

Impact of formative assessment to summative achievement in pre-graduate students of health sciences

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Summary

Introduction: In addition to summative assessment, educational experts earnestly recommend the use of formative assessment. In this research we show the impact of formative assessment on summative assessment in pre-graduate health science students from four Spanish universities.

Method: The relationship between formative assessment and summative assessment was studied in six subjects of health science degrees (Medicine, Psychology, and Biology). The study was carried out in four Spanish universities. The students voluntarily answered the formative assessment tests at the middle of the academic term.

Results: The students that carried out formative assessment got better summative examination results than the ones that did not, and also, a higher proportion of them passed formative assessment. Finally, the students that passed formative assessment tests obtained better summative marks than the ones that failed them.

Conclusion: Although causal relationships between formative and summative assessment cannot be established from this research, formative assessment was always associated to an improvement of summative achievement.

Key learning points

1. The students that carried out formative assessment got better summative exam results than the ones that did not.
2. Achievement in the formative assessment was a clear predictor for achievement in summative assessment.
3. The positive effect of formative assessment on summative assessment was obtained in the three health science degrees studied: Biology, Medicine, and Psychology.

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Contributors

All the authors were actively involved in the development and implementation of the study. JP was the co-ordinator and the writer of the paper. EB was responsible for collecting the data from the three subjects at Pompeu Fabra University. MTC was responsible for the educational project and collecting the data from the University of Santiago de Compostela. XC was one of the lecturers in charge of collecting the data from the Autonomous University of Barcelona. GO was in charge of collecting the data from the Jaume I University, and also of the final English version of the article.

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Introduction

Assessment of students' academic achievement is a basic step in any educational project. Academic assessment lets us know the success of specific teaching aims (Citas). Furthermore, it is well known that students cope with learning processes according to the particular type of assessment used (Citas).

Educational experts recommend earnestly the use of formative assessment in addition to summative assessment. The purpose of formative assessment is not accreditation, but the improvement of the learning and teaching processes (Citas). There are some centres where formative assessment is institutionalised and is carried out systematically (Citas: U New México, UPF), unfortunately this kind of assessment is not very frequent (citas), especially in Spain. Nonetheless, formative assessment is specially recommended in our country (Cita Editorial EM) and is being implemented in some educational processes in different Spanish universities. We are a group of lecturers that actually use formative assessment regularly and share our academic experiences with the objective of improving our educational projects.

Some time ago, we presented a research related to different experiences about formative assessment in health sciences studies (Cita Congrès Lleida). This work showed a positive relationship between formative and summative assessments. This research presents the impact of formative assessment to summative assessment in different subjects carried out in health science studies in four Spanish universities.

Method

The data presented was collected during the 2000-01 academic year. The subjects studied were the following:

- a) A course of Medical Psychology at the Faculty of Medicine in the Autonomous University of Barcelona (MP-UAB). This course is a Medicine degree subject in second year.
- b) A course of Personality Psychology at the Faculty of Human and Social Sciences in the Jaume I University of Castelló (PP-UJI). This course is a Psychology degree subject in first year.
- c) A course of Physiological Psychology at the Faculty of Psychology in the University of Santiago de Compostela (PhP-USC). This course is a Psychology degree subject in second year.
- d) Three course subjects in the Biology degree at Pompeu Fabra University. The subjects were Zoology, in first year (ZOO-UPF); Genetics (GEN-UPF), in second year; and Ecology (ECO-UPF), in third year.

All of them are compulsory subjects in the respective degrees. The first three cases represent isolated teaching experiences developed by the lecturers responsible for the subjects and the present study. However, the last three cases are part of a global

educational project in which formative assessment is mandatory and is carried out in all subjects of the Faculty of Health and Life Sciences at Pompeu Fabra University.

