

A Simple E-learning System based on Classroom Competition

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Abstract. We present an e-learning system based on online forms that allows teachers to easily organise competitions in a classroom. This system is used in a preliminary study to evaluate whether cooperative competition is positive or not in education, and to identify which are the characteristics this kind of activity should have to be no harmful for students, motivating and helping them in their learning process.

Keywords: education, e-learning, student motivation, competition, cooperation.

1 Introduction

In the literature, there is a controversy about whether the use of competition in education is positive or not [1]. There are authors who are strong supporters of its benefits, claiming that a well-organised competition challenges its participants to give their best, and thus enhances the students' motivation, self-esteem and learning [2-5]. Other authors, however, state that competition damages the learning process by forcing students to focus on goals instead of on the process itself, and also argue that the stress to which students are exposed has negative effects [6-7].

Despite this controversy, there is a more general agreement that team competition is less harmful for students, and can effectively improve their learning skills. Cooperative goals make students take better care of their responsibilities and tasks for the sake of their groups [8]. Moreover, anonymous rather than face-to-face competitions are commonly preferred [9]. A "healthy" competition is defined in [10] as a short activity where outcomes have to be trivial, and which has to be focused on the process rather than on the outcomes.

Following these principles, we propose a simple e-learning system based on online forms that allows teachers to easily organise cooperative competitions in a classroom. This system is used in a preliminary study to evaluate whether cooperative competition is positive or not in education, and to identify which characteristics this kind of activity should have to be no harmful for students, motivating and helping them in their learning process.

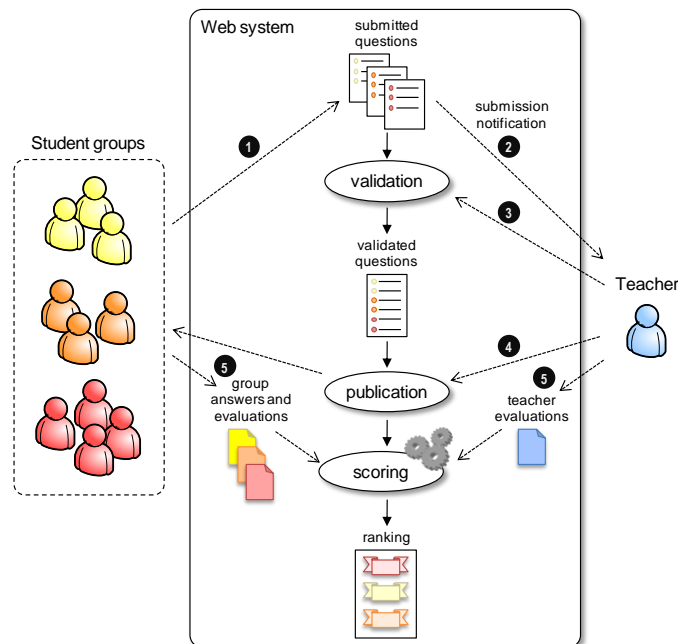
The rest of the paper is organised as follows. Section 2 presents the system implemented to organise cooperative competitions. Sections 3 and 4 describe the conducted case study and discuss preliminary results. Finally, Section 5 ends with some conclusions, and depicts some future research lines.

2 System Description

In order to allow teachers to organise competitive e-learning activities with little effort and no need of sound technical knowledge in Computer Science, we propose a simple Web system based on online forms automatically created with Google Docs¹.

A competition created with the system is composed of two stages. In the first stage, groups of students pose several multiple-choice questions about the last topic studied in the classroom, and submit them via online forms. The teacher is notified when new submissions are placed on the system. Then, he corrects and evaluates the received questions. Evaluated questions are sent to the student groups. In the second stage, each group is requested to answer the questions prepared by the rest of the groups, and also to evaluate their quality based on several established criteria. According to the number of questions correctly answered, and the question evaluations given by the teacher and the rest of participants, each group is assigned a score. The weights of these criteria in the scoring formula are set by the teacher. The scores of all groups are published after each round so students know how they are going in the competition. This is done through several rounds, covering different subject topics. The final score of a group is the sum of its scores in the different rounds.

