ENHANCING LEARNING INFLUENCE WITH PRODUCT DEVELOPMENT SIMULATION GAME - PRODESIM

Tommi Metso

Turku University of Applied Sciences

Kari Lindström

Turku University of Applied Sciences

ABSTRACT

The importance of product development from a business point of view is both challenging to learn and teach in a university setting without the context of a real business environment. Turku University of Applied Sciences uses innovation pedagogy in its teaching practices, which on a practical level refers to an approach to learning and teaching that emphasizes working life skills. The automotive engineering and logistics degree program offers a course called Product development and Planning. In 2011 the course was altered to include teaching technology, a virtual environment where the product development skills obtained throughout the course are put into practice. Furthermore, the students are provided with an insight to the importance of the research and development activities in relation to profitability. The method applied was a product development simulation game called ProDesim.
Student feedback after the simulation aspect greatly supported the inclusion of a simulation based teaching approach. This paper presents the results of students' feedback about the simulation game used during the Product development and Planning course. As a result of this encouraging feedback, the simulation game was included as a permanent part of the course from year 2012 onwards.

KEYWORDS

Educational Game, Simulation Game Model, Product Development, Product Planning

INTRODUCTION

The Product development and Planning (PDP) course [1] is primarily aimed at engineering students (Degree Programme in Automotive and Transportation Engineering, Bachelor's degree). The course extent is 5ects (European Credit Transfer and Accumulation System) points and is classified as optional studies [2]. The course spans over the entire autumn period; the first part of the course consisted mainly of the theoretical background lectures (project management and planning and also different kind of innovation methods). The second part consisted of participating in development projects given by the faculty. The course concluded with a final seminar where all projects were presented. The original structure of the PDP course is shown in figure 1.
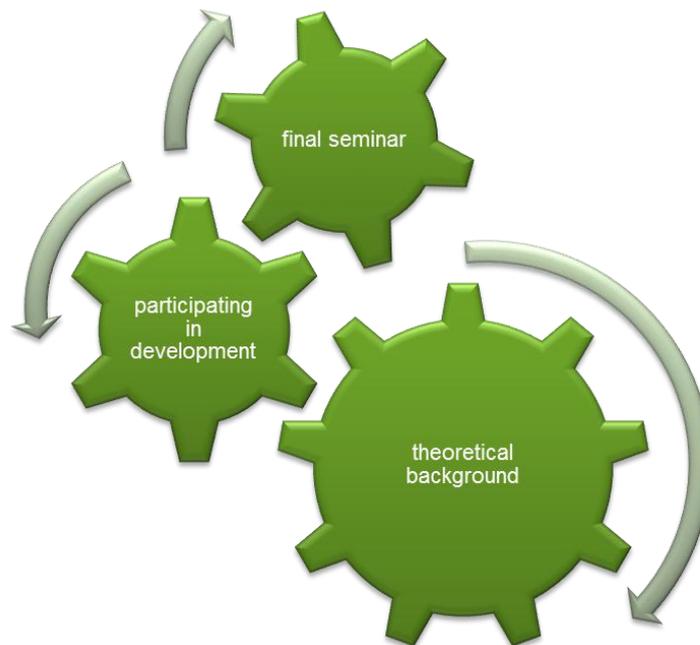

Figure 1. The original structure of the PDP course.

