

HOW TO DEFINE PROJECTS TO TEACH DESIGN?

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ABSTRACT

In design education project-based learning is essential in order to simulate real-life design process. For this reason the students need to face a design problem, which has not been satisfactorily solved yet. The question is how to define a number of such projects each year. There are different ways to do that. Basically, the projects can be defined by the lecturer, or by the students themselves. In both cases, cooperation with industrial partners may be taken into account as well. Based on years of experience we have made a detailed survey of the advantages and disadvantages of different approaches to the definition of projects for teaching design. In doing so, we used a questionnaire, which was fulfilled by different groups of students after the completion of their projects. Their answers were analysed and compared with our experience. The results of this analysis are presented in this article.

Keywords: Design education, project-based learning, project selection, problem definition

1 INTRODUCTION

The real-life design process can be well simulated in education process only by dealing with real-life project/problem, which is not adequately solved yet [1], [2]. Thus, new projects need to be set every year for number of student groups. Basically, there are two different ways how to define projects for design education. First of all, projects can be defined by the lecturer, who is appointed to guide the students through project-based design education. As each group needs to deal with another project, many projects have to be defined over certain period of time. One way to deal with this is to generate different variants of the same problem, each for one group of the students. Even in this case, searching a number of good projects is not an easy job. On the other hand, there will always be one group of students that will feel that they had got the most difficult project.

Alternatively, the students can define their projects by themselves. In this case, the lecturer should help them with some guidelines. Through discussion, he or she animates the students to find out what is required on the market. When the students define the project by themselves, they are usually much more motivated to realize it as best as they can. However, sometimes the students are not able to define a suitable project in reasonable time. Often they have too many ideas to select one of them, as none of them seems to be perfect. Many times they also recourse to the statement "we are only students" and they prefer to get the project definition from someone else.

In both cases, the projects can be prepared in cooperation with industrial partners [3]. This seems to be very good approach [4], however the industry is often reluctant to provide novel and innovation projects for education process. Instead, they are usually offering to the students to work on re-design of the existing solutions, which is less interesting for the students and also not ideal from pedagogical point of view, having in mind that the main goal of design education process is to teach the students how to generate innovative design solutions. If main design problem is already solved, the students usually tend to be handicapped with the existing solution. Many times they are persuaded that they cannot find better solution from the existing one. Usually it is also very difficult to motivate the students to improve the existing design.

In our education process, the students are usually welcome to play an active role in the project definition. They are encouraged by the lecturer to analyse the wishes, the needs or the requirements of the market in order to find the suitable product/project, which could in real-life, ensure them a job and economic survival. Typically their projects are related to their personal experiences with home appliances, sport and gardening equipment, special tools, etc.

Although the extensive up-to-date information is available these days on the World Wide Web, our experiences show that in the last few years the students had many difficulties to define the subject of

their project by themselves. Thus, we have decided to make a survey of the advantages and disadvantages of different approaches to the definition of projects for teaching design. In order to do that, we have used both two approaches in winter semester of study year 2010/11. At the end of semester, after all projects have been completed, we have made a detail analysis based on the anonymous questionnaire answered by all participating students.

In the continuation of this paper we briefly introduce the layout of the experiment and then present the questionnaire and some of the most important answers. At the end, the results of the survey are discussed and some conclusions are derived.

2 EXPERIMENT LAYOUT

The experiment took place in the semester in which two groups of mechanical engineering students in different year of polytechnic study were involved in project-based design education [5]. Each group had its own characteristics that were taken into account when defining their projects [6].

The first group consisted of 39 mechanical engineering design students in the third-year of the old curriculum, which is running out after the introduction of the Bologna reform. As this is the last year of their undergraduate study, they should have enough knowledge and competencies to define their project by themselves. For this reason, they were informed to search for their own projects two weeks before project-based exercises started. They were divided in eight teams. Each team had a different project, selected by the team as a whole after evaluation of the proposals being proposed by individual members of the team. This group of students carried out project-based design education process exactly the same way as it was performed in previous years.

The second group of students that participated in this experiment were the students in the second-year of the new Bologna curriculum that was carried out for the first time. In comparison with the first group, they have less knowledge and competencies, while the number of students was much higher (68), as they did not choose the field of study yet. This means that the students who will choose manufacturing or energetics as a professional field in the third year of their study, were participating in project-based design class together with those that will specialise in engineering design. From educational point of view, this is a good experience for all of them. However, the subject has less ECTS points than the subject taken by the first group, as design students will take another subject, as a continuation of the one mentioned here, in the last year of their study.

Since the second group consisted of less confident students, who had to complete the projects in less time available, we have decided to define their projects in advance by ourselves. In this way, they did not spend extra time for choosing their projects. Due to a big number of students that were divided in 13 teams, the same project was defined for all the teams. Moreover, project teams were not fixed for the whole semester, and their composition was different at each exercise. Thus, at various design stages the students were forced to take into account and adjust the results of another team that was working on that particular project at the last exercise.

In both cases, each project team has independently performed systematic design process following some basic guidelines given by the lecturer [7]. At the end, they presented their project to professors and their colleagues. Since the quality of the project is influenced by many factors, like motivation [8], team management, knowledge, team creativity [9], etc., and has a significant influence to the final grade, we have carried out a survey among the students in order to find out how the way of project definition influence on their performance.

3 QUESTIONNAIRE

Two similar questionnaires that vary in some points in order to address the differences in project definition were fulfilled by all 107 students participating in the education process that was observed within the experiment. Each of the questionnaires had eight questions. In continuation of this section, all questions (Q) are presented along with graphic representation of the distribution of the answers given by the students.

Questions are ordered with Arabic numbers (1-8), while Roman numerals (I or II) indicate the group of students, to which the actual question was presented. For example Q3-II denotes the third question in the questionnaire for the second group of students.

Questions are listed in sequence from the first to the eighth for both groups of students in order to facilitate comparison of the answers given by the students from different groups. Roman numerals are omitted in the legend for questions that were common for both groups (e.g. Q4). On the other hand,

the answers to common questions are still given for each group separately to present the difference in the answers as a consequence of different way used to define the project.

Questions and answers follow:

Q1-I: How would you describe the chance to define your project by yourselves? (Figure 1-I)

Q1-II: How would you describe the chance to work in a project team? (Figure 1-II)

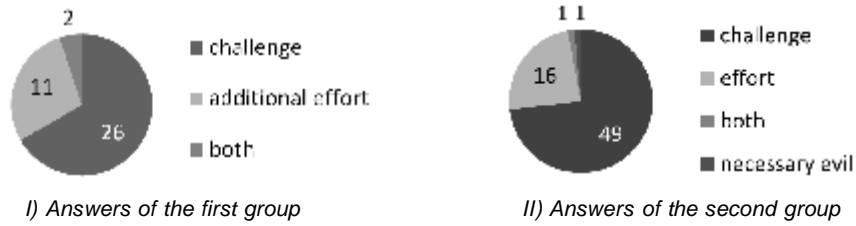


Figure 1. Distribution of the answers to the first question

Q2-I: Would you rather get a pre-defined project? (Figure 2-I)

Q2-II: Would you prefer to define your project by yourselves? (Figure 2-II)



Figure 2. Distribution of the answers to the second question

Q3-I: How would you describe the project chosen by your group? (Figure 3-I)

Q3-II: How would you describe the project assigned to your group? (Figure 3-II)

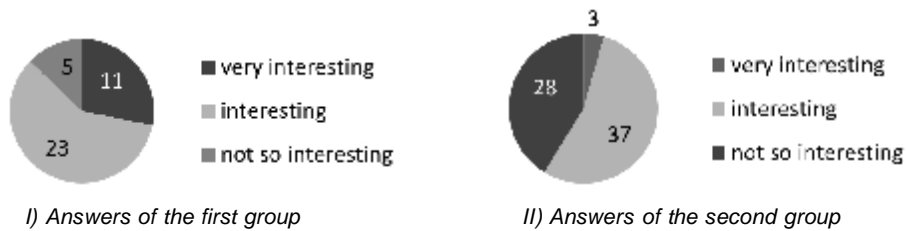


Figure 3. Distribution of the answers to the third question

Q4: Who do you think should define the project? (Figure 4)



Figure 4. Distribution of the answers to the fourth question

Q5: Rank the characteristics by the influence (1-5) they have in your opinion on the success of the project! (Figures 5 and 6)

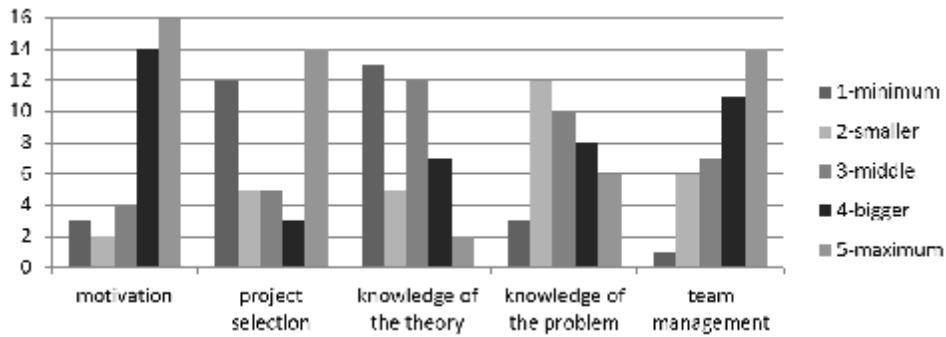


Figure 5. Distribution of the answers to the fifth question for the first group

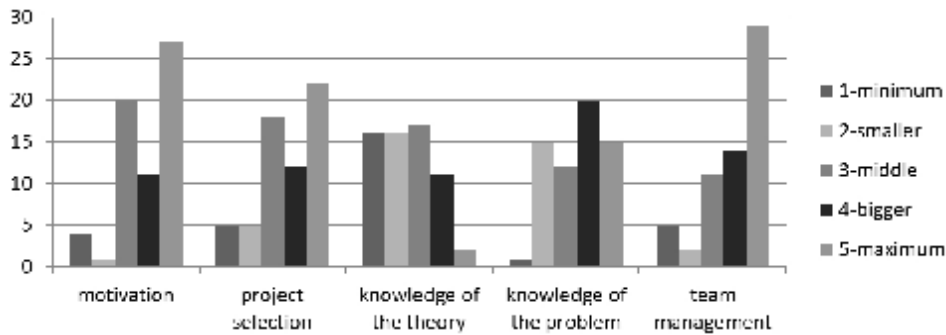


Figure 6. Distribution of the answers to the fifth question for the second group

Q6: Rank the characteristics by the influence (1-5) they actually had in your team on the success of your project! (Figures 7 and 8)

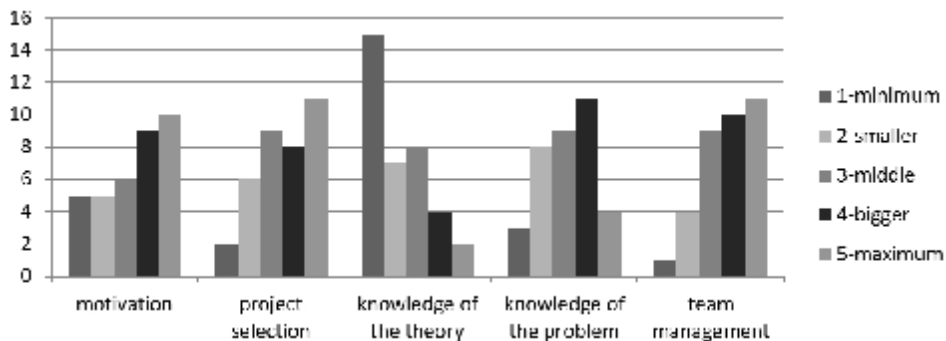


Figure 7. Distribution of the answers to the sixth question for the first group

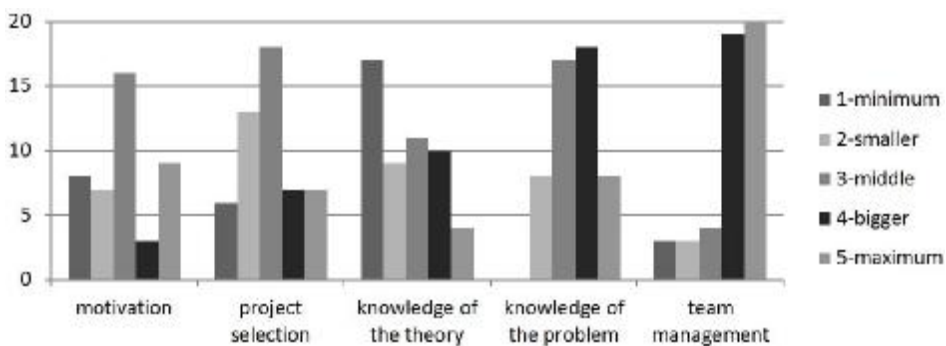


Figure 8. Distribution of the answers to the sixth question for the second group

Q7-I: What were the main advantages of choosing the project by yourselves? (Figure 9)

Q7-II: What were the main advantages of assignment of the project by the lecturer? (Figure 10)



Figure 9. Distribution of the answers to the seventh question for the first group

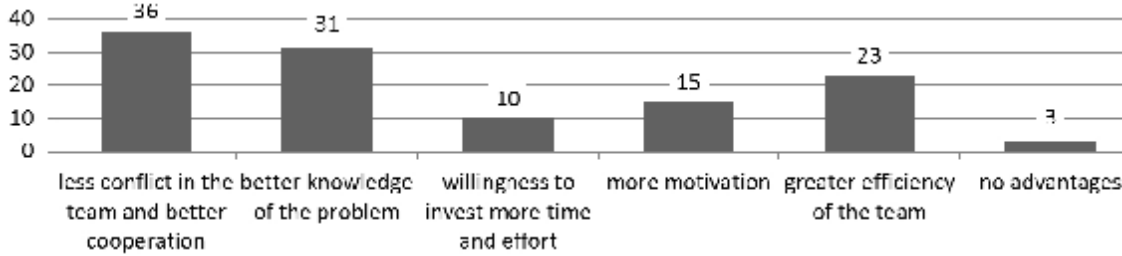
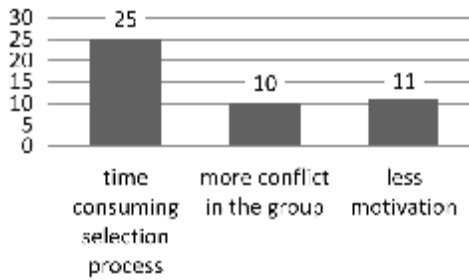


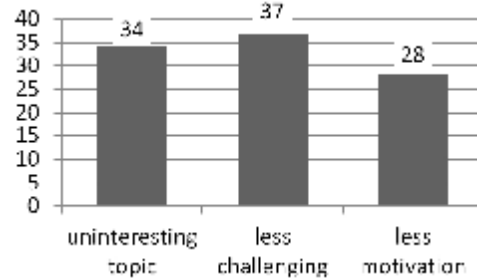
Figure 10. Distribution of the answers to the seventh question for the second group

Q8-I: What were the main weaknesses of choosing the project by yourselves? (Figure 11-I)

Q8-II: What were the main weaknesses of assignment of the project by the lecturer? (Figure 11-II)



I) Answers of the first group



II) Answers of the second group

Figure 11. Distribution of the answers to the eighth question

4 RESULTS

The results of the questionnaire show that the vast majority of the students take project-based learning as a challenge. More than half of them claim to have many ideas and they would prefer to choose their project by themselves. In case when project was assigned to them by the lecturer, the topic was not interesting to 41% of the students, while only 4% of them found it very interesting. On the other hand, when the students were in position to choose their project by themselves, the selected topic was very interesting to 28% of them, while it was not interesting to 5% of those students.

About 73% of those students, who were not in position to choose their project, felt that it would be better to have a choice. In the group, which had the choice available, the proportion of those who were happy to choose was smaller, but still high, around 64%. The reason lies in the fact that some believe the lecturer would assign them better project, in sense that they would have less problems and may get a better grade. In both groups, only 6% felt that the students should define their project together with the lecturer.

Personal opinion of the students about the influence of different characteristics on the success of the project is in good agreement with the experience gained within project-based education process. Perhaps the most surprising finding is that most of the students ascribe minimal impact to the theoretical knowledge to perform the project with success!

The students, who chose their own project, identified as the main advantages better cooperation, more interesting topic, and consequently an increase in motivation and performance. According to them, distinct disadvantages of this approach are time consuming project selection and more conflicts within the team. On the contrary, less conflicts, and thus better cooperation and efficiency were recognised as the main advantages when the project was assigned by the lecturer. In those cases, the biggest problem is how to make the project interesting enough to keep the level of challenge and motivation.

5 CONCLUSIONS

According to a survey, we can conclude that project work is challenging for most of the students. Majority of them wish to select the project by themselves. They believe that they have enough ideas to do that. Some would expect just a little support in terms of some suggestions. The projects are also much more interesting in the case of their choice and less when they get defined.

According to our experience the result of the team is very dependent on the internal organisation and dynamics of the team [10]. A group of students, who chose their own project that they like and represented a challenge for them, was very well organised. A systematic approach to work [11] with a great deal of enthusiasm led them to the successful completion of the project, in terms that they have managed to produce some useful results within expected scope on time. However, the other project team was more speculative when choosing their project. They had some ideas, but none of them seemed to be interesting enough for them. In the end they chose the simplest one, thinking that it will require the least work. Throughout the whole project they were performing on the principle of doing something that is necessary evil, which ultimately led them to poor results.

In both cases, if the project is defined in advance, or if it can be chosen by the students, the topic is rarely attractive to everyone. If the organisation within the project team is poor, more active are those who like the topic, while others have a more passive role, as the students usually work in teams on a more friendly level, and less on the level referring to their duties, responsibilities and rights.

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