

## TEACHING SOFTWARE PROJECT MANAGEMENT: THE MIXED COLLABORATIVE-COMPETITIVE APPROACH

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### ABSTRACT

*Education has been the subject of change throughout history. There is a consensus among scientists that collaborative learning has a positive effect on student achievement, while competitive learning depends on a student's self-reliance in order to achieve high learning results. This paper aims to propose a new learning method for teaching Software Project Management in a university-based environment that combines the competitive and collaborative approaches into a mixed approach, and creates better academic-oriented conditions for students to improve their team-working skills in a computer software education 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.

This type of learning tries to combine the collaborative effort with the advantages of the competitive approach. On the one hand, collaborative management assumes that students have the same goal and sometimes rely on the same outcomes. This is beneficial for learning how to work in a team. On the other hand, the competitive management has different points of view. Each participant works for their own success and for the other's failure. It also focuses on working against each other and learning independently. This type of learning can be beneficial for some of the students, meaning that it can inspire some of them to be more interested on a certain subject.

The purpose of this document is to present a mixed collaborative-competitive approach that helps students learn and acquire more information about a certain field.

### PREVIOUS WORK

Throughout time, there have been a series of case studies regarding the mixed collaborative-competitive approach.

For example, Johnson & Johnson recognized the necessity to integrate these two types of learning, stating that although these two are very different, they can provide benefits for students by combining them. [3]

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Dyson and Grineski [4] highlighted the positive impact on student learning that cooperation can have when employed adequately in a competitive environment, since collaboration emphasizes each person's contributions toward collective goals.

Moreover, Wyne [5] emphasized the necessity of synthesizing these two types of learning (competitive and collaborative). He stated that combining both motivational competition and open collaboration can be done by using inter-group competition between teams whose members collaborate directly.

## **PROPOSED APPROACH**

Throughout our society, competitive and collaborative approaches are evident, especially in the professional area, where there have been a lot of changes regarding teams and working methods.

Both of them have certain advantages and disadvantages and various benefits have been observed regarding either of these two.

For example, they improve the way of thinking by comparing ideas. They encourage innovation regarding the students' participation and learning/teaching techniques. Moreover, they proved to have a higher level of achievement than other learning methods.

Regarding the collaborative approach, there are a few advantages like having the opportunity to learn how to work together and how to communicate as part of a team. Also, students learn to assist each other and they acknowledge the fact that goals in life can be achieved by cooperating. [1] Furthermore, this can be a new enjoyable overview upon school and learning. Of course there are disadvantages as well, like the fact that there is a possibility of uneven engagement in a team.

When it comes to competitive approach, students are encouraged to learn and work for their own success and outcomes. The fact that every person has to work for themselves motivates them to dedicate to their work and by default their performance goals increase. Competition can be seen as "a social process that occurs when rewards are given to people based on how their performances compare to the performances of others doing the same task or participating in the same event".

In this type of approach, the teams compete for positive individual outcomes as well as the team's results (Wyne) [5]. Throughout time, it was proved that combining cooperation and competition helps motivating students and improve their performances.

Document Image Binarization Contest (DIBCo) is an international contest aimed at creating benchmark procedures representative to the challenges of the binarization process. It is one of the prestigious meetings in the field of document image binarization. The main objective is to record state-of-the-art image binarization advancements by using fixed evaluation procedures [6].

During the Software Project Management course from the POLITEHNICA University of Bucharest, there has been a contest regarding the mixed approach that had as purpose the development of an "Image Binarization System" (IBS). [2]

