

Team Formation and Project Assignment –the dilemma of assigning students to project groups

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Abstract

To meet the needs of globalization and change in higher education group work projects are increasingly used. However, there is many methods mentioned in literature to assign student teams but little guidance on how best to allocate students to groups with reference to the project itself.

The experience over a decade of teaching an IT (information technology) project course is shared with different team composition methods in the context of various project settings: first: teams and projects are self-selected, second: randomly assigned groups select the projects, and third: projects are selected individually followed by assigned team formation. The different methodologies are outlined in detail and the impact of the composition and assignment method on project results and individual learning progress and success is discussed.

Keywords: *student projects, group, team; team assignment, project assignment.*

1. Introduction

Unlimited access to information in a globalized environment requires the shift to a competency-based teaching model enabling students to take over responsibility and master their own learning process. One well acknowledged approach is project based learning that reinforces students' natural desire to learn: Gomez-Pablos et al. (2016), entails deeper learning outcome: Cuseo (1992) and gains skills above and beyond sheer theoretical and factual knowledge with improvement of interpersonal and interaction skills: Muller (1989).

However, forming teams and deciding on self-selection or assignment of group members remains a challenge for both, students and lecturers. To give weaker students a chance to learn from stronger group members and to meet important inter-student differences regarding skills, experience and confidence project groups may be formed referring to the individual student's learning background. Moreover, assigned groups more likely contain compatible people and a balanced distribution of student skills making the process of group work easier and more productive: Huxham (2020), Muller (1989) significantly improving the individual student performance: Pinto (2012). However, Muller (1989) observes tentative evidence in balanced groups that the more experienced students will be less satisfied and feel less challenged by the group: Muller (1989) and pedagogic difficulties arouse: Hübscher (2010).

Methods of team formation have been discussed widely: Layton et al. (2010), Hishon (2019). Wei et al. (2021). However, up to now there is no evidence in literature to connect team formation and project decision. In this paper we will give a brief insight of forming groups directly focusing on the project itself as means of strong team building criteria.

1.1. Methods to assign students to teams (Figure 1)

A) Self-selection: Students chose their group individually.

Pros: Students take over responsibility and control over learning experience with respect to accountability, cooperativeness and group cohesiveness: Layton et al. (2010). Decision-making and problem solving skills are enhanced: Hishon (2019).

Cons: Clique behavior erodes team cohesion and performance resulting in a lack of the teams' diversity: Razmerita and Brun (2011) and necessary skills: Layton et al. (2010). Some students might feel excluded, lonely, embarrassed or frustrated.

B) Assigning: assignment of groups by external force

Pros: Communication and problem-solving skills are earned by delegating work and navigating different styles of learning. Fast group selection is offered and students get to know each other early: Layton et al. (2010), Hishon (2019).

Cons: Students feel unhappy because being imposed upon. Problems such as rivalry, friendship, fights, conflicts, etc. may arise: Layton et al. (2010) because students feel lack of fairness regarding unequal distribution of skills in a team.

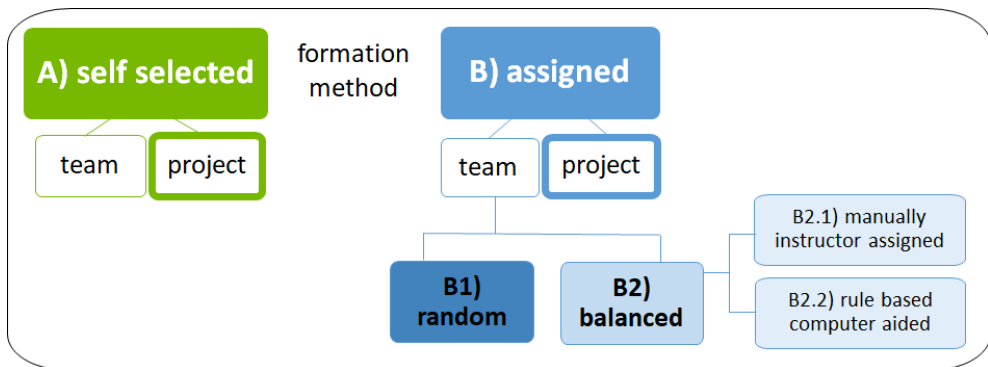


Figure 1. Schematic illustration of team formation and project selection. The team may be assigned (blue) or group members select their team individually (green). NEW: implementation of project decision into group formation procedure.

Assigning group teams may follow one of the following procedures:

B1) Random assignment: assignment to groups by random selection (e.g.: counting, etc.)

The method is often mentioned as the simplest and most efficient approach but is found to have a number of disadvantages and no clear strengths not necessarily resulting in a team with any more diversity, balanced skills, or blend of personalities than does self-selection, but raises concerns about fairness: Layton et al. (2010), Reis (2016).