Figure 1. Tasks conducted during a competition round: 1) question submission by student groups; 2) notification of question submissions; 3) teacher's validation of questions; 4) Web publication of questions; 5) student groups' answering and evaluation, and teacher's evaluation of questions.



¹ Google Docs, <http://docs.google.com>

The performance of participants in a contest is evaluated as follows. Let G be the groups of students who participate in the competition. The total number of groups is $|G|$. Let t be the teacher of the subject who evaluates the questions submitted by the different groups. We define $S = G \cup t$ as the set of subjects involved in the competition, i.e., the groups of students and the teacher. Let Q be the set of questions a group submits at the current round of the competition, and let $|Q|$ be the number of submitted questions per group. By $q_{g,i}$ we denote the i -th question submitted by group g . Let $\text{eval}(s, q): S \times Q \rightarrow [0,10]$ be a function that corresponds to the evaluation given by subject s to question q . Let $\text{answ}(g, q): G \times Q \rightarrow \{0,1\}$ be a function that is 1 if group g answers correctly question q , and 0 otherwise. Finally, let g_a be the active group, i.e., the group whose score we want to compute at current stage of the competition. The score obtained by group g_a is a function $\text{score}(g): G \rightarrow [0,10]$ defined as:

$$\begin{aligned} \text{score}(g_a) = & \theta_{\text{eval}} \frac{1}{|Q|} \sum_{i=1}^{|Q|} \text{eval}(t, q_{g_a,i}) + \\ & + \theta_{\text{diff}} \left(10 - \frac{\sum_{g \neq g_a} \sum_{i=1}^{|Q|} |\text{eval}(t, q_{g_a,i}) - \text{eval}(g, q_{g_a,i})|}{|Q| \cdot (|G| - 1)} \right) + \\ & + \theta_{\text{answ}} \cdot 10 \cdot \frac{\sum_{g \neq g_a} \sum_{i=1}^{|Q|} \text{answ}(g_a, q_{g,i})}{|Q| \cdot (|G| - 1)} \end{aligned}$$

where $\theta_{\text{eval}}, \theta_{\text{diff}}, \theta_{\text{answ}} \in [0,1], \sum_i \theta_i = 1$, are fixed parameters that weight the influence of three factors considered on the computation of the score value: the professor's evaluation of the active group's questions, θ_{eval} , the difference between such evaluation and those provided by the rest of the groups, θ_{diff} , and the percentage of correct answers given by the active group for the questions of the rest of the groups, θ_{answ} .

The values of the fixed parameters taken in the conducted experiment were $\theta_{\text{eval}} = 0.5$, $\theta_{\text{diff}} = 0.3$, and $\theta_{\text{answ}} = 0.2$. This choice of the values assures that there are not unfair evaluations among students. Since student evaluations are compared with the teacher's evaluations, actual better student questions obtain higher evaluation values. The parameter setting also assures that there is a high probability that changes may occur in the rankings of the groups until the last round of the competition. In fact, during the contest, there were significant changes in the classification table through the rounds. Thus, almost all students felt they had the chance to win.

3 Preliminary Experiments

We conducted a study by using the proposed system in order to evaluate whether cooperative competition is positive or not in education, and which characteristics of this kind of activities are not harmful for students, motivating and helping them in their learning process. We hypothesised and empirically demonstrated that a competition in an e-learning environment can be beneficial if it is designed following

a number of principles, such as having a symbolic or little value prize, a short duration, and a goal clearly set into the learning process instead of into the results.

The experiment was performed in a subject called Applied Informatics, which is taught to Chemical Engineering first year students at Universidad Autónoma de Madrid, Spain. The subject contents include theoretical and historical aspects about Computer Science, as well as a practical part involving MATLAB² programming. 77 students, distributed in 17 groups of between 4 and 6 members each, participated in the activity. The competition itself consisted of three two-week rounds. In each round, the student groups had to perform two tasks as described in Section 2. In the first task, they had to prepare 4 theoretical multiple-choice questions about the last topic studied in class, and submit them to the Web system. In the second task, each group was requested to answer the questions prepared by the rest of the groups, and also to evaluate their quality based on several criteria established by the teacher. The contest winners got a (symbolic) surprise gift and the congratulations from their classmates.