From the beginning of the academic year 2010, the course was altered by changing the projects from faculty given to development project also include assignments from local enterprises. These company driven development projects required increased amount of course time which was achieved by reducing theoretical lectures. This required new thinking with regards to course material distribution. The course material was originally distributed via the Discendum Optima eLearning solution [3]. The website degree of automation was increased, thus enabling students to study more of the material independently as shown in figure 2.
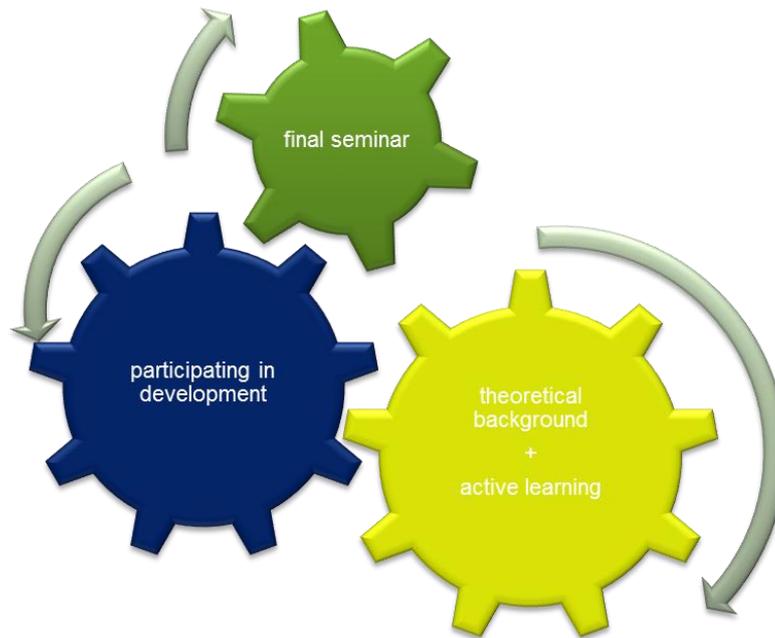
Figure 2. The structure of PDP course after 2010 changes.

The course duration is 13 weeks. During the first three weeks the theoretical background was covered. During week 4 the project development teams were established and briefed. Teams were able to choose from either the faculty given subjects or alternatively suggest their own subject, which has to be approved by the faculty.

During 2011 Turku was the European Capital of Culture. One of the events organized during was the Turku Grand Prix – Downhill Racing [4] in which the Turku University of Applied Sciences had several participating teams. A pre-race was held in 2010. The faculty given assignment project was to design and build a racing vehicle to this race. Three of the six project teams choose to design a downhill vehicle. The other chosen subjects were as follows: motorized kick sledge assignment given by an elderly private person, development of trash pallet given by a local enterprise and organizing a car expo event, a subject given by a student co-operative. The three downhill teams took part in a race at the end of the assignment. Only the best design was going to be built and the winner was picked by peer assessment.

The time allocated to the PDP project time was eight weeks. During these weeks only a minimal amount of lectures were held. The subjects of these lectures were connected to the development projects covering topics such as industrial design, immaterial rights, team work etc. Week 13 was the final week during which the teams gave a presentation in the form of a final seminar and also submitted the final project documents. The assessment of the course was based on tree parts: seminar peer assessment, self-evaluation and faculty assessment of the closing report.

The students feedback obtained during the academic year 2010 confirmed that the basics of the course were on track. Nevertheless, the learning influence had to be reinforced. Some evidence has been obtained in prior studies that simulation games are suitable for this purpose [5]. Fortunately Turku University of Applied Scienses had developed a simulation game, which was now included as part of the course as shown in figure 3.
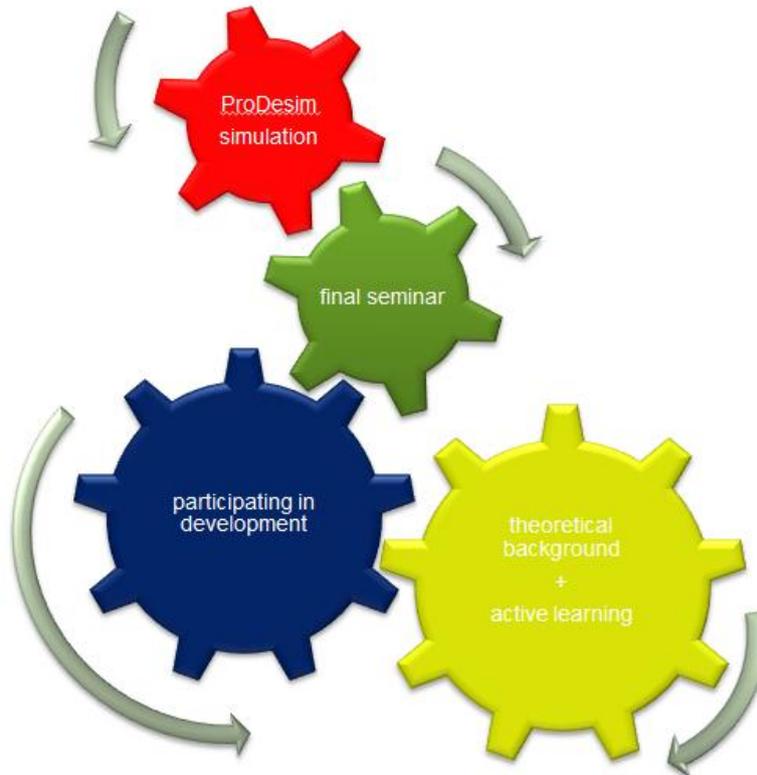
Figure 3. The structure of the PDP course after the inclusion of the simulation game 2011.

