

TEACHING SOFTWARE PROJECT MANAGEMENT: THE COLLABORATIVE APPROACH

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ABSTRACT

The process of learning has been subject of change in order to meet new principles of study in emerging technologies. There is a consensus that collaborative learning is a method in which participants achieve success more often. This paper aims to combine the benefits of collaborative learning and apply them while teaching Software Project Management in a computer science academic 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.

A rather recently used model of learning, the collaborative approach, focuses on concepts such as: team-work, interaction and acknowledgement of the abilities and contributions of peers' work. It is a concept in which students team up together in order to understand and study a more complex subject, or work to create a meaningful project [1].

The underlying premise of the collaborative approach is based upon consensus building through cooperation by group members, therefore this approach may be defined as a philosophy of interaction and personal lifestyle. Individuals are responsible for their actions, including learning and forming and applying interpersonal skills.

It is important to note that there is a difference between cooperative learning and collaborative learning. Although many psychologists have defined them similarly, cooperative learning is considered a special case of collaborative learning, where participants work together on a project following a better structured activity [2].

The purpose of this paper is to present the particularities of the collaborative approach through following the students' behavior while developing an "Automated Data Analysis and Extraction System". As the system was logically divided in separate, interconnected sub-systems, each team was assigned to develop a certain module of the final project.

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The outcome consisting of the students' progress, the overall quality of the products developed and the final grades are indicators for the efficiency of the collaborative approach.

PREVIOUS WORK

In regards to the collaborative approach, David Kaufman, Elliott Sutow and Ken Dunn identified the following elements as essential to the success of collaborative learning [3]: positive interdependence, individual accountability, group processing, social skills, being given a specific task and face-to-face interaction.

Various studies had been conducted on the different oriented learning approaches applied within groups, most of them tending to favor cooperative learning [4-7]. Although there is considered to be a difference between cooperative and collaborative learning, several psychologists, notably Johnson & Johnson, Slavin or Cooper [8-10], have used similar ways to describe the two approaches.

More recently, studies in collaborative learning have started to focus on how the group itself involved in the project, rather than how individuals function in a group [11].

PROPOSED APPROACH

During the Software Project Management course from the University POLITEHNICA of Bucharest, the collaborative learning method was applied in the development of an "Automated Data Analysis and Extraction System".

The functionalities provided by the system consisted in: digital image enhancing, image segmentation, entity hierarchy generation and optical character recognition, with the latter being the most complex.

The optical character recognition module was structured as an interconnection between smaller sub-systems:

- Document Processing Manager
- Web based Processing Manager
- Preprocessing Graphical Interface
- Layout Analyzer
- Hierarchy Analyzer



Figure 1. Example of input files, thus illustrating image document diversity

The Document Processing Manager and Web Based Document Processing Manager had to deliver an executable able to manage a complete workflow of data processing, from image color to obtaining PDF files based on the chosen images.

The purpose of the Preprocessing Graphical User Interface was the creation of an executable which performed the visual evaluation of the results provided by the several available preprocessed data and the binary elements.

The Layout Analyzer had to obtain an executable allowing the correction of errors regarding the grouping of characters into lines and of lines into block texts, error of formatting and text content.

The Hierarchy Analyzer created an executable allowing the correction of errors regarding the grouping and classification of blocks from several image-documents.

All the modules described above had to communicate through XML files.

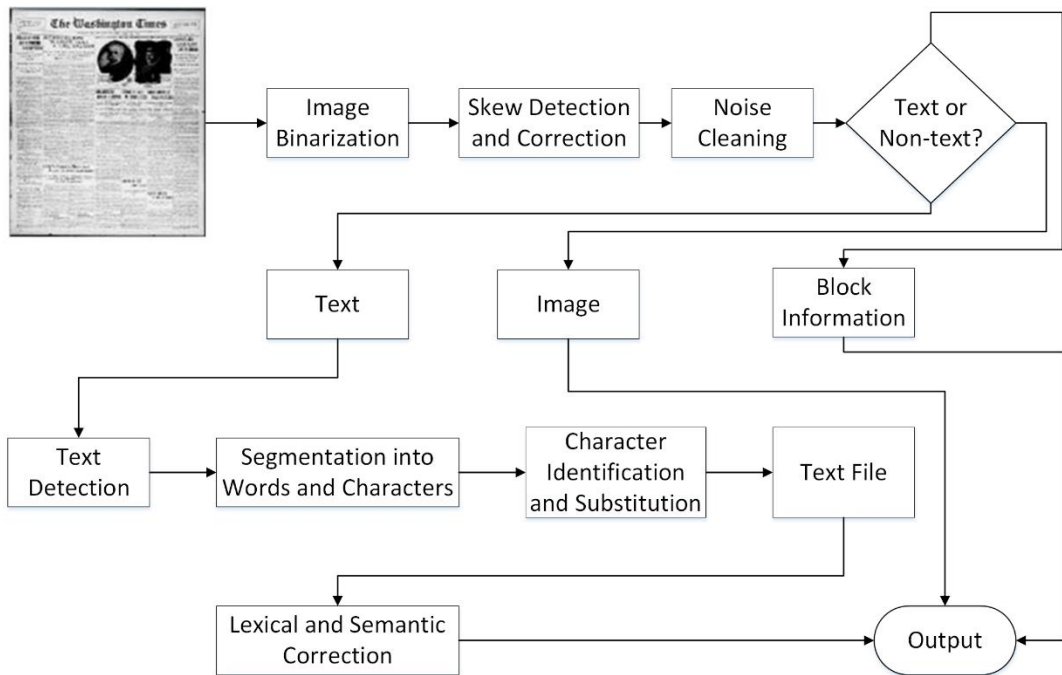


Figure 2. Main processing flow inside a Document Image Analysis System (DIAS)

Students were organized into ten groups of five to seven members, every two teams having to develop one of the five sub-systems described above. Specific details on the implementation process were provided and milestones during the semester were set to ensure the success of the development. The team-members were not assigned specific or different roles within the group and were encouraged to display interest and implication in the project.