Although the contexts were different (various universities and different university degrees), the experiences were very similar. Formative assessment was carried out during the academic year, in most cases at middle term, using short answer question tests. If the students passed the tests they obtained a small increase in the final summative mark, but if the pupils did not pass the tests they did not get any negative consequence in the final summative mark. Formative assessment was voluntary and the students got feedback of the results very quickly.

In each case, summative assessment at the end of the academic term was carried out using multiple choice question exams. In two subjects, ZOO-UPF and ECO-UPF, short answer question exams were also used. We would like to point out that only the first summative examination period was used in the collection of the data. In Spain, the pupils that do not pass the first exam may re-sit. This study presents the results of the students that completed the first summative examination.

Firstly, we compared the mean summative examination results obtained by the students that took part in formative assessment with the mean results of the students that did not do formative tests. Secondly, we compared the percentage of students that passed the established standard (marks equal or higher than 5 in a 0-10 scale) between the group that participated and the group that did not participate in formative assessment. Finally, and only with the group that participated in formative assessment, we compared the final summative marks between the students that passed the formative test and the ones that did not.

The comparison of means was carried out using the Student's t test. For the comparison of percentages we used the chi-square test. We subtracted from the final summative mark the increase obtained by the students that passed the formative assessment test.

Results

The percentages of participation in formative assessment among the course enrolled students were: MP-UAB 60,3 %; PP-UJI 39,7 %; PhP-USC 50,0 %; ZOO-UPF 92,1 %; GEN-UPF 60,3 % and ECO-UPF 66,1 %.

Table 1 shows the mean of the final summative examination results of the students that took part together with the ones that did not participate in formative assessment. In all the subjects, the students that completed formative tests obtained higher summative marks.

Table 1

In Table 2 we presented the percentages of students that passed the established standards among the group that participated, and the one that did not, in formative assessment. There was always a higher percentage of students that passed the standard (5 or higher out of 10 points) within the group that participated in formative assessment.

Table 2

The percentages of students that passed the final summative exams, among the group that participated in formative assessment, together with the percentages of the students that did not participate are presented in Table 3. The students with higher examination results in formative tests also obtained higher results in summative exams, although in some cases the differences were non-significant.

Table 3

Discussion

Firstly, we want to point out that, although the academic experiences were developed in very different educational situations (type of university, university degrees, and students) the results are practically identical in all cases. The participation in formative assessment was higher in Medicine and Biology degrees than in Psychology. This could be due to the fact that Medicine and Biology students need a significantly higher mark in the university entrance exam than Psychology students and, commonly, the more brilliant the students are, the higher the motivation for academic achievement.

In relation to the main aim of this research, the results are conclusive. The students that participated in formative assessment obtained better examination results in summative assessment than the ones that did not. This was observed both quantitatively (better mean marks, Table 1) and qualitatively (higher percentage of students that passed the summative tests, Table 2). Moreover, academic achievement in formative assessment was an important predictor of academic achievement in summative assessment (Table 3). The results show that most of the students that got good academic marks in formative assessment also obtained good results in the summative exams. However, failing in formative assessment is not a predictor of examination failure, since the majority of the students that participated in formative assessment, but failed the formative test, were successful in the summative exams. The act of taking out formative

assessment, with or without success, allows the students to receive positive feedback about their learning processes, which in turn may favour the final academic performance.

From our results we cannot extract causal relationships, we cannot confirm that formative assessment was the cause of higher summative achievement. Probably, the more brilliant and motivated students are the ones that participate more and obtain better results in summative assessment. In order to establish causal relationships it is necessary to design educational experiments with random groups, but we find it ethically difficult to put into practice with our students. Nonetheless, the results of this study show clearly that formative assessment is associated positively to summative achievement. Thus, nothing goes against considering formative assessment as beneficial and worthy in any educational project.

Finally, and considering the necessity of a best evidence education (Citas), we believe that our results may promote the use of formative assessment in health science studies. Formative assessment could be used in specific teaching processes developed by university lecturers or, even better, developed within joint educational projects co-ordinated by the faculty government team.