In order to keep track of the study, students were asked to fill in questionnaires at several points of the competition. They had to complete questionnaires after each round of the contest that were intended to measure the tasks difficulty, and the students' perception about the utility of the activity. Table 1 shows a summary of their responses.

Table 1. Some response statistics obtained from the intermediate questionnaires.

Question	Answers	Percentage of responses
How useful was the last competition round for you to review/study the subject?	Useless at all/Not enough useful	6%
	Neither useless nor useful	35%
	Useful/Very useful	59%
How difficult was writing the questions by your group?	Very difficult/Difficult	18%
	Neither difficult nor easy	49%
	Easy/Very easy	33%
How difficult was answering the questions of the rest of the groups?	Very difficult/Difficult	26%
	Neither difficult nor easy	54%
	Easy/Very easy	20%
How difficult was evaluating the questions of the rest of the groups?	Very difficult/Difficult	59%
	Neither difficult nor easy	35%
	Easy/Very easy	6%
How much time did your group spend writing your questions in the last competition round?	Less than 30 minutes	22%
	Between 30 minutes and 1 hour	55%
	Between 1 and 1.5 hours	17%
How much time did your group spend answering and evaluating the questions of the rest of the groups in the last competition round?	Less than 30 minutes	3%
	Between 30 minutes and 1 hour	36%
	Between 1 and 1.5 hours	39%
	Between 1.5 and 2 hours	16%

² MathWorks: MATLAB and Simulink for Technical Computing, <http://www.mathworks.com/>

After the competition, there was a final questionnaire in which students were asked the name of their group, in order to allow measuring statistics relating each group ranking position in the contest with its provided questionnaire responses. Table 2 shows a summary of the responses provided to questions aiming to analyse the social atmosphere during the competition, and the students' motivation and enjoyment in the activity.

Table 2. Some response statistics obtained from the final.

Question	Answers	Percentage of responses
How was the atmosphere in the group during the activity?	Very bad	0%
	Bad	0%
	Good	53%
	Very good	47%
How was the atmosphere among the groups during the activity?	Very bad	0%
	Bad	6%
	Good	76%
	Very good	18%
What was your main motivation during this activity?	The surprise prize	18%
	Reviewing and studying the subject	29%
	The pride of being first	47%
	Gaining recognition from my classmates	0%
	Other	6%
How much did you enjoy this activity?	Not at all	6%
	A little	35%
	Neither a little nor much	41%
	Quite	18%
	Much	0%

4 Discussion

Analysing the responses provided in the questionnaires, we can conclude that the proposed activity was beneficial for the students. 59% of the participants admitted that the activity was quite useful, since it made them to review and study the subject in advance, before the final exams. In contrast, only 29% of the participants stated in the questionnaires that their main motivation in the competition was the study of the subject. 18% of them said that the prize was their most important motivation, and, surprisingly, 47% claimed that they were putting an extra effort in the activity because of their proud of being first in the competition. We achieved our goal of designing a not too long activity. 77% of the participants spent less than 1 hour per round to write their group questions, and 81% of the participants spent less than 1.5 hours to answer and evaluate the questions of the rest of the groups. In general, students felt the activity tasks were not difficult. The percentages of students who said writing and answering questions were not difficult tasks were respectively 82% and 64%. In the question evaluation task, the percentage was much lower, 41%. The students commented to the teacher that this was due to the fact that the evaluation

criteria were not clear in the first round of the competition. Most of the students agreed there was a good social atmosphere within and among the groups.

5 Conclusions and Future Work

In this paper, we have presented a simple Web system that allows teachers to easily organise competitive activities in the classroom. It has been used in a preliminary study showing that competition in education can be beneficial if it is designed following a number of principles, such as having a symbolic or little value prize, a short duration, and a goal clearly set into the learning process instead of into the results.

We have not put enough effort into the satisfaction of the students' enjoyment needs. As future work, the system based on online forms may be replaced by or enhanced with more sophisticated and attractive e-learning tools, and alternative gaming and competition schemas could be followed.

We still have to analyse how the conducted competition is related to the actual performance of the students' marks. Moreover, we have to investigate how different results (motivation, performance, etc.) would be without the competition (i.e., only with group work). These issues call for an experiment with a control group design.

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