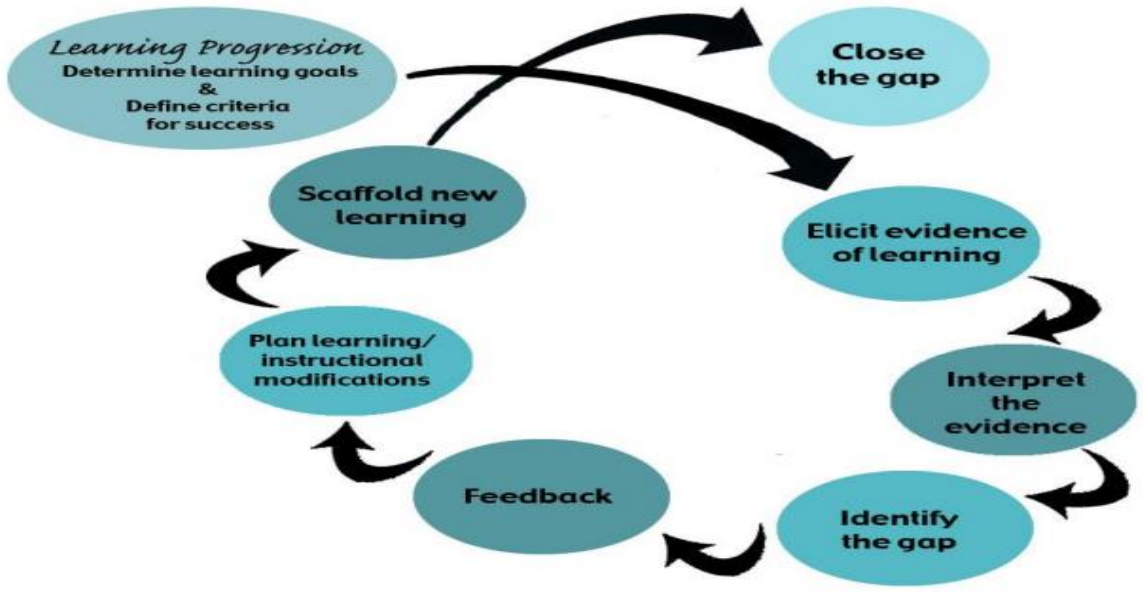

Figure 1: Margaret Heritage's "Formative Assessment Model"[10–12]

To reap the full benefits of formatives assessments, students must be involved. Catherine and Michael[2] observed that "if students are not involved in the assessment process, formative assessment is not practiced or implemented to its full effectiveness." When students are involved, for example, in decision making, they are more responsible in making it work[2]. If they know that their peers are evaluating them, they lean on each other as a resource and thrive for higher standards[2]. However, unlike formative assessments which sometimes involve students, summative assessments are conducted by instructors without the inputs of students. Though it may sound ironic at the first hearing, involving students in the kind of questions in an exam (such as an end of semester exams) may provide positive reinforcement for them. This idea was experimented in a Safety class which had 28 students, including 12 seniors, 13 juniors, 2 sophomores, and 1 freshman. About 86% of the students were males. The approach, has further been explained in the next section.

Methodology

Every student was asked voluntarily to prepare 5 questions, which could be multiple-choice, fill-in-the-blanks, or true-or-false (not more than 2) for the end of semester's comprehensive exam. It was agreed that at least 75% of the question for the finals will come from the pool of questions prepared by the students. To improve participation, extra credit was awarded for preparing the questions. All, but 1 student, prepared the 5 questions. The instructor acted as the expert system to authenticate the exam worthiness of the questions prepared by the students. The motivation for doing this was to get students involved in the summative assessment, and improve their engagement with the class material. Since material engagement cannot be easily measured, the students were asked to complete a survey at the end of the exam to give an insight on how the approach affected their engagement with class materials. The results of the survey, and the exam scores served as the means to assess the assumptions. The outcome of the survey is presented in the next section.

Forty questions were prepared for the final exam. About 80% which, were combination of multiple-choice, fill-in-the-blanks, and true-or-false were questions selected from the pool of questions prepared by the students. Since this is a new research area with no previous research, the proportion of questions selected from the students' questions pool, and the number of questions prepared by each student, were randomly selected so that students will know they are contributing to a greater percentage of the final exam questions. No other justification was assigned to these proportions. The results of the voluntary survey completed by the students after the exam are presented below.

Results and Discussions

The students were asked to respond to the questions in the first column of table 1. Their responses, together with the number of student who responded in each category are shown against each question. Exactly 50% (14) of the survey participants stated that the level of difficulty of the exam was moderate, and 7 (25%) felt that the exam was difficult.

What was the level of difficulty of the exam	**Very easy**	**Easy**	**Moderate**	**Difficult**	**Very difficult**
	1	1	14	7	1
Did any of the questions you prepared appear in the exam?	**No**	**Yes**			
	4	17			
Did the questions you prepared help you in identifying main lecture content?	**No**	**Yes**			
	3	18			
If you were to take this course again, will you like to increase your participation by preparing potential exam questions after every topic?	**No**	**Yes**			
	3	17			

Table 1: Survey Questions and Responses

From the table above, approximately 81% of the respondents confirmed that they saw some of the questions they prepared in the final exam. In addition, about 86% of the survey participants responded that their involvement in the assessments, helped them in identifying the core content of the lecture materials. This may be attributed to the fact that they were aware of the implications of the questions prepared, hence, taking time to dig deep into the lecture materials. This reinforces the sentiments expressed by Catherine & Michael[2] that knowing that peers are evaluating them (answering each other's questions), they lean on each other as a resource and thrive for higher standards[2]. Furthermore, 85% expressed the willingness to get more involved if they were to take the Safety class again, by preparing questions after every topic. The next paragraph explains the other hypothesis concerning the students' participation in the assessment.

