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Participatory grading in a blended course on Multimodal Interface and Systems.

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Abstract. As part of a project aiming to demonstrate feasibility and meaningfulness of on-line and blended P^{3}BL (Problem, Process & Project Based) design educational processes (Interaction Design, Design or the Experience, etc.), in this paper we present and discuss a participatory-grading procedure that has been designed to assess the intermediate tests of a course on "Multimodal Interface and Systems". The results, characterized by lights and shadows, provide useful guidance for the future to achieve a participatory monitoring of the full educational experience.

Keywords: Participatory Grading, Assessment, P3BL, On-line and Blended Design Processes, Design Inspired Learning, Organic Process, Design for the Experience.

1 General Introduction

Since several years, at the Tor Vergata University of Rome, we are engaged in a research aimed at promoting the mediation of technologies in on-line and blended design-based courses that implement a P^{3}BL (Problem, Process & Project Based) philosophy [1] inspired by the organic process [2]. It is worth to stress that the third P points out that *problem* and *project* are not left orphans of the *process* but, rather, the design of this latter is considered an essential and distinctive component either of the educational process and of the skills that a student is expected to acquire, especially as far as the ability to define and redefine "on action" the design process (meta-design) is concerned. Such skills, in fact, due to the complexity of contexts and activities in which one is expected to operate nowadays, assumes a considerable relevance not only in design-based educational process but, more in general for all educational processes [3]. In our opinion meta-design skills should be considered as important as traditional "literacy and numeracy" and more relevant than the so-called soft skills [4-20].

The experience accumulated in the recent past, during many P^{3}BL educational cycles, carried out in very different fields of design (Interaction Design, Design for the experience, Technology Ehnanced Learning, Photography) gave us the opportunity to collect interesting observations and, as well, suggestions on how to enhance well known design methods and implement more meaningful and effective

online educational processes by means of TEL (Technology Ehnanced Leaning) [5,6]. We came also to the conclusion that, due to the complexity of P^3B educational processes, the approach to assessment and evaluation needs to be deeply revised to allow for a monitoring of all dimensions of an educational experience (e.g. social interaction, emotional interaction, etc.) [7,6]. Of course, this requires a quite big effort that we took only since a relatively short time and that will last for many years to come to be fully exploited. As part of such effort, in this paper we present and discuss a grading approach on which we started to work three years ago: *participatory grading*.

It is not by chance that hard-sciences have a long tradition in the use of the peer evaluation procedure that, rightly or wrongly, is considered one of the driving forces of the scientific and technological progress. In fact, when not diminished by a superficial or interested action of the reviewer, and is carried out according to the dictates of ethics and scientific method, it comes out to be one of the most rapid and effective ways to get aware of limitations of her/his own work and collect expert advices on how to improve it. For this reasons, since more than two decades, peer assessment is experiencing also a growing interest in education [8]. It has been used in many domains either for the evaluation of the entire educational process, to asses a considerable and heterogeneous "qualities" of various types of student-works and, finally, to assess quantitatively tests (peer grading) [9].

Peer evaluation, in general is considered by educators to have the following advantages [8,10,11]:

"- encourage reflection and thereby promote skills in self-assessment ;

- enhance greater meta-cognitive self-awareness;

- increase student motivation by fostering a sense of responsibility and ownership for their peers' learning;

- promote independent learning and reduce dependence on staff as 'the experts';

- improve self-confidence;

- provide valuable experience and preparation for the professional workplace"

In this article we will focus on a variant of the peer grading, which differs also from the participatory examinations [12], and that we call *participatory grading*. In it the opinion of the teacher is integrated with that of peers.

2 Introduction to the case studies

The case studies presented in this paper concern two editions of the course on "Multimodal Interfaces and Systems" of the bachelor degree in Media Science and Technology, held during the academic years '09-'10 (32 students) and '10-'11 (14 students) at the Tor Vergata University of Rome. The courses were focused on the Design for the experience. During the first part of the course the teacher gave a series of lectures on the evolution of the HCI - from the origin to the design for the experience – and, as well, of the rapid prototyping (software, electronic and mechanical). The lectures were accompanied by few practical sessions held in the lab and, whenever the students felt the need, by focused brainstormings.