IMPLEMENTATION OF PRODESIM SIMULATION GAME IN THE PDP COURSE

ProDesim is a business simulation software designed for work communities and teaching organisations operating in the field of product development [6]. It simulates the operations of a product development company covering a five-year period. The participants develop multiple products according to their interpretation of the current market situation. The participants of the simulation learn and get feedback about the economical results of their investments in product development, market dynamics, project management, personnel management, scheduling and issues concerning interaction and expertise levels of the group [7].

ProDesim has a conventional playing board with a computer interface. The participating team is placed around a 'real-life' managerial board, which is equipped with a specific chart indicating the project flow and the main phases. Decision-making play cards and resource pawns, both containing RFID tags (Radio Frequency IDs) are also provided. When the relevant cards and pawns are moved through the RF reader, the computer model identifies the decisions made and calculates the next move. As the Board of Directors, the players make decisions on new, existing and future products according to the market situation and competition shown on computers data projector. Decisions are made about what kind of products to develop, recourse allocation to the development, the span of the development period, cost and price. In a way, the game jumps one managerial level upwards from the product development project [8]. Figure 4 shows a picture from a simulation session from 2011.

Figure 4. The virtual simulation of product planning in an enterprise environment was brought to the 2011 course to reinforce the learning influence.

From the PDP courses point of view the main issue was the learning influence, in particular how to concretize the complex connections of product development and business in small and medium-sized enterprises. The lectures given to participants had made it clear that time is money, resources are limited and money is a limited resource. ProDesim resolves this dilemma by using a tree-level simulation model. The levels were teamwork, the design process and business as shown in figure 5. Teamwork level forces players to make both individual and joint decisions. Thus it is possible for participants to share professional knowledge. Organization roles give participants insight into different kinds of responsibilities and authorities within the organization. The organization structure is clarified, i.e. whose responsibility the decision making is in certain matters. The design process level models the process of the development process by a flowchart and also describes the scripted communication between roles and functions. Tasks and design phases, durations, cost and needed resources are modeled on this layer. The business layer models strategic goal setting and financial aspects of the new product development project in order to support managerial decisions of the players. The resources, time and money dilemma is thus tested and the feedback from the decisions made can continually be observed by the participants on the data projector throughout the simulation [9].
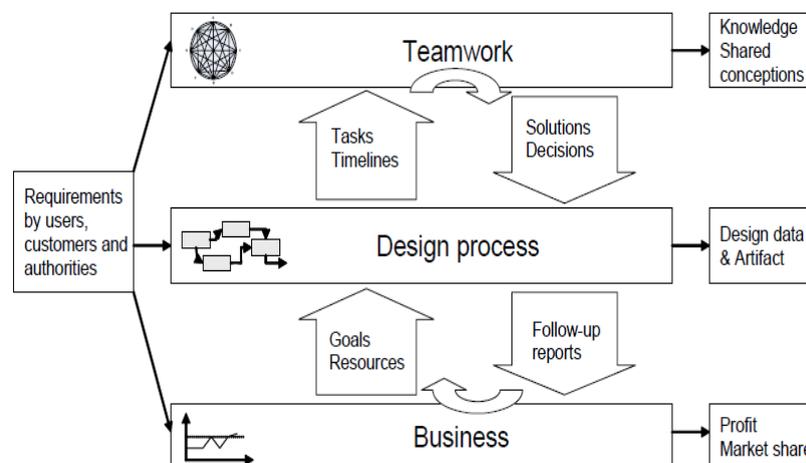

Figure 5. The ProDesim three-level simulation model.