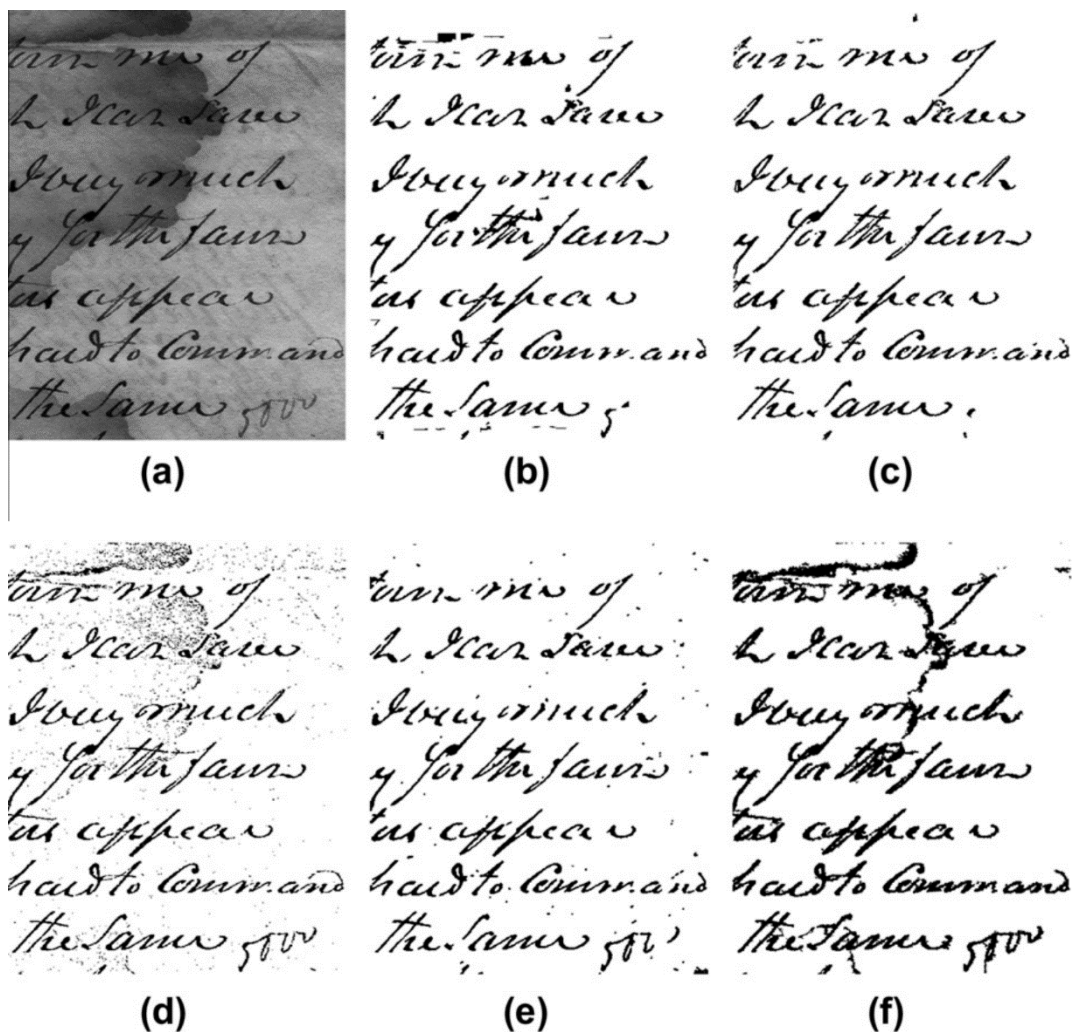


Figure 1. Document images: (a) Representative image from DIBCO-2011 dataset; corresponding binarization result produced by the method (b) Messaoud et al. (2011); (c) Su et al. (2010); (d) Ntirogiannis et al. (2009); (e) Howe (2011); (f) Gatos et al. (2008). Image taken from [7]

The IBS can be used in the process of image document analysis, by doing operations on a simplified black and white version of the original image, which offers a clear separation between the writing and the background.

The IBS project consisted in two components:

- “Binarization Algorithm Module” (BAM) – an executable which will receive an input continuous-tone image and will produce an output binary image;
- “Voting Binarization Algorithm Module” (VBAM) – using more BAMs a “smart-voting” technology will be used to blend the independent results into a binary image;

Students from each laboratory were split into four teams, each consisting of three members. The work was divided as it follows:

- Three teams were responsible for three BAMs;
- The fourth team was responsible for VBAM and project management activities regarding teams' synchronization.
- Each team had to cover 3 roles: research, development and testing and the team members were encouraged to switch their roles every now and then to assure equity.

In a collaborative-competitive approach, the organizer should divide the class members randomly into groups. This should be done to ensure heterogeneity and homogeneity in every team. This aspect is very important because in a professional environment, there is no possibility for one to choose the team in which one will work on.

The BAMs will input a continuous tone image and will output a binarized image. Each team has the liberty to implement a binarization method of their own choosing, either a fixed or adaptive local thresholding method or using a global threshold method [8].

