Integrated Curriculum

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INTRODUCTION

The main idea of this paper is to give an insight of how the integrated curriculum is applied in Lapland University of Applied Sciences by building students' curriculums around projects and project based learning.

The structure of the integrated curriculum in Lapland University of Applied Sciences is presented in the first chapter. The definition and purpose of Teacher team is also presented in the same chapter, as well as how the SCRUM method is applied in Lapland University of Applied Sciences. The second chapter is focused on case studies. The projects implemented in 2016, Smart Cabin, Bit Factory, and eSLED are used as an example of seasonal projects to give a better idea of how the integrated curriculum is applied in practice. The references are at the end of the paper.

1. GENERAL

1.1 Seasonal Projects

The main idea of the integrated curriculum is that each student group, total of 40 students, will complete all their 30 ECTS (European Credit Transfer and Accumulation System) in a project containing each study unit scheduled in curriculum. Each study unit consists of 5 ECTS so there are 6 different study units. CDIO (Conceive-Design-Implement-Operate) is being used as a leading pedagogical method. Since 2011 several publications which describe the early years of the CDIO have been written [1, 2, 3]. Students form project teams that consist of three to five students. All teams will complete the same topic defined by the Teacher team which consists of teachers responsible of courses during seasonal projects. During their studies, students will have eight seasonal projects. The structure of integrated curriculum is shown in Figure 1.

Fig. 1. Structure of integrated curriculum. Each semester is divided in two seasonal projects.

Integrated curriculum method requires strong project management. The Teacher team has got their own project which needs to be planned, manuscripted and managed just like the students' projects – only with different goals. Aim of the teachers' project is to increase students' skills mentioned in curriculum by supporting the process and, of course, get them to pass the studies. Teacher team is a tool for managing the run. It plans and schedules all functions (lessons, workshops, reviews, final session organizations etc.) together, discusses progress of the students and student teams and shares all upcoming issues.

Project management is integrated to the current seasonal project. Students will be orientated to use SCRUM method, which is a method for project phasing and management. In SCRUM method the project is separated to smaller functions, features and tasks that are work amount estimated. SCRUM process is based on sprints. The sprints contain sets of functions to be completed. Teacher team represents the customer, acts as a product owner and reviews the sprint results in sprint reviews. Between the sprint reviews, the task of the teacher is to support the teams to complete their tasks and give some supporting lessons if necessary. Applying SCRUM is described in Figure 2.

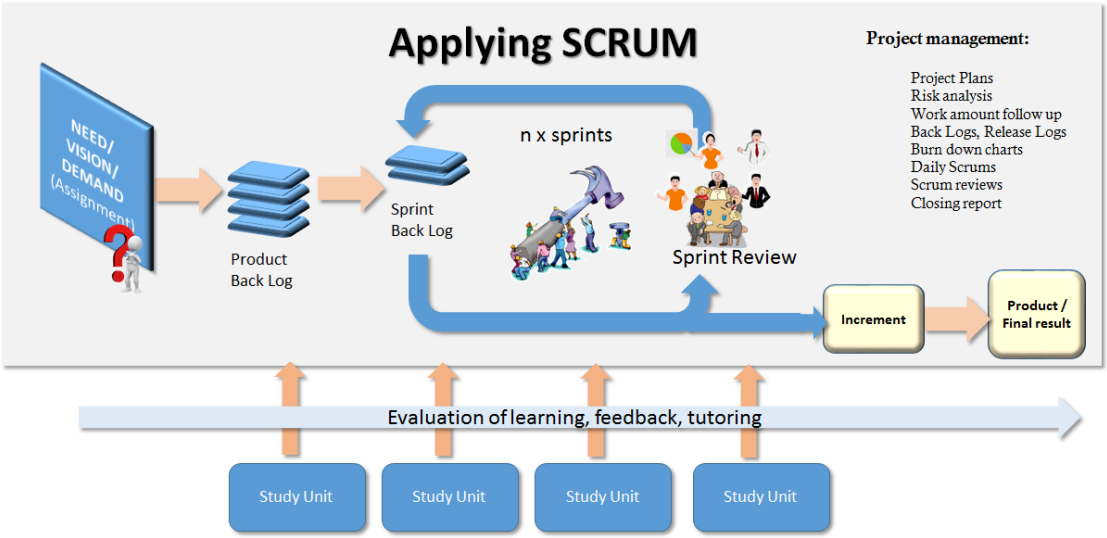

Fig. 2. SCRUM project management method

2. CASE STUDIES

2.1 Smart Cabin

First-year students' goal is to build a house automation simulation based around Internet of Things (IoT). The project is implemented using Raspberry Pi microcomputer with relays, sensors, switches and other discrete electronic components. The system is required to include an user interface controlled over the Internet that can be used for client's role as an end-user to monitor and control the elements of a house automation. Systems to be controlled are for lighting, heating, ventilation, security technology etc. Students will receive guidance and information from each courses organized during the spring period. Basic idea of an intelligent system project called Smart Cabin is presented in Figure 4.

