Emergo: Academic Performance Assessment and Planning with a Data Mart

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Abstract. National-level, objective assessment in higher education has been a practice in Brazil since 1996, surviving political shifts that frequently dismantle public policies. This paper presents the Emergo Project – the assessment of Psychology students using a data mart with multiple-choice questions from national exams and students' answers. We run two annual examinations, giving individual feedback and discussing aggregate results with faculty and students. We identified patterns for the evolution of correct answers across semester enrolled – Growing, Decreasing, Peak, Constant, and Other. Actual results in the national exam suggest that the feedback and discussions might have helped achieving superior performance standards.

Keywords: Assessment, Higher Education, Empowering, Cognition, Developing countries.

1 Introduction

Objective assessment of cognitive learning has been part of a national policy for higher education in Brasil since the National Course Exam (ENC – Exame Nacional de Cursos), from 1996 to 2003. The initiative faced strong opposition from irrationalists, but also received objective criticism.

Landeira-Fernandez and Primi [1], for instance, used ENC questions to assess first- and last-year Psychology students from 4 universities. They showed that the results expressed better the "cultural capital [that] the students bring to the university" [2] than course quality.

Schwartzman [2] approaches politics, policy, implementation, costs, and impact of the ENC initiative. He accounts for the political shift that led to a new initiative, since 2004, called the National Exam of Student Performance (ENADE – Exame Nacional de Desempenho do Estudante).

Leaders of the new political establishment diverged from their antecessors in several aspects, but recognized the quality of the exam's questions [3]. This quality and the public availability of the exam's questions prompted us to create the Emergo

project – an instrument for planning and assessment of a specific undergraduate course of Psychology.

Students that participated in Emergo achieved higher performance standards than the ones that didn't participate. We see this positive correlation as evidence of the project's effectiveness. The next sections describe the project's design and implementation, together with a discussion of its results and impact.

2   Emergo: Design and Implementation

The validity of the national exams for measuring cognitive performance was a fundamental design assumption for Emergo. We built a data mart and interface to store exam questions and students' answers. The resulting star schema [4] has the main dimensions EmergoRound (date), Person, SemesterEnrolled (a number from 1 to 10), Question, Topic (or subject area), and Course. The facts in the star-schema are expressions of the results achieved by students, crossing several dimensions. These were the main technological aspects of the project.

On the human-organizational side, we planned a couple of meetings with all students and faculty, in preparation for Emergo. We didn't face student boycott such as in the national exam itself, but there was some resistance to the identification of answers (something clearly irrational, since the university generally posts identified grades on the walls with no opposition). We also planned a couple of meetings after the exam to make sense of the results.

We composed the Emergo exams with 40 5-choice questions from previous national exams – unknown to the vast majority (if not all) of students. Topics were balanced similarly to the composition of the national exam. The main differences to the national exam were the omissions of essays and general (socioeconomic and infrastructure) questions. For an illustration, this was question 6, the shortest in the EmergoRound 2003 (from question 1 in ENC 2002, with correct answer C):

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According to Jean Piaget, the epistemic subject is
(A) the subject himself, independent of the object.
(B) determined by the object along his development.
(C) what is common to all subjects of knowledge.
(D) identical to the kantian transcendental subject.
(E) each subject of knowledge, taken individually.
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We run two Emergo rounds, the first in 2002 (when the course was going to graduate its first psychologists and preparing for its first actual national exam, exclusive of graduating students) and the second in 2003. The data mart and the interface built allowed us to give prompt feedback to students and faculty.

3   Results and Discussion

Table 1 presents the number of respondents (according to semester enrolled) and percent of correct answers for both rounds. It is not possible to make a direct

comparison between the 2 rounds because the question sets had different levels of difficulty and the students are different. In each round, however, there is a growing trend along the semesters, with irregularities. For instance, 9th-semester (not 10th-) students had the highest scores in both rounds and 5th- and 6th-semester students in 2002 have beaten their colleagues from 7th and 8th semesters.

Table 1. Emergo respondents and correct answers by semester enrolled in both rounds

Semester enrolled		1	2	3	4	5	6	7	8	9	10	Total
Round 2002	Respondents	18	13	18	15	7	8	19	13	17	13	141
	% correct	36.9	40.5	43.7	43.7	50.9	52	50.9	50.5	53.8	49.5	46.7
Round 2003	Respondents	31	26	16	9	14	18	25	25	14	8	186
	% correct	27.6	30.5	35.1	30.2	37	39.9	37.7	39.8	41.2	40.4	35.2

We identified patterns for the evolution of correct answers across semester enrolled – Growing, Decreasing, Peak, Constant, and Other. In 2003, the quantity of questions that adhered to those patterns were 9, 7, 6, 10, and 7, respectively. Figure 1 gives examples. The bars represent percents of correct answers. A horizontal line marks the expected success rate for pure chance (20%).
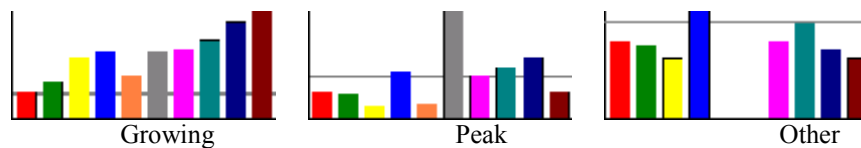
Fig 1. Examples of performance patterns by question across semester enrolled.