The VBAM will input a numbers of BAMS (Fig. 2) and execute a “smart-voting” algorithm on all the received inputs. This algorithm implements a weighed-decision mechanism to decide each pixel's binarized state according to how the majority of inputs have called it.

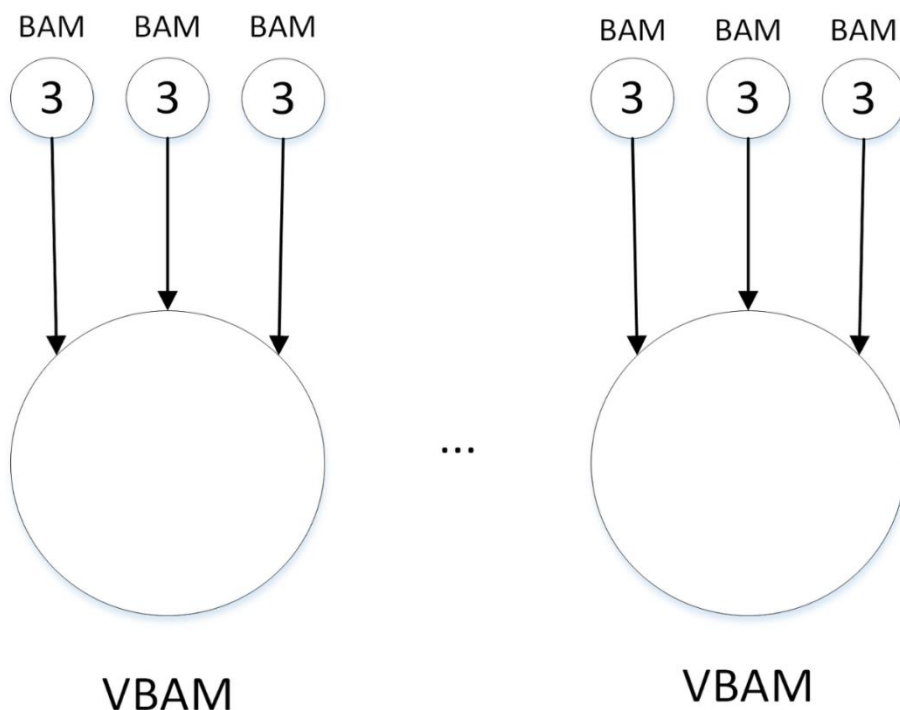


Figure 2. The BAM-VBAM relation in the “smart-voting” process

The final evaluation of the project was blended, regarding multiple aspects:

- All subgroups were set to compete against each other using the VBAMs results;
- All BAMs from all the subgroups has to compete against one another.
- All VBAMs from all the subgroups has to compete;
- The selected BAMs and VBAMs would be tuned to work together.

The rating procedure will involve tests similar to those used in the DIBCO evaluation process [9].

The quality of the OCR output will be ranked using the Tesseract OCR engine, a free open-source optical character recognition software, considered one of the most accurate engines currently available [10-11].

## **CONCLUSIONS**

A benefit for using a competitive-collaborative approach is that the failure of a team in the final functionality does not necessarily mean that the entire project would fail. Also, it is easier to synchronize the teams, given the fact that there was a team that was responsible with the management part.

Moreover, using this type of learning, there is a balance between teamwork and individual activity among the team members.

It is safe to say that the competitive-collaborative approach provides a better environment and student interaction and development for project management.

Although students may initially be reticent regarding this type of approach because they don't like working in a team or because they would like to choose their own group, this mixed management helps them prepare for the professional part of their life. This is why it is very important for them to understand the implications and the advantages of the collaborative learning on the one hand, and competitive learning on the other.

They need to keep in mind that when working in a company, they won't be able to choose their team mates and they will have to adapt to the given circumstances.

To sum up, these two types of learning are at first very different from one another, and they present various aspects in the teaching/learning technique, but blending them chooses the best from them.

This is why the mixed approach encourages an individual to explore and to look further into a certain subject in order to succeed, but also it teaches him/her to work with others, even though they don't know one another.

## **FUTURE WORK**

Considering the importance of the mixed approach in the professional life, it would be a very good idea for teachers to encourage their students to interact with others by working together on some projects, but also to inspire them to evolve individually and for their own good.

More details about alternate educational approaches in teaching Software Project Management can be found in [8, 12-13].

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