

TEACHING SOFTWARE PROJECT MANAGEMENT: THE COMPETITIVE APPROACH

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ABSTRACT

Learning has been the subject of continuous change throughout time. Although cooperation and competition are mostly two different ways of approaching the learning process, the combination of the two might offer promising outcome to the participants. This paper aims to put forward a particularly designed learning approach for teaching Software Project Management in an academic environment by adapting already-defined cooperation and competitive learning techniques to a new and improved teaching approach for a computer software study field.

KEYWORDS: *software project management, educational models, teaching strategies, collaborative learning, cooperative learning, competition-based learning, mixed collaborative-competition learning, independent learning, anarchy learning.*

INTRODUCTION

Among the different oriented approaches, the following can be distinguished as efficient learning processes: collaborative, competitive, anarchic, independent and mixed.

A competitive environment is described as a process in which one participant's success depends on the other participants' failure. The key of maximizing opportunities for learning in a competitive-based environment requires a better defining of the instructional strategies which would nurtures competition and cooperation between participants [1]. Studies have recognized the need to integrate cooperation, competition and individualistic types of learning into a single approach [1-4].

The purpose of this paper is to study the impact of the competitive approach in student learning, analyzing its benefits and when it is more efficient to use.

The competitive approach aims to achieve high learning results through students' self-reliance. While other approaches focus on cooperation among students with a common goal, this learning method implies that motivation is raised by the goal of surpassing one another. This incentive determines each individual to put more effort in their assignments, resulting in increased confidence and self-improvement.

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PREVIOUS WORK

The work of Triplett in 1898 states that cyclists achieved better results when racing than when cycling alone [5]. This implies that competition had favorable results by adding an extra incentive to the race.

A more recent study taken in 2004 by Lam, Yim, Law, & Cheung concluded that competition had a positive impact on performance and learning motivation in an academic environment [6].

Johnson & Johnson [1] describe the results of a research regarding learning in sport management classrooms. It was concluded that the key to maximize students' opportunities was the successful development of instructional strategies and practices applying both competition and cooperation approaches.

A considerable number of studies have analyzed the effectiveness of cooperation, interpersonal competition and personal motives in achieving success and productivity in the learning process. It was found that cooperation is more effective than interpersonal competition or other personal ambitions, but that competition between groups is more beneficial than competition between individual peers. [7]

PROPOSED APPROACH

During the Software Project Management course from the POLITEHNICA University of Bucharest, one particular project was proposed in order to illustrate the competitive approach.

The project consisted of implementing a Formula 1 race simulation. Each student was assigned to a team which had to develop an application that simulates a race between two cars on the Monte-Carlo Formula 1 racing track. When the project is over, all the teams get to compete between each other. The evaluation is based upon the lap times that each team can achieve in their simulation. The team score is calculated as a weighted average between the fastest and the slowest time it takes to complete a lap around the circuit. If a car does finish an entire lap, a negative score is earned.

Each team member had a certain role, the most important of all being the position of project manager. In order to enter the election, the students interested in this position had to provide a CV to the supervising assistant. The latter could turn down an application if he would not think the student was the best choice. In that case, the team had to propose a new project manager.

An important aspect of the competition was that the teams' work would be compared at each of the 4 milestones, each one receiving a score. After each evaluation, all the teams continued working with the winning project as a starting point. Thus, the competition would be as fierce for each milestone in the case of a team gaining advantage.



Figure 1. One sample race circuit (Monte-Carlo Formula1 Circuit) defined as a 1BPP (Black & White) image and the winning team's race simulation (zoom on viewing application followed by full screen dump of the entire running system)

The competition was divided into four milestones:

1. The role assignment among the team members and the creation of the project's documentation: the software requirements specification (SRS), the software design description (SDD) and the programming platform on which the application is developed.
2. The implementation of the project viewing application;
3. The implementation of the racing program;
4. The artificial intelligence (AI) system for the racing cars and the competition between teams;

The project viewing application is a graphical-user interface (GUI) which allows a front-end visualization of the implemented racing scenario. It resembles a usual setup menu, common with most race-based video games, where the players can load their racing strategies and start the simulation.