Collective sessions with students and faculty were dedicated to feedback on those aggregate results, as well as to propose questions for reflection. We proposed that students and professors should discuss the questions pertaining to their disciplines. They should consider plausible explanations for right and wrong answers and the patterns exhibited – we suggested hypotheses such as "a Peak question is one strongly affected by memorization (in the peak semester)", "a Growing question suggests a cumulative expertise along the semesters", and "a Decreasing question reveals confusion acquired by the students along their way from freshmen to seniors".

Note the case Growing in Figure 1: the success level starts by the chance rate in semester 1 up to a high rate in the 10th semester. The Peak question shows a single semester – the 6th – significantly above the chance rate. Case Other, still in Figure 1, corresponds to the question 6/2003 presented in the previous section. It seems plausible that students were misled for some acquired conceptual confusion – only 4th semester students performed better than chance, and all students from the 5th (14 subjects) and 6th semesters (18 subjects) chose the wrong answer. Why was that? Our point was not to provide ready answers, but to stimulate reflection.

We also gave individual feedback. Figure 2 is an excerpt of the performance report each student received (in this case, from someone from the 4th semester). It shows, for

each question, the correct answer (Gab), the respondent's answer (Você), and the count of answers for each alternative from all students from the same semester.
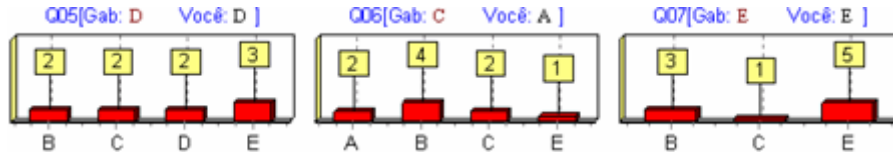

Fig. 2. Example (excerpt) of individual feedback report with same-semester counts.

Note that the question 6/2003 is the one in the middle. Four out of 9 students chose the wrong alternative B. Our goal was not to reach a conclusion about the reasons for the error, but to stimulate students and faculty to reflect and discuss the issue. We hold that, in a systemic view [5], the emergence or submergence of a system or a system's property (in our case, the property was *collective excellence in cognitive performance*) depends on the bonds between the system's components. By challenging the students' cognitive capacity and then giving them feedback and provoking discussion and reflection, we've empowered them and strengthened the communication bonds that could help excellence in cognitive learning to emerge.

We ran Emergo twice, just before the 2 earliest participations of our graduating students in the ENC. ENC results were very welcome by the community, as they exceeded expectations. Figure 3 plots the average scores of those students in ENC in relation to the national average and standard deviation. Then Emergo was discontinued for institutional disinterest. Only one national examination of Psychology was taken after that, already under ENADE. The national system has changed – e.g., now seniors *and freshmen* take exams (but Figure 3 shows results of 2006 from seniors only, for comparability). The numbers suggest that our systemic hypothesis – Emergo strengthened the bonds necessary for an emerging academic excellence – is plausible, but more longitudinal data is necessary to allow for a conclusion. The next ENADE for Psychology will be taken in November 8, 2009.

4   Final Remarks

We described Emergo, an instrument for planning and assessing cognitive performance using questions from Brazilian national exams in a data mart. The instrument was applied to a specific undergraduate course on Psychology, with good results. The data mart was not meant to provide definitive answers to the community it served, but to elaborate meaningful information instead. The computer system did the data manipulation and the people did the thinking.

Emergo expresses student learning performance only in the cognitive aspect. It may be adopted, nonetheless, as part of a broader scheme for measuring effectiveness of undergraduate education as proposed, for instance, by Dunn et al. [6].
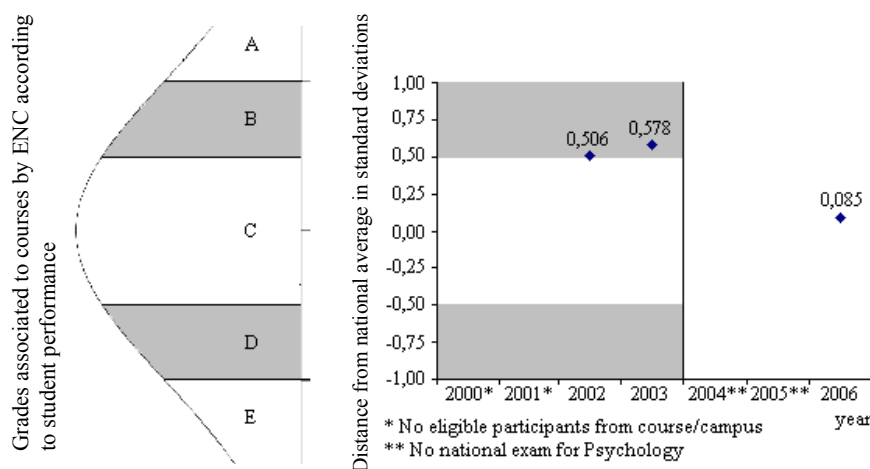
Fig. 3. Relative performance of graduating students of Psychology, Univali at Biguaçu-SC, in the Brazilian national examinations ENC (2002-03) and ENADE (2006).

Acknowledgments and Declaration of Authorship

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