RESULTS

After the inclusion of the simulation game to the course the students were asked to give feedback about the course itself as well as the ProDesim simulation session. Even though the number of responses is quantitatively insufficient some conclusions can be made using a qualitative approach [10]. The overall feedback obtained from the 2011 course was generally good, as was the case of the 2010 feedback and it seems that these development project assignments given by the local enterprises enhanced the working life connections and the average feedback rose up to 3.7 from the previous 3.1 as shown in figure 6. Also it seems that these modifications to the PDP course structure were successful as the student's feedback average on courses learning influence rose to 3.7 in 2011 from the 3.1 in 2010 as shown in figure 7.
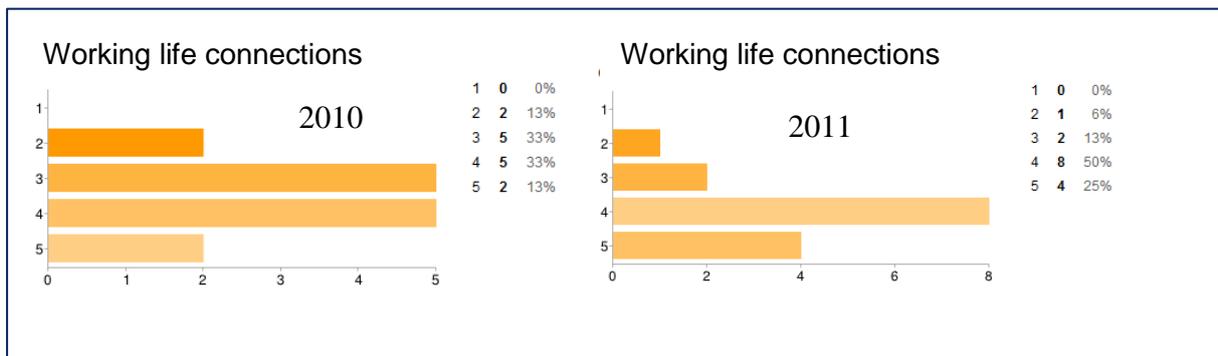

Figure 6. Student's feedback on the PDP course working life connections. Average rose from 3.5 in 2010 in to 4.0 in 2011.
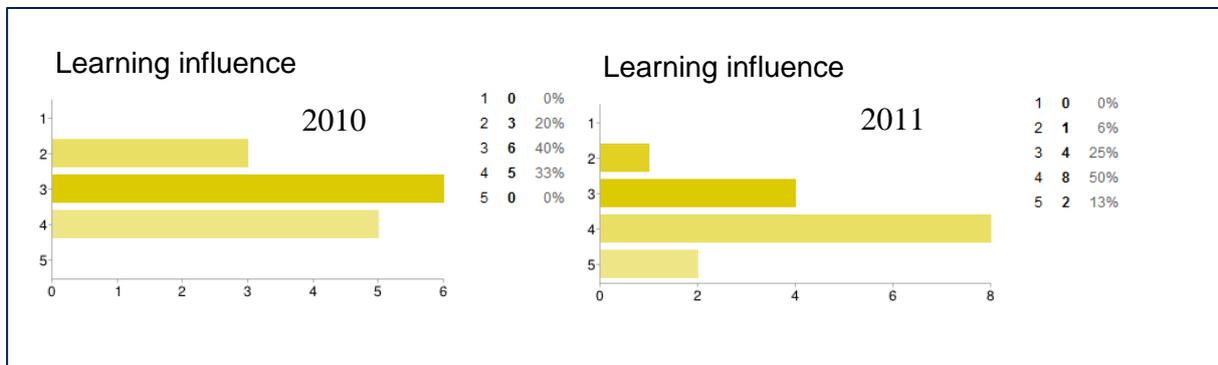

Figure 7. Student's feedback on courses learning influence. Average rose from 3.1 in 2010 to 3.7 in 2011.

Feedback from the first simulation session held in year 2011 was of great interest. Feedback obtained from students was positive as demonstrated in Figure 8. According to the students the simulation helped to realize the importance of the research and development (R&D) activities in relation to profitability. Furthermore, students recommended using simulation as a part of the course also in the future. The written feedback was also good, for example one particular student wished for a longer simulation period.