The viewing application offers a real-time 2D circuit visualization, as seen in Fig. 1, where the competing cars are represented depending on the track position returned by the input AI algorithm.

During the simulation, the time elapsed since the beginning of the race is displayed in the top center part of the viewing window, along with the current race standings in the top right corner and the last lap time for each participant in the top left corner.

A mini-map illustrating the entire circuit, with each participant labeled according to their location on the track is displayed in the bottom left corner of the viewing window. The GUI viewer communicates with the server that runs the back-end racing program, which makes all the necessary location-specific calculations.

The implementation of the racing program requires the development of a set of computer game physics to simulate the racing environment. The application runs on a dedicated server which communicates with the GUI viewer by advertising general race status data like current standings, lap times or car position on the track. The program inputs two AI modules which calculate the momentary position of the two competing cars according to the track configuration and the path-finding algorithm implemented by each module. Every calculation made is refreshed according to a quanta of time which can be modified before starting the simulation.

The AI system implements a custom path-finding algorithm that calculates a movement strategy by alternating the current speed of the car. The algorithm should determine when a car shall reduce speed by braking, increase the speed by accelerating, steer left or right. For the simplicity, the speed shall be incremented or decremented by one unit. For a better simulation, the AI system will communicate with the racing program that implements the game physics, which will have an effect on the steering of the vehicle by simulating understeer – the car cannot turn enough at the current speed and leaves the circuit – or oversteer – the car turns more sharply and could get into a spin.

Due to the team-based structure of this project, the students relied on each other to successfully meet the milestones involved. Even though each student was graded

individually, a few features of the collaborative approach can be remarked in this project. However, due to the competitive spirit, the team members motivated each other in order to accomplish their goals.

Each individual received grades from his team's project manager, thus resulting in a personal score. The project manager was evaluated by the supervising assistant. However, the score of the project manager was used as a scaling factor for each team member's score. In this way, no team member could have a greater score than the project manager, thus resulting the motivation to apply a CV and to be elected the project manager.

This assignment managed to combine multiple levels of competitiveness through the competition between teams in order to win and receive the highest team score and the election of the project manager position from between team members. Through this system, each student had enough incentive to work hard both for the team and for himself.

CONCLUSIONS

As the scoring was based upon a ranking system, these results show that the competitive approach enabled the students to learn and participate efficiently in the development of the final products. As a result, even though a few projects were exceptional, the teams could not be awarded maximum scores, thus raising the incentive for each individual to provide better work for their assignments.

As most of the team members had close grades, this demonstrates an equal effort provided by each individual in order to achieve the team's and their own goal.

In addition, the competitive approach was proven to be successful by the students' and assistants' positive feedbacks. Most of the students reported an increase in interest due to the competitiveness of the project and some stated that having a competitive goal even made the project more enjoyable.

In conclusion, the competitive approach presents both advantages and disadvantages, proving to work perfectly with projects that are divided into independent modules. In addition, each individual should have enough experience to work independently, otherwise additional time is implied for research and studying.

FUTURE WORK

Research is needed to clarify which mechanisms operate on the group as a whole and which are tied to specific experiences in group interaction. If, for example, increased student morale plays a major role in increasing achievement, then individuals may benefit from the group experience regardless of their own rate of participation.

In addition, there are many ways in which the competitive approach can be combined with other work methodologies. Through the potential of combinations with the collaborative and independent approaches, this topic leaves plenty of room for further research and conduction of case studies.

More details about alternate educational approaches in teaching Software project Management can be found in [8-9].

ACKNOWLEDGEMENTS

The authors would like to thank teaching assistant Mihai Zaharescu and students Tudor Zugravu, Oana Spatarelu, Andrei Vasilescu, Codina Mihalache for their great support and assistance with this paper.

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