In parallel, students were introduced to the design and delivery of tests, one aspect of the design processes that we deem critical, since its relevance is too often underestimated. Due to the initial inexperience of the students on many aspect of the design process we decided to focus the test activity on the measurement of individuals' characteristics and styles (experiential styles [7]). A choice, this, which does not affect the evolution of the design process, but rather foster the acquisition of an expertise that will turn to be very useful later, during the monitoring and evaluation cycles that are part of any good design process and project work development.
After three weeks from the beginning of the course a P^3B design cycle started, and were conducted almost entirely online, till the prototyping phase. This choice was motivated by the need to expand the time available for the process. Face to face meetings were used only for periodic and collective intra- and inter-teams brainstorming and reviews.
The students of the course on "Multimodal Interfaces and Systems" are usually asked to pass two intermediate tests that, excluding teamwork presentations (critical discussions of test activities and of project works), are the only formal verifications provided by the educational process.
The first of these tests is based on open questions (4 mandatory questions plus an optional question and the sketch of a concept map, optional too) related to the contents of the theoretical lectures. The second is aimed to assess the ability to use UML [13] to describe the various aspects of technologically augmented experiential processes (e.g.: eating pizza in a smart restaurant or whatever).
The participatory grading were introduced to assess such intermediate tests. We aimed at verifying if the use of the participatory grading procedures could: a) contribute to increase the level of responsibility toward, and involvement into, the educational process; b) foster a deepening of the topics covered by the lectures. One of the assumptions of the participatory grading, and more in general of the peer grading, in fact, is that in order to judge objectively, you must have a reasonable familiarity with the topics on which the tests are based.

3 The Participatory Grading

The participatory grading, unlike the peer grading, takes into account also the opinion expressed by the teacher. In our case such opinion is taken as a reference, starting from which the final score is worked out taking into account the result of the peer grading. We consider this approach particularly suitable and useful every time the students have no special familiarity with the peer review process, nor with the content of the course, like in the case studies discussed here.
In detail, the final grade is determined by three factors:
- the teacher's grade;
- plus the difference between the teacher's grade and the average grade assigned by the peer reviewers (usually three), time a suitable weighting factor, w;
- minus the sum of the distance between all grades assigned by the reviewer with respect to those assigned by the teacher, measured in unities of the standard deviation of the average distribution of such distances.

In practice, the last factor counteracts the second one: if by chance a peer-reviewer decide to assign particularly high and unjustified grades to her/his peers, this would determine a consistent distance from the teacher's grades with the result to get a negative correction to her/his own grade.
To stimulate further the objectivity of the assessment we have introduced a rewarding mechanism that assigns a bonus when the distance from the teacher's grade remains below a given threshold. Obviously the teacher's grades are not known by the students, who are aware only of the mechanism used to determine the final grade.
Moreover we have also introduced a penalty to discourage the non-delivery of the revisions.

In the case of the first test (the one dealing with the contents of the theoretical lectures), consisting of open-ended questions, students were not given specific guidelines for revision. We just asked to evaluate the correctness of the response on a scale ranging from 0% to 100%.
Instead, as far as the second test, due to the limited familiarity of the students with the UML, we provided them an evaluation grid organized as follows:
- originality of the proposed process, developed around the theme assigned: 10%
- consistency among diagrams: 10%
- use case diagrams (grammar and syntax, ability to synthesize, completeness): 20%
- static view: class and, possibly, object diagrams - (grammar and syntax, ability to synthesize, completeness): 20%
- dynamic view: activity diagrams - (grammar and syntax, ability to synthesize, completeness): 20%
- view of interaction: sequence and state diagrams - (grammar and syntax, ability to synthesize, completeness): 20%
- nodes and/or components diagrams (grammar and syntax, ability to synthesize, completeness): 10%