In order to motivate the students as individuals in particular and as teams in general the following marking rule was followed: 60% of the grade was based on the whole project's performance and 40% was based on the work completed individually. The results obtained valued 50% of the course grade.

All the projects were divided into four phases:

1. Initial phase – marked by the beginning of the project, the assessment of related work and the role assignment among the team members;
2. Planning phase – resource plan, budget, activity plan, milestone definition;
3. Execution phase – the actual product is being developed and tested. There is also a quality check, taking into account possible risks and bug fixing;
4. Closing phase – delivering the product to the client and receiving feedback according to the quality of the functionalities provided.

Achieving success implied interaction between team-members, but also between teams, since the communication process of several components of the project was vital.

In addition, for obtaining a positive outcome, it was essential that the students acknowledged that they worked for a common objective, and that they depended on and were accountable for each other.

CONCLUSIONS

The high grade obtained by the students for the project indicated that the collaborative approach suited the students' needs and enabled them to learn and participate noticeably in the development of the final products.

Another important indicator for the collaborative approach efficiency is represented by the feedback provided by the students and teachers involved.

Although being part of self-organizing team put some pressure on the members, it ensured reaching a high level of creativity. In addition, debating, negotiation and communication skills were developed. Students had to reason with each other, find suitable solutions for each problem and support their ideas with convincing arguments.

The disadvantages of this approach are represented by the assumption that every individual is involved and willing to participate at their full potential. The existence of disinterested, uncooperative and inefficient team-members may lead to frustration and have a negative impact on the final product. In addition, assigning different tasks to each team might lead to dissatisfaction, as the tasks could vary in difficulty, which may probably reflect in the final grade.

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 conclusion, the collaborative approach presents both advantages and disadvantages. It works perfectly with projects that require integration between subsequent modules, whereas it is not the most suitable for projects that are divided into independent modules.

FUTURE WORK

Even though plenty of studies have been conducted on the collaborative approach and its advantages, there is still room for further research. There are a lot of variables involved when it comes to human interactions within groups.

Further studies could focus on how the groups should be organized and how different personality characteristics, knowledge and skill levels of the members involved influence the team and the final results. More details about alternate educational approaches in teaching Software Project Management can be found in [12-13].

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REFERENCES

- [1] Pierre Dillenbourg, "Collaborative Learning: Cognitive and Computational Approaches. Advances in Learning and Instruction Series", Elsevier Science, Inc., PO Box 945, Madison Square Station, New York, NY 10160-0757, 1999.
- [2] Rebecca L. Oxford, "Cooperative learning, collaborative learning and interaction: Three communicative strands in the language classroom.", *The Modern Language Journal*, Vol. 81, No. 4, 1997, pp. 443-456.
- [3] David Kaufman, Elliott Sutow, Ken Dunn "Three Approaches to Cooperative Learning in Higher Education", *The Canadian Journal of Higher Education (La revue canadienne d'enseignement supérieur)*, vol 27, no 2-3, 1997, pp. 37-66
- [4] David W. Johnson, "Student-Student Interaction: The Neglected Variable in Education", *Educational Researcher*, Vol. 10, No. 1, January 1981, pp. 5-10. Published by: American Educational Research Association, Stable URL: <http://www.jstor.org/stable/1175627>
- [5] Shlomo Sharan, "Cooperative Learning in Small Groups: Recent Methods and Effects on Achievement, Attitudes, and Ethnic Relations", *Review of Educational Research*, Vol. 50, No. 2, Summer 1980, pp. 241-271, Published by: American Educational Research Association, Stable URL: <http://www.jstor.org/stable/1170146>
- [6] Robert E Slavin, "Classroom reward structure: An analytical and practical review", *Review of Educational Research*, Vol 47, No 4, 1977, pp. 633-650
- [7] Robert E Slavin, "Cooperative learning" *Review of Educational Research*, Vol 50, No 2, 1980, pp. 315-342.
- [8] Robert E Slavin, "Research on Cooperative Learning: Consensus and Controversy", *Educational leadership*, Vol. 47, No. 4, 1990, pp. 52-54.
- [9] David W. Johnson, Roger T. Johnson, "Learning together and alone: Cooperative, competitive, and individualistic learning", Prentice-Hall, Inc, 1987.
- [10] Robert E. Slavin, Robert Cooper, "Improving intergroup relations: Lessons learned from cooperative learning programs.", *Journal of Social Issues*, Vol. 55, No. 4, pp. 647-664.
- [11] Pierre Dillenbourg, Michael J. Baker, Agnes Blaye, Claire O'Malley, "The evolution of research on collaborative learning", *Learning in Humans and Machine: Towards an interdisciplinary learning science*, 1995, pp. 189-211.
- [12] Costin-Anton Boiangiu, Alexandru Constantin, Diana Deliu, Alina Mirion, Adrian Firculescu, "Balancing Competition and Collaboration in a Mixed Learning Method", *International Journal of Education and Information Technologies*, ISSN: 2074-1316, Volume 10, 2016, pp. 73-81
- [13] Costin-Anton Boiangiu, Adrian Firculescu, Nicolae Cretu, "Combining Independence and Cooperation as One Anarchic-Style Learning Method", *International Journal of Systems Applications, Engineering & Development*, ISSN: 2074-1308, Volume 10, 2016, pp. 97-105.