The PDP course was lectured for a second time in its new form autumn 2012. A post-study was undertaken about the influences gained during simulation as shown in figure 8. The summary shows similar results as in year 2011. All the main measurements obtained showed high grades.
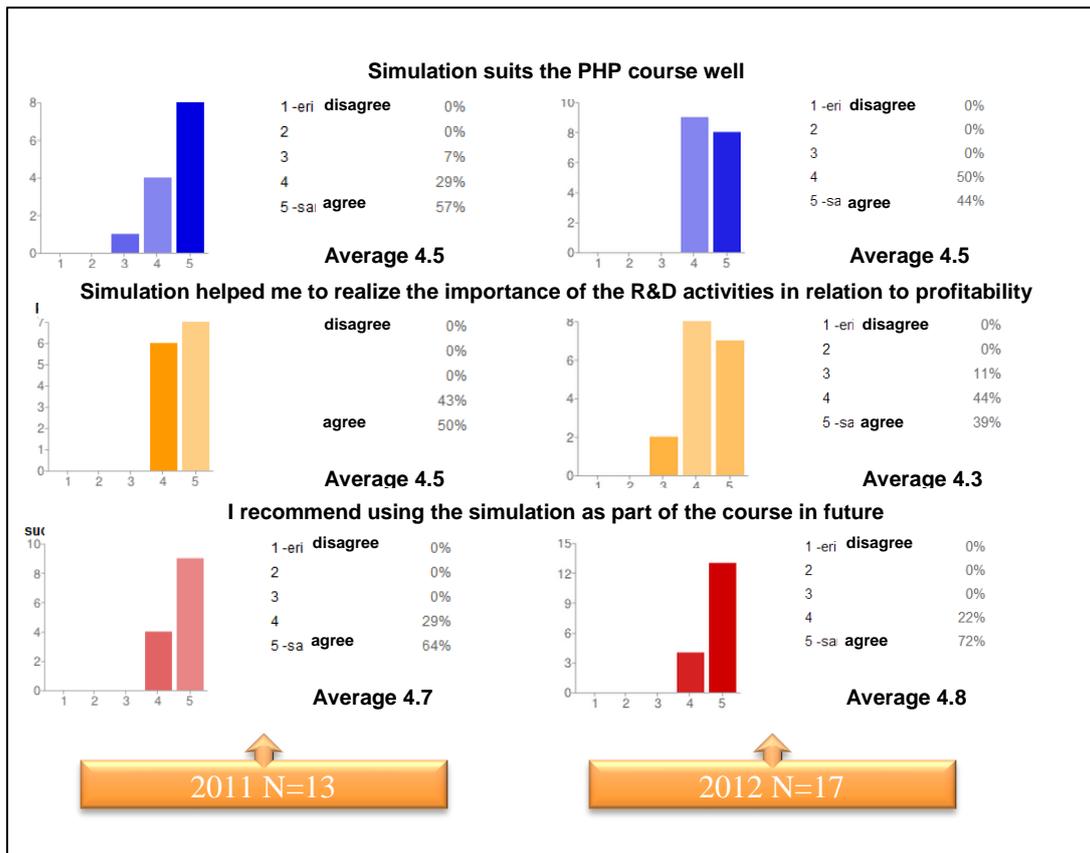
Figure 6. The results from feedback given after the 2011 and the 2012 ProDesim simulation sessions.

CONCLUSION

The PDP course has been developed during last five year period. The steps taken were changing the course projects from faculty given to development project assignments from the local enterprises, enabling students to study more of the material independently by increasing the degree of automation on the eLearning website as well as implementing the ProDesim product development simulation.

It was clear from the beginning of the development process that the basis of the course was on track, however the feedback highlighted that the learning influence needed improvement. The importance of the product development from a business point of view was on target. The results show that these challenges were responded to. The steps taken enhanced active learning among students, the learning influence raised and most of all the importance of the product development from a business point of view was clarified.

The ProDesim simulation was also developed and new element was included: strategic planning. How does product development and planning fit the strategy chosen by the company? The new element is well suited for the goals of PDP course and will be the future course development focus as well as describing of clear intended learning outcomes and mechanisms of development projects assignments from local enterprises.

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BIOGRAPHICAL INFORMATION

Tommi Metso is a Senior Lecturer in Mechanical Engineering in Degree Programme Automotive and Transportation Engineering at Turku University of applied sciences, Finland.

Kari Lindström is a Degree Manager in Degree Programme Automotive and Transportation Engineering at Turku University of applied sciences, Finland.

Corresponding author

Mr. Tommi Metso
Turku University of Applied Sciences
Sepänkatu 1
FI-20700 TURKU, FINLAND
+358 50 59 85 643
tommi.metso@turkuamk.fi