

Student Motivation in Project-Based Learning

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Abstract

During the TIKLI-project, we have experienced that engaging students towards self-directed learning and working in the projects is challenging. In this project, we piloted a new learning environment for information technology students.

The purpose of the research study was to explore what issues of PBL affect the motivation experienced by students towards learning. The study is based on interviews of students who participated in the project.

The main outcome of the study is that the motivation of the students is influenced by the level of control the teacher holds in the project. Teachers' ability to doubt and ask questions was also seen valuable in guiding and challenging students' learning and working. According to our study, the customer contact is also one crucial element which affects motivation to learn. In addition, since the projects are carried out in teams, it is natural that the quality of teamwork influences the motivation of individuals.

Keywords

Project-based learning, motivation, engagement, control, motivational aspects

1. Introduction

Contemporary businesses require that employees possess and develop relevant skills and abilities in order to survive in the global business environment. Simply mastering a single specialized skill or subject is not relevant anymore. Instead, employees should be able to learn continuously on the job, therefore have acquired the skills to learn to learn. According to Peter Senge, the father of Learning Organization theory, humans are designed for learning, but unfortunately the working and learning environment today are more focused toward controlling rather than learning. They reward human beings for the outcomes or performance rather than supporting their natural desire to learn (Senge, 1990). Employees should have inspiring learning experiences already in the schools, so they can be more self-steered to learn in working life. This could also decrease costs spent on management and control structures in organisations.

To meet the elevated requirements of working life, several different learning methods have been developed. Project-based learning (PBL) is one of these methods. The PBL-method has been said to increase learning effectiveness. Barab et al. concluded that the conceptual understanding of students, who participated in an introductory astronomy course with project-based learning (PBL), was higher than students of the previous year with traditional lecture style (Barab et al., 2000). Aside from learning goals and motives, it is said that the benefits for PBL are increased student motivation and engagement (Bell 2010; Frank et al. 2003; Green 1998; Thomas 2000; Lenschow 1998; Melanie 2005; Orevi and Danon 1999; Helle et al. 2006). For example, Bartscher et al. studied the effectiveness of the PBL with third-, fifth- and tenth-grade students. They concluded that project-work conducted in the classes increased the level of motivation and interest in subject topic (Bartscher et al., 1995). Unfortunately the study of Bartscher et al. investigated motivation of students only in primary school. Since the subjects, learning environment and goals are quite different in primary schools compared e.g. to higher education, the applicability of the study is quite restricted. In addition, in the literature review few studies (Helle et al., 2006 & Blumenfeld et al., 1991) were found investigating what phenomena affect the motivation experienced by students. Therefore we cannot explain for example what phenomena affect the level of motivation experienced by the students participating in PBL modules. To increase the motivation levels of the students, our aim in this study

is to explore the factors affecting student motivation in a PBL learning environment in the university. This paper is structured as follows. In section two we briefly describe characteristics of project-based learning as well as findings from studies related to motivational aspects of PBL. The third section outlines the research settings and methods. The fourth section outlines the findings. The conclusions of the study are at the end where possible future work is also discussed.

2. Learning and Motivation

According to Thomas (2000, p. 1): “project-based learning is a model that organizes learning around projects”. In addition, Blumenfeld et al. (1991, p.1) describe project-based learning as a “comprehensive perspective focused on teaching by engaging students in investigation”. In this model, students approach the solution to complex problems by asking questions, debating the ideas with each other and clients, finding and analyzing information, deriving conclusions, discussing the findings and ideas and creating artefacts. These artefacts act as representations of the students’ problem solutions and they reflect the emergent knowledge which students have developed in the course of the projects (Blumenfeld et al., 1991). Critical for the project-based learning method is students’ freedom in asking different questions and approaching the problem. The problems should not be so strict that the outcomes of the projects are predetermined. It is through this process of freedom of choice to generate solutions that students produce their knowledge (Blumenfeld et al., 1991).

Proponents of project-based learning have argued that one of the outcomes of using project-based learning is better understanding of key principles and concepts, but unfortunately this is not evident in the scientific literature. Helle et al. (2006) conducted a literature review on project-based learning and the result is that only two articles out of 22 provided concrete evidence of the impact of project-based learning.

On the other hand Thomas (2000) found different evidence in his research on project-based learning. In his study, he described different kinds of studies on the effectiveness of project- and problem-based learning methods in the context of primary schools in the USA. The effectiveness in his review was evaluated in several forms which were e.g. summative evaluation, formative evaluation, assessing the role

of student characteristics affecting PBL and many more. Studies showed that PBL had a positive effect on the level of students' understanding of the subject content.