The main hypothesis before the exam was conducted was that students' involvement will translate to better learning, which, was evaluated by the exam score in the finals. For this reason, the results of the exam involving students' participation (Student Participation) were compared with that of the first two exams for the same class. These two exams, did not involve any student participation. It is worth emphasizing that the final exam was comprehensive but with study guide. The first two exams (No Student Participation_1 and No Student Participation_2) only covered about 5 chapters each with no chapter overlaps, that is, chapters covered in the first exam were not part of the second exam.

The results from the three exams were each coded into SPSS statistical software. Analysis of variance (ANOVA) was then conducted and the results are shown below. Table 2 shows the descriptive statistics of the three exams. Exam 1 (No Students Participation_1) had the highest mean followed by exam 2 (No Student Participation_2). Table 3 shows that homogeneity of variances cannot be assumed ($p < 0.05$). Table 4 also states that there is a significant difference ($p < 0.05$) between the groups $F(2, 81) = 8.246$, $p = 0.001$. Table 5 shows the Welch for the robust test on equality of mean which indicates that at least one of the means is statistically significantly different from the others.

Since Homogeneity of variances could not be assumed as explained above, Games-Howell post-hoc test was ran with the results shown in table 6. It can be seen that there is no statistically significant difference between the means of the second and final exams. However, there was a statistically significant difference between the mean of the second exam and that of the first exam. Finally, the mean of the final exam was statistically significantly different from that of the first exams as seen in table 6. This means that students did not necessarily learn better during the final exam as hypothesized. Thus, by comparing the results of exam 1 to that of the final exam, (using exam score as the measure of the level of learning), then students did not learn better. However, since there is no statistically significant difference between the means of the second and final exams, the same conclusion cannot be drawn just by comparing the exam scores. The final exam was comprehensive; students had lots of materials to cover, which potentially, could affect the final exam score. The final exam was also conducted during the exam (finals) week when students usually take exams for the other classes they are enrolled in, leaving them with limited time to adequately cover all examinable materials. The next section discusses the conclusions from the research.

Descriptives

ExamScore

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
No Student Participation_2	28	32.1250	4.77188	.90180	30.2747	33.9753	18.00	40.00
Student Participation	28	32.0893	3.43741	.64961	30.7564	33.4222	22.50	37.50
No Student Participation_1	28	35.5179	2.21728	.41903	34.6581	36.3776	30.00	40.00
Total	84	33.2440	3.93279	.42910	32.3906	34.0975	18.00	40.00

Table 2: Descriptive statistics

Test of Homogeneity of Variances

ExamScore

Levene Statistic	df1	df2	Sig.
3.564	2	81	.033

Table 3: Homogeneity of variances

ANOVA

ExamScore

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	217.167	2	108.583	8.246	.001
Within Groups	1066.580	81	13.168		
Total	1283.747	83			

Table 4: Analysis of variance

Robust Tests of Equality of Means

ExamScore

	Statistic[a]	df1	df2	Sig.
Welch	12.700	2	49.384	.000
Brown-Forsythe	8.246	2	61.752	.001

a. Asymptotically F distributed.

Table 5: Equality of means

Multiple Comparisons

Dependent Variable: ExamScore

Games-Howell

(I) StudentParticipation	(J) StudentParticipation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
No Student Participation_2	Student Participation	.03571	1.11141	.999	-2.6504	2.7218
	No Student Participation_1	-3.39286*	.99440	.004	-5.8177	-.9681
Student Participation	No Student Participation_2	-.03571	1.11141	.999	-2.7218	2.6504
	No Student Participation_1	-3.42857*	.77303	.000	-5.3005	-1.5566
No Student Participation_1	No Student Participation_2	3.39286*	.99440	.004	.9681	5.8177
	Student Participation	3.42857*	.77303	.000	1.5566	5.3005

*. The mean difference is significant at the 0.05 level.

Table 6: Post Hoc-test

Conclusion

In this paper, the prospects of involving students in summative assessments have been explored. It was observed that the students appreciated their involvement in the assessment. They expressed the willingness to increase their participation in future assessment when given the chance, with 86% confirming that their involvements in the assessment, helped them in identifying the main ideas in the lecture materials. Furthermore, the final exam did not record the best exam score, which, was used as the measure of students learning as was hypothesized. This may be attributed to a lot of factors such as the volume of materials that the final exam covered: the final exam which had students' involvement was comprehensive covering all the materials covered in exam 1, exam 2, and other additional chapters covered after exam 2. Therefore, more research is needed before a definitive conclusion can be drawn on the effect(s) of students' participation in this form of assessments on exam score, and the level of learning. Finally, this may not be applicable to highly quantitative or advanced level courses. However, it is firmly believed that students can be involved in summative assessments of courses similar to the one used for this study in order to maximize the benefits of the assessments as observed by Catherine and Michael[2].

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