B2) Balanced assignment: assignment of groups by instructors or algorithms

B2.1 manually instructor assigned: When the instructor knows the students' background characteristics (e.g., grade point average, major subject, level of skills, etc.) the distribution of member resources can be balanced and improves student outcomes. However, instructor assignment may become dramatically complex and time consuming: Layton et al. (2010).

B2.2 rule-based computer-aided assigned: Computer-aided team-assignment helps the instructor to control and facilitate the selection process using instructor-specified criteria: Razmerita and Brun (2011) and increases the likelihood that instructors' team-formation criteria are met consistently: Layton et al. (2010). But, when the weights of certain criteria are set to be strong, the rank algorithm is not effective enough: Wei et al. (2021)

As one of our main propositions the project itself is indispensable for successful group work. Therefore, in Figure 1 we include not only the main team formation routes but also apply this selection procedure for projects. During self-selecting of projects students may decide to individually choose existing projects or choose the project as result of a group decision.

2. Course setting: project computer engineering

Up to now project assignment is not considered an important decision factor for team composition as in educational settings often all teams work parallel on the same task.

The project setting in our IT program is different. The new project course generally aims at the application of programming skills as well as at the self-exploration of new technology within a certain business context. The projects are conducted in cooperation with different external partners, e.g. companies, non-profit-associations or public authorities. The projects, though comparable by effort differ with respect to the product and the technology stack. The choice for a certain project has impact to the expertise gained as well as the personal network. Some students like to work together with big companies as Zalando, IBM or SAP others prefer to gain start up experience or work together with non-profit organizations. The same accounts for the technology stack – some students like to choose and explore new technology others want to get expertise in well-established often proprietary technology stacks.

The students in the IT program at HTW Berlin have to take the project course twice: already within their 3rd term and again much more experienced within their 5th semester: Siegeris et al. (2018). In the beginning of the semester the partners frame the goal of the project and pitch their idea. The student teams then work in a mainly self-organized way (following an agile process) throughout the entire semester. The expenditure of the project course is set by 10 ECTS, which implies an effort of about 300 hours per student and project.

The setting requires high motivation of the individual student and a good performance of the group. Here, the intrinsic motivation highly depends on the individual preferences for a certain project(partner) but the team performance is sensitively dependent on the team composition. This poses high requirements to the matching process in the beginning.

3. Approaches of assigning students to teams and projects

We present and reflect on team formation methods encountering the last decade (2010-2021) (Figure 2). During the first three years, the so-called “Table-Method” was used, leaving the choice for the group and project to the students:

Table method (2010-2013) fully self-selected (Figure 2, bottom):

Methodology: 1 day: pitch before team formation and choice of project. Teams are formed self-selected simultaneously to also self-selected project choice.

1. The partners pitch their projects. - after a short break (external partners leave)
2. The project names are pinned to different tables in front of the class.
3. The lecturer then signals the students to approach and write their names onto the project table until the team size was matched.

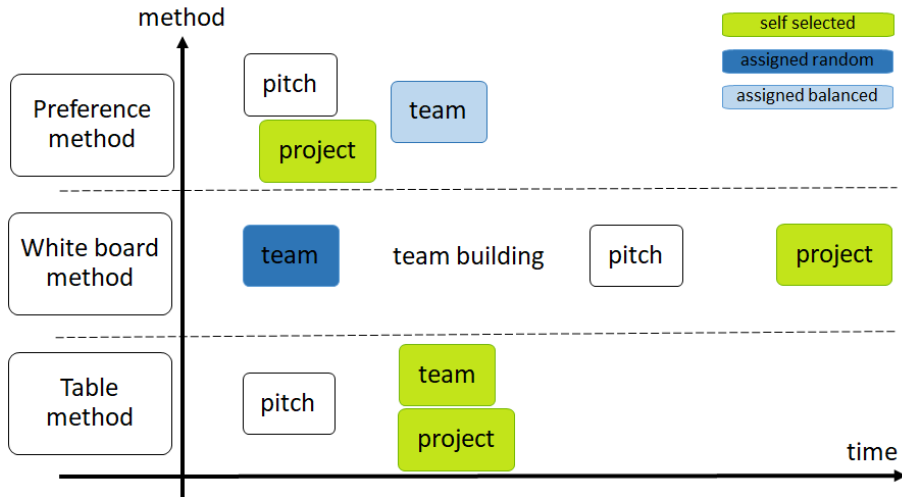


Figure 2. Comparison of team and project formation with regard to expenditure of time and formation method: self-selected, randomly assigned or balanced assigned. For project topics see: Siegeris et al. (2018).

Whiteboard method (2013–2020) assigned, only projects self-selected (Figure 2, middle):
Methodology: 3 days: Random teams are assigned before projects are pitched. Projects are chosen self-selected.