2.1 Project-Based Learning and Motivation

To increase the benefits of PBL- or any other instructional methods - is to think and design the courses in a way that increases the motivation of students participating in the course. Among the first ones to study the effect of PBL on student motivation was Blumenfeld et al. (1991). They conducted a literature review on the effect of PBL on student motivation and they found several aspects of PBL which affect the level of motivation experienced by students. According to their study, the first aspect which has to be considered in PBL design is authenticity of project. Students are more motivated to bring out and test their ideas and increase their level of understanding when they are confronted with authentic projects and problems. However, Blumenfeld et al. (1991) state that the evidence does not fully support this hypothesis. Regardless of how interesting and meaningful the projects are from the students' point of view, they may not want to put in the effort necessary to acquire the knowledge and develop their skills in order to complete the project. They propose that several components might explain more deeply how motivating the project is from the students' perspective. Among one of these components is interest and value.

The component of interest and value consists of a) variety and novelty of tasks, b) authenticity of problem, c) complexity of problem, d) ending of the project, e) freedom to choose on how to perform the project and f) opportunities of collaborative work. Tasks that have clear closure are authentic and complex enough, and tasks that enable freedom to choose how to work, have higher probability to raise and sustain student motivation for a long time. In addition, students may feel "ownership" towards the project when they have the chance to raise the questions to solve the project on their own (Blumenfeld et al., 1991).

Helle et al. (2007) have made similar findings in their research on the relationship between intrinsic motivation and self-regulation of students in the University of Jyväskylä, Finland. They interviewed 44 university students of University of Jyväskylä participating in the information systems course which used project-based learning as a learning method. They listed seven different "motivating aspects" which were found during the interview of students (see table 1). Three of the students felt

that the course was very motivating. In contrast, three students said that they had a problem with their motivation in the course due to the getting tired or due to the group dynamics.

Self-determination theory (SDT) has also been studied to explain and measure different motivation levels and learning performance of students. The SDT tries to explain subjects' internal motivation by dividing different subjects into four groups based on how internally motivated they are. The four groups of behavioural regulations from the least-self determined, to the most self-determined behaviour are; *external* regulation, *introjected* regulation, *identified* regulation and finally *intrinsic motivation*. Liu et al. (2009), tried to identify four homogenous student groups based on SDT's four types of behavioural regulations, and to measure differences in students' motivation, metacognition and perceived skills learned within the groups. The results of the study show that the most internally motivated students are most motivated in the PBL-setting of the study, and the least internally motivated students enjoyed the lowest motivation levels.

Other aspects related to motivation mentioned in the paper of Barron et al. (1998) were the role of group work. The individual in the PBL is actually responsible for his own work towards the group which is directly related to the factors related to the group and also a sense of agency mentioned by Helle et al. (2007). The last aspect in Barron et al. (1998) was outside audiences of projects which can be viewed as the presence and involvement of the client expressed in Helle et al. (2007). The following table (1) summarizes the most important aspects related to students' motivation towards learning in projects.

Motivational aspects of PBL in Helle et al. (2007)	Blumenfeld et al. (1991)	Barron et al. 1998
Authenticity	“The problem is authentic and has value”	“The outcome of the project would actually be used with the client”
Presence and involvement of client		“outside audience”
Self-directness, agency or "sense of ownership"	“Freedom of choice”	
Feelings or cognitions related to competence		
Factors related to group	“Opportunities to work with others”	“ individual accountability in group working”
The assignment	“The problem is challenging”, “tasks have closure”	
A different course		

Table 1 – Aspects related to motivation of PBL found in the literature

3. Research Settings and Method

We studied project-based learning courses which were piloted in EU-funded TIKLI-project at the Saimaa University of Applied Sciences. The aim of the project was to develop the learning environment of information technology students in the university to involve authentic customers in the project-courses. Courses were optional for the information systems and business students participating in the courses. The projects in the course were actual client projects of TIKLI-project. Each project had a university teacher as a coach who could use the level of control on the students based on his preferences. This means that in some projects teacher could have been in total control of the decisions of the project, while in other projects the teacher could have been more like coach or mentor allowing the students to have freedom of choice. Most of the coaches had little or no experience of project-based learning. Twelve university level students from 2nd year to 4th academic year attended the courses. Students were in six projects the focus of which ranged from small changes to Excel-worksheets to designing of corporation-wide IT-architecture.

The focus in most of the projects was on design and / or implementation of solutions to abstract client problems which were related to information systems. Two projects (hence, a and b) had much more abstract problems compared to other projects and the problems were relatively new to students. In project (a), the problem was stated as “*sustainability or green IT concept in services of company X*”; the goal was to discover possible new product lines or product ideas to the customer company,

including competitor analysis. In project (b), the problem of the project was stated as “*evaluating and benchmarking IT efficiency of industrial manufacturing companies*”; the goal was to study and report different kinds of models for evaluating IT efficiency in industrial companies. As can be seen, the goals were quite abstract and the scope of the projects very large. The company representatives in projects had a face-to-face contact with the students 3-4 times in 6 months period. Students worked in 2-5 member teams during the course.