Note that the full scale is 110%, to allow recovery of any deficiencies in the limit of 10% of the total.
During the academic year '09-'10, the participatory grading has been carried on without the help of an online environment. The student works were photocopied and distributed to peers for evaluation (three for each peer) without obscuring the name of the author. After the collection of ratings data were entered in a standard spreadsheet and analyzed using statistical tools made available by the software. In the academic year '10-'11, however, to study the possibility of using the participatory grading as part of on-line P^3BL processes, we have integrated such grading method into the test module of our on-line learning environment, LIFE [14]. The transfer of the participatory grading on-line allowed us, among other things, to assign the revisions randomly and anonymously.
It is worthwhile to note that in the case of the test based on open-ended questions, students were provided with a copy of their work and were asked to insert the answers into an on-line form to make them available to peer reviewers (of course after a check on the correspondence with the original text). As far as the test on UML, the student works were scanned, anonymized and made available for review through an appropriate download mechanism.

Students of the '10-'11 cohort, at the end of the course, were asked to express their opinion on the participatory grading by filling in a questionnaire.

4 Results and discussion

Table 1 synthesizes the results of the participatory grading that took place during the academic years '09-'10 and '10-'11, as described in previous paragraphs.

Table 1. Legend: C = mean value of the quantity [(peers' grade – teacher's grade)/teacher's grade] for the compulsory part of the test; O = as C but for the optional part of the test; OA = as C but for the whole test; M = mean value of the distribution of the distances between peer reviewers' and teacher's grades (in points); SD = standard deviation of the distribution of the distances between peer reviewers' and teacher's grades (in points); Stud% = percentage of students that obtained a reward for their "objective" grading (see body of the paper).

	C	O	OA	MD	SD	Stud %
'09-'10 test I	41%	60%	44%	2.1/10	1,1	15%
'09-'10 test II	1%	220%	21%	1/11	1,1	46%
'10-'11 test I	23%	58%	29%	2/12	1,9	54%
'10-'11 test II			52%	2/11	1,1	27%

It comes out that, on average, students tend to evaluate the works of their peers more generously, 21% to 52% more, than the teacher [see also ref. 12] (this observation suggested us to assign a value of 0.2 to w, see paragraph 3). Going into the details, however, the two different cohorts showed contrasting trends. The students of the cohort '09-'10, in fact, after a particularly generous evaluation of the first test, improved greatly their peer reviewing performance and on the occasion of the second test, if it were not for the optional part, their average grade would had been in almost perfect agreement with that of the teacher. In any case, the difference between the mean of the peers' grade and teaching's grade decreased from 44% to 21% and the distance between the means of the distributions decreased from 2.1 points of 10 to 1 point out of 11, while the standard deviation remained equal to 1.1 points. As far as the second test such value makes teacher's and peers' grade distributions compatible within one standard deviation. At the same time the number of students who received a reward, because the average distance between their grade and the teacher's grade were less than one standard deviation, increased from 15% to 46%.
Quite different is the situation observed during the academic year '10-'11. The grades assigned by the students in occasion of the first test were closer to those of the teacher than the previous year, especially as far as the compulsory part of test was concerned; the standard deviation, however, was higher which, in turn, allowed to 54% of

students to obtain the reward for "objective" grading. In the case of the second test the situation was reversed, on average the peers assigned a grade 52% higher than that of the teacher, while the standard deviation of the distribution decreased, features that suggest the existence of what one might call a "systematic error". Of course also the percentage of the rewarded students dropped to 25%. The reason for such behavior cannot be easily extracted from the data of table 1, and can be found in the delay with which the students of this cohort began the design process (due to the high pressure of concurrent exams) and, thus, in the lack of an adequate familiarity with UML to successfully deal with the second intermediate test.
No differences between the two cohorts, however, can be significantly ascribed to the modification in the participatory grading procedure that we adopted during the academic year '10-'11: on-line vs. off-line procedure, anonymous vs. manifest author. This proves that the participatory grading can be seamlessly integrated within a design process carried out in blended (or on-line) configuration and that the counteracted mechanism through which the final grade is worked out is robust enough not to be affected by the knowledge of the authors.
As indicated at the end of the preceding paragraph, the students of the academic year '10-'11 were also asked to fill out a questionnaire to express their opinion on participatory grading. Using a four levels scale - definitely not, no more than yes, yes more than no, definitely yes - we asked the students:
a) if they liked the participatory grading
b) if such activity allowed them to take more of their own level of understanding and knowledge
c) whether or not this activity had encouraged the deepening of the topics covered by the lectures
d) if they felt more involved in the training process
e) if they got more responsible because of the participatory grading