1. Teams are randomly chosen. In order to gain mixed teams, the projects were drawn from two prepared boxes, containing either 3rd term or 5th term student names.
2. The external partners pitch their project ideas in front of all teams.
3. Idle time (combined with a team building workshop) to facilitate discussion.
4. The actual assignment starts by putting project names onto a whiteboard.
5. First round: teams get sticky notes to mark down their decision by writing down their team's name and the preferred project.
6. Only if all notes have been collected, the papers are pinned to the whiteboard underneath the corresponding project names
7. Projects with only one team name underneath get assigned.

All other teams go for a second or a third round. In between rounds, time is given to enable discussion between teams. If the third round would not bring a result, the lot would decide.

Preference method (2021), assigned according to project (Figure 2, top):
Methodology: 1 day: Projects are pitched and self-selected. Balanced teams are assigned according to project preference.

1. External partners come and pitch their project ideas.
2. Meanwhile students list their preferences ranking 7 out of the 12 projects pitched.
3. Teachers use the individual rankings to build balanced teams.

4. Reflection on learning outcome versus group setting – individual needs

Table method (2010-2013) fully self-selected (Figure 2, bottom):

We rate the Table method a bit as a “first come first served” method: the fastest students get the project they like; the second fastest are able to sort their project by looking upon what their team mates decided; the undecided students looked what is left but benefit from choosing with respect to project and team.

One - to our experience negative - effect of this method is that students agreed for a certain project in advance. (Sometimes entire student teams compete for the same project. If no agreement is found, the lot decides.) This resulted quite often in very homogeneous teams with respect to migration background, age and expertise.

Students are highly dissatisfied and lack motivation when they were not quick enough to make it for the project and/or the team mates. Team formation according to the *Table method* resulted in very strong and very poor performing teams. The latter frustrated not only students but also the external partners. Especially in the 3rd term the frustration level was quite high as their naturally still low expertise did often not match the requirements. A pro: the whole procedure fit into one day.

Whiteboard method (2013-2020) assigned, only projects self-selected (Figure 2, middle):

As a first step to overcome these deficiencies, we decided to combine the courses to form mixed teams of 3rd and 5th term students. Homogeneous teams are avoided by assigning the teams randomly. Still, the teams should maintain the right to choose their preferred project.

From the lecturers' point of view this method was rated extremely smooth. Sometimes only two rounds were needed to succeed and whispering went through the rows as all teams were satisfied. To optimize the level of expertise we decided on two compartments in the lot boxes, ensuring that the stronger students would be spread out evenly over the projects. However, the duration of the whole team formation procedure (up to three days) is quite time extensive and needs a lot of organization beforehand.

Surprisingly, students reported a high level of stress. First, the random team composition results in uncertainty regarding team atmosphere: Layton et al. (2010). Second, the decision process was often decided by the loudest team members, who insisted on their choice leaving preferences of less assertive team members unconsidered. This led to ongoing discontent throughout the semester, especially if the arguments used did not come true.

Preference method (2021), assigned according to project (Figure 2, top):

In order to improve the situation for the students, we decided to give more scope to the individual preferences again. Conducting the new method, each student ranks the projects with respect to their own priorities. The subsequent composition of teams was surprisingly

smooth and guaranteed that every student got a match within their choice (around 90% of the students got one out of their preferred best three projects, only one student had to live with the seventh best choice.) This was also possible because we had two more projects than needed and could skip projects that gained not enough interest. Within this procedure again the semester and the expertise of the students were considered. Only after one hour the results could be communicated to the students. From the lecturer's perspective the method is very effective, as it took less than a day and resulted in even better-balanced teams.

Only two out of 31 (70%) students taking part in a mid-term questionnaire (44 students took part in the course) preferred the old method, one had no preference. The following quotes provide good examples for the opinion of the 28 proponents (90%): "My motivation to learn something is much higher, if I am interested in the topic. I also see more motivation in the team.", "... also better project start, as disputes in the beginning are avoided. " "You get a project, you are interested in. Team is important too, but prio 2"

Although the knowledge of teammates prior to team formation is associated with improved team performance: Gosenpud and Miesing (1984) students felt comfortable knowing the project and learning outcome right from the beginning - not necessarily their team mates. Most likely students hoped for fellow students with the same content interest will perform well naturally. In our project the shared interest in project content seems to outweigh that team mates were not known ahead and is therefore rated a strong and so far underestimated means in the process of team formation.

5. Conclusion

Based on more than 10 years of teaching practical project courses in IT education the methodology of group formation and project selection was identified as main reason for student motivation and performance throughout the one semester course. Usually team formation was followed by project assignment. But, this method frustrated both, students and lecturers as student motivation were low, student teams were extremely heterogeneous in terms of project progress and outcome and students lacked motivation. As a result of different procedures over various semesters in Winter semester 2021 students first rated their project choice and were then assigned to teams. According to recent questionnaires students were highly motivated, got good contact to fellow team mates and relied on their equal intrinsic motivation. Future research will focus not only on student performance and well-being but also on course assessment. However, it is highly important to understand that knowledge of the project seem to be outweigh team composition. Therefore, the project content is extremely important regarding student group performance and individual learning outcome in practical project courses.

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