Table 1. Means and standard deviations (SD) of the summative results (0-10 range) obtained by the participants and non-participants in formative assessment (FA).

University and Subject	FA participants		Non-participants		t-test
	N	Mean (SD)	N	Mean (SD)	
MP-UAB ¹	153	6.41 (1.1)	15	5.41 (1.1)	2.99 **
PP-UJI	56	5.33 (1.5)	85	4.21 (1.6)	4.04 ***
PhP-USC	40	6.61 (2.0)	25	5.41 (1.8)	2.41 *
ZOO-UPF ²					
GEN-UPF	38	6.63 (1.0)	19	5.60 (1.1)	3.49 ***
ECO-UPF	39	7.74 (0.9)	20	6.86 (0.9)	3.50 ***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Note: MP-UAB = Medical Psychology-Autonomous University of Barcelona. PP-UJI = Personality Psychology-Jaume I University of Castelló. PhP-USC = Physiological Psychology-University of Santiago de Compostela. ZOO-UPF = Zoology-Pompeu Fabra University. GEN-UPF = Genetics-Pompeu Fabra University. ECO-UPF = Ecology- Pompeu Fabra University.

¹In this subject, two formative tests were carried out, only those students that completed both tests and those who did not complete any of them were included.

²No comparisons were made because practically all of the students completed the formative test in this subject.

Table 2. Number of participants and non-participants in formative assessment (FA) tests, and number and percentage of them that passed summative assessment (SA) exams.

University and Subject	FA participants/ Passed SA (Percent.)	Non-participants/ Passed SA (Percent.)	Chi ²
MP-UAB ¹	153 / 138 (90.2 %)	15 / 9 (60.0 %)	13.39 **
PP-UJI	56 / 40 (71.4 %)	85 / 36 (42.4 %)	11.48 ***
PhP-USC	40 / 32 (80.0 %)	25 / 14 (56.0 %)	4.28 *
ZOO-UPF ²			
GEN-UPF	38 / 36 (94.7 %)	19 / 14 (73.7 %)	5.21 *
ECO-UPF ³			

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Note: MP-UAB = Medical Psychology-Autonomous University of Barcelona. PP-UJI = Personality Psychology-Jaume I University of Castelló. PhP-USC = Physiological Psychology-University of Santiago de Compostela. ZOO-UPF = Zoology-Pompeu Fabra University. GEN-UPF = Genetics-Pompeu Fabra University. ECO-UPF = Ecology- Pompeu Fabra University.

¹In this subject, two formative tests were carried out, only those students that completed both tests and those who did not complete any of them were included.

²No comparisons were made because practically all of the students completed the formative test in this subject.

³All the students passed summative assessment in this subject.

Table 3. Number of students that passed or failed formative assessment (FA), and the number and percentage of them that passed summative assessment (SA).

University and Subject	Passed FA/ Passed SA (Percent.)	Failed FA/ Passed SA (Percent.)	Chi ²
MP-UAB ¹	138 / 127 (92.0 %)	15 / 11 (73.3 %)	5.35 *
PP-UJI	32 / 27 (84.4 %)	24 / 13 (54.2 %)	6.13 *
PhP-USC	21 / 18 (85.7 %)	19 / 14 (73.7 %)	0.90
ZOO-UPF	12 / 12 (100 %)	46 / 36 (71.7 %)	4.37 *
GEN-UPF	17 / 17 (100 %)	20 / 18 (90.0 %)	1.79
ECO-UPF ²			

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Note: MP-UAB = Medical Psychology-Autonomous University of Barcelona. PP-UJI = Personality Psychology-Jaume I University of Castelló. PhP-USC = Physiological Psychology-University of Santiago de Compostela. ZOO-UPF = Zoology-Pompeu Fabra University. GEN-UPF = Genetics-Pompeu Fabra University. ECO-UPF = Ecology- Pompeu Fabra University.

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