Table 2. results of the questionnaire filled in by the students of the academic year '10-'11

	d. not	more no	more yes	d. yes
a	18%	36%	36%	10%
b	9%	18%	55%	18%
c	9%	55%	27%	9%
d	18%	27%	46%	9%
e	27%	27%	46%	0%

The answers to question b) - except for a physiological 25% of the students that every year feel not satisfied with the course delivery (usually are students who are struggling to deal with "open" educational process, that like and need, instead, to follow very linear trajectories and that, probably, are not suitable to attend P^3BL process) - indicates that the participatory grading is considered a method able to

induce a greater awareness on her/his own level of knowledge and understanding of the topics covered by the course.

However, such increase in awareness does not seem to encourage the deepening (question c) and only in a minor part of the students (45%) is able to generate a greater sense of responsibility (question e). This latter, then, as revealed by the comments, is induced mainly towards others than towards her/himself.
Slightly more positive is the effect on sense of involvement and participation in the educational process (question d).

5 Summary and Lesson Learnt

Overall we are facing with a landscape characterized by lights and shadows:

- on the one hand we can state that there are no technical or methodological difficulties in the introduction of participatory grading within blended and/or online design-based educational processes;
- the grading procedure is sufficiently reliable and robust to make the request of anonymity not compelling, though it seems that it should be explained to the students in greater details (maybe using practical examples);
- surely the participatory grading helps in becoming conscious of her/his own level of knowledge and understanding and makes feel more involved in the educational process;
- it does not seem able, however, to make feel the majority of students more responsible;
- it is considered a time consuming procedure (see also ref. 12, 15].

It is not easy, on the solely bases of the comments to the questionnaire, to fully understand the reasons for these not completely positive results. Certainly it is a methodology that requires an additional effort to the students that have to spend more time to study, otherwise it would not be easy for them to act as peer reviewer. This is an aspect of the participatory grading not appreciated by some students, despite the largest majority of them recognize the usefulness of the method in raising awareness. Perhaps, it is worth stressing that, in general, students of courses carried on "face to face" tend to have no particular sympathy for the online activities that are considered time-consuming. Such feeling is not unexpected and it is fully shared by most of the teachers. In fact, the daily practice demonstrates that on-line and blended courses, when carried on following robust and advanced pedagogical criteria, tend to require more energy and skills with respect to equivalent courses carried on face to face.

Other problems that seems to emerge from the comments to the questionnaire concerns the trust toward their own peers, the confidence in themselves and, in part, in the procedure. These outcomes are in fully agreement with what has been observed in [12,16,17]. As with the practices of scientific peer review, it may happen also to students not to trust in their peers or to feel themselves inadequate do review a given paper. While in scientific peer review procedure if you do not feel appropriate you can kindly reject the assignment, in the case considered here the students can not refuse their assignments and compulsory have to face with their own level of understanding of the subject and with the responsibility to contribute to the grade of their peers. It may be because of such insecurity that students tend to be stricter with

their best peers and more generous with weakest ones (compared to the teachers' grade) [18].

Trust is definitely an aspect of the participatory grading on which one can work on by providing more information [19]: more detailed guidelines (which in the case of very complex topics may give rise to the production of an e-agenda and grids of assessments) and explanations on how the various steps of the procedure concur to the definition of the final grade.

It is also likely that the degree of confidence in themselves and their peers can be further increased by enlarging the involvement of the students: not only in grading intermediate tests, but fostering their involvement in a more general and constant action of participatory monitoring aimed at assessing all relevant dimensions of a collaborative educational process [7]. This will be the goal of the work we intend to carry on in the close future ... without forgetting to pay attention to the time factor, since: time is always the king!

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