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Group Maker Tool for Software Engineering Projects

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Abstract

Project-based learning is widely used in various academic fields. Nevertheless, software engineering projects have a special statute due to their interdisciplinary features. Unlike other academic disciplines, software engineering requires knowledge from diverse engineering areas, but also from system modeling and design, business domain, communication. In order to maximize the learning benefits and to facilitate obtaining successful projects, the teacher has to be actively involved in all the phases of the project life cycle, including team formation. This article presents a new application which implements the collaborative learning paradigm through project-based learning in software engineering. The model automates the process of optimal grouping of students in teams based on a skill inventory created by the teacher. The collected answers related to students' skills will help the teacher to build the most equilibrate groups in one's class. The grouping is made taking into account various criteria. Once groups are formed, students can collaborate by chatting in the project's forum or by attaching additional files to their project. Preliminary results are provided and discussed in the context of various groupware tools.

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1. Introduction

Project-based learning (PBL) is not a new teaching method (Blumenfeld, Soloway, Marx, Krajcik, Guzdial & Palincsar, 1991). Its benefits are well-known and unanimously acknowledged: it increases the learners' motivation;

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it improves the learning retention rate; it increases the learning outcomes, due to the fact that the students are engaged in enhanced collaborative activities; it prepares students for real work environments (Spoelstra, van Rosmalen, Houtmans, & Sloep, 2015). In the same time, nowadays, when we speak about education, we also speak about new learning paradigms, e.g. collaborative learning, student-centered learning, community-based learning (Dascalu, Moldoveanu, & Shudayfat, 2014) and extensive use of technology on daily educational processes. Consequently, it is normal that PBL to be enhanced by software tools, such as groupware and to be used in collaborative e-environments. When one considers the classical classroom and the traditional students, whether they are children, young adults or adults in their own right, when confronted with PBL, they still perceive it as a challenge. In virtual environments or blended environments, the challenge is even bigger.

The current paper discusses the team formation issue in the context of PBL, how this issue can be solved with groupware and, finally, it proposes a new software application, GrooPro, specialised for PBL in engineering projects, but easily customizable for other academic disciplines as well.

2. Project-based learning and team formation

Becoming a team in the context of project based learning can be a tough challenge for some learning facilitators to conduct and for some learners to implement (Problem Based Learning, 2014). One of the most difficult steps in beginning the process of forming groups, which later on can become teams, in project based learning, is teaching the delegates to organize themselves (National Academy Foundation, 2014). Following that difficult first moment, when delegates are told to form teams (or groups), as they are about to study or practice together, two things can happen: either a leader emerges and facilitates the team formation, by assigning roles and responsibilities and smoothing the way for the participants to take a task in the learning project and carry it out or, as it is usually the case, the facilitator will closely work with each group until they find the balance and identify which activities are needed to complete their learning project together and then monitors the process, as it goes on. In academic contexts, the delegates are the students and the facilitator is the teacher. Team formation in project based learning is most difficult in the beginning of a learning journey. For short-term classes, it can be challenging when the delegates do not know one another, which is why the facilitator's art is to establish a safe and learning-friendly environment. For long-term classes, such as traditional education in schools, high-schools and universities, the aspect of team formation is perceived as a challenge in the beginning, while later on, it can be seen as an advantage for work-sharing among the team members.

As all processes, team formation in project-based learning follows a strict path, more or less lengthy, that was first identified by Bruce Tuckman in 1965, made up of four initial stages: (1) forming, when the group comes together for the purpose established by the facilitator; (2) storming, when the group member egos challenge the perceived state of affairs, so that a leader can emerge and the project can go forward; (3) norming, when the group has set the "work procedures" in place and is no longer fighting; (4) performing, when the group is actually working as a team, so as to achieve the learning purpose they were assigned. In 1970, after project management became a current occurrence in solving different issues, Tuckman added the fifth stage to his model, which is adjourning. This is closely connected to the idea that projects are temporary organizations developed for the achievement of a specific purpose. Therefore, the team that implemented the project is only a temporary team, so this stage is when the team members each leave the project, with their lessons learnt and with new experiences to carry on. The Forming-Storming-Norming-Performing theory is an elegant and helpful explanation of team development and behavior. Similarities can be seen with other models, such as Tannenbaum and Schmidt Continuum and especially with Hersey and Blanchard's Situational Leadership model (Bruce Tuckman's 1965 Forming Storming Norming Performing team-development model, 2014).

The difference between team and group is that teams are heavily oriented towards "performance, commitment, and outcomes", while groups might follow a vague list of classroom norms, talk, share some insights and such. High performance teams operate by an explicit ethic of service to others, listening, attentiveness, and shared leadership, which are all requirements to turning out the highest quality product based on team effort (Markham, 2011). The typical steps a facilitator makes to address the formation of groups, which later on become teams, are:

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