The research question of the study was: “What are the factors affecting students’ motivation in PBL learning environment in higher-education?” Since the subject of the study is the subjective experiences of the students, we used a qualitative research method (Järvinen, 2001). Semi-structured interviews were used as a data collection method in order to keep the structure of the interviews flexible and open to new issues discovered during the interviews (Kvale, 2007). Interviews were in two stages: during the courses and one month after the PBL courses. Interview themes were derived from researchers’ experience and the above mentioned studies on the motivation of project-based learning.

4. Findings

The factor which emerged most often from the interviews was the authenticity of the customer and the problem, and the presence of the customer during the project. One student expressed the presence of the (real) customer in this way: “*I think you feel more the pressure. The customer is the customer. So, even if we are not paid for the outcome, still it is pressure from some outer source that should come with some resolution, some solution ... You can’t just come with hands (up) and say: “Oh, there’s nothing done”. So that’s the one thing. That’s the difference.*” The quotation can also be regarded as one aspect of the phenomenon of agency described by Helle et al. (2007). The presence of outside customer creates the feel of agency of students. A student from another project expressed the importance of the authenticity of the client and the problem as follows: “*...project was good, there was like the real customer which is also positive that he really has problems and worries (Student tries to express in English that the project was good, there was a real customer, which was positive, who also has problems and worries). Not necessarily anything disastrous but something that would help them.*”

In project (a), the customer was involved in the project meetings with the students almost right from the beginning. In project (b) students got contact with customer two months after the start of the project. The experienced motivation levels in these two projects supported theories found in the literature: *“In the first meeting with the customer was enabled, so before that we had very little motivation. That was because we didn’t have a talk with customer (student trying to express in English that before first meeting with the customer, they weren’t very motivated).* Another student supported this expression: *“Yea, it was like.. The time was way past half of the course already and we (hadn’t) met with the customer before that. It was like.. I didn’t even care much about the project in that point.”* Other students continues this analysis and make interesting observations on the effect of the customer meetings to teamwork: *“We hadn’t even divided the work because we couldn’t.. there was so much information we could have found so.. that was quite a messy”*.

Part of the frustration students felt was due to the complexity or intangibility of the project. In the projects (a & b) one student described the situation after the customer meeting as follows: *“I think that even in (the) later phase when we had these clear goals, still the project seemed like we’re lost in the field. The whole space around us, all the mountains but we never knew where are we, how much time, how long it will take to another phase. Still you have this kind of feeling.”* The complexity of the project experienced by students related also to the feedback from the customer. If the customer doesn’t clearly express what she or he thinks about the project, students feel themselves lost because they are used to someone always giving feed-back. Based on our experience, part of the frustration might have been due to the fact that students were expecting precise orders on what and how to do it. They were not used to project-based style courses where the goals depend on the decisions made by students. Asking to describe how the coach or instructor affects the motivation of students, one student saw that the role of the coach was to challenge the students to think about the subject in matter: *“...even when we just (had to) reply what we are doing, it was good for us just (to) put it together and that we had to say aloud what we are doing. If you just have some clue what are you doing and that you need to explain it to someone, it’s completely different. So, it needs you to really get it together and think about what you are doing”*. Consequently, the line between how much control from the coach is optimal is thin. One student expressed how he felt the role of the coach in

his project (b): *“Well, in the ICT-project we had too less (little) the guidance. It would be much more helpful if there would have been clearer things to do...”*. Conversely student in the other project (a) said that the support from coach is good: *“I think that we had just enough support from the teacher. Not too much, because now we have possibility in this project.”*

The experiences of the teamwork were quite opposite between two projects. In one project, there was no trust between the project leader and team members at the beginning of the project, but it improved in time. In the other project the leader trusted other team members right from the start. This might be because one project leader was quite knowledgeable on the subject of the project as opposed the other project leader who was neither experienced nor knowledgeable on the subject. Additionally, the coach affects also the teamwork of the students as is reported by one student who described the feedback meeting of students and the coach: *“We could think about it some other way, like we heard what another thinks and try to reflect about that. Somehow rearrange our opinions, and it was good. To know what others thought about the project.”* According to this opinion, expressing the feelings and opinions of the project and the teamwork is safer when the coach is present and when the expression of feelings is the specific agenda of the meeting.

According to our study, also the learning environment has some effect on the teamwork experienced by students. The following quotation describes this situation: *“...our team was sitting at one table and everybody was behind computer and it was hard to push something to come out and say something (communicate). And to reach somebody on the opposite side was a problem... somewhere to sit some comfortable place to sit where nobody would come around and say “ok. You have to leave because we have here.”... Like we did more work at home in my point of view than other team”*.

As can be seen by looking at descriptions above, the factors affecting the motivation experienced by students affect also each other, forming a complex network where one cannot identify which aspect is the cause and which is consequence.

5. Conclusions and Future Work

In this paper, we have expressed what factors affect the motivation experienced by the students in project-based learning in third-level education. We used semi-structured interviews to gather data from the 12 students participating in courses where project-based learning method was used. The factors related to students' motivation were: the role of the customer and the coach, complexity of the problem / project, quality of the teamwork, agency and the environment of the PBL course. The positive role of the customer included characteristics like the number of customer meetings, authenticity of the customer and the project and the feedback which customer gives to the students. The authenticity of the customer and the project seemed to develop the sense of agency to the students. Based on our study, we can express that a good mix of control and support from the coach to the students might improve the motivation of students. If the coach can give responsibility to the students for conducting the project, it can develop a sense of agency for them. In most of the cases, this might increase the motivation of students. If the coach gives all the control to students and doesn't support them in the project, students might feel too much pressure and loneliness, which might decrease the motivation. The support from coach can be as simple as being around in the project meetings or giving a couple of supportive utterances to them.

According to our study, the complexity of the project relates to the novelty of the problem domain and to the concreteness of the problem which is included in the project. The problem shouldn't be too abstract or too novel to the students, since excessive complexity might kill the motivation of the students.

It seemed that the environment of the PBL course related to the time and place where the PBL course was implemented. If the time of the PBL course is very busy for students, it can decrease the motivation towards the project. Additionally, if the physical environment (classrooms, meeting rooms etc.) is not suitable for teamwork, it might decrease the quality of the teamwork and thus, decrease the motivation level of the students.

There are limitations for the study. For example, the fact that the interviewer was the coach for the students might have altered the responses which students gave in the interview sessions. Although this study suggested factors relating to the students' motivation at university-level, according to our findings, there is some evidence that the factors are interrelated. More research is needed in order to gain more

understanding on how these factors interrelate and how they affect the motivation of students.

6. References

- Barron, B., Schwartz, D., Vye, N., Moore, A., Petrosino, A., Zech, L. and Bransford, J. (1998). Doing with Understanding: Lessons from Research on Problem- and Project-Based Learning. *The Journal of the Learning Sciences*, 1998, Vol. 7, No. 3/4, 271-311.
- Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House*, 2010, Vol. 83, No. 2, 39-43.
- Blumenfeld, P., Soloway, E., Marx, R., Krajcik J., Guzdial, M. and Palincsar, A. (1991). Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning. *Educational Psychologist*, 1991, Vol. 26, No. 3&4, 369-398.
- Bradford, M. (2005). Motivating students Through Project-Based Service Learning. *T H E Journal*, 2005, Vol. 32, No. 6, 29-30.
- Frank, M., Lavy, I. and Elata, D. (2003). Implementing the Project-Based Learning Approach in an Academic Engineering Course. *International Journal of Technology and Design Education*, 2003, Vol. 13, No. 3, 273-288.
- Helle, L., Tynjälä, P., Olkinuora, E. and Lonka, K. (2007). 'Ain't nothin' like the real thing', Motivation and study processes on a work-based project course in information systems design. *British Journal of Educational Psychology*, 2007, Vol. 77, No. 2, 397-411.
- Helle, L., Tynjälä, P. and Olkinuora, E. (2006). Project-based learning in post-secondary education – theory, practice and rubber sling shots. *Higher Education*, 2006, Vol. 51, No. 2, 287-314.
- Järvinen, P. (2001). On research methods. *Opinpaja*, 2001.
- Kvale, S. (2007). *Doing Interviews*. Sage Publications.
- Lenschow, R. (1998). From Teaching to Learning: A Paradigm Shift in Engineering Education and Lifelong Learning. *European Journal of Engineering Education*, 1998, Vol. 23, No. 2, 155-161.
- Liu, W. L., Wang, C.K. J., Tan, S. T., Coh, C. and Ee, J. (2009). A self-determination approach to understanding students' motivation in project work. *Learning and Individual Differences*, 2009, Vol. 19, No. 1, 139-145.
- Senge, P. (1990). The Leader's New Work: Building Learning Organizations. *Sloan Management Review*, 1990, Vol. 32, No. 1, 7-23.
- Thomas, J. (2000). A Review of Research on Project-Based Learning. Available at: <http://www.autodesk.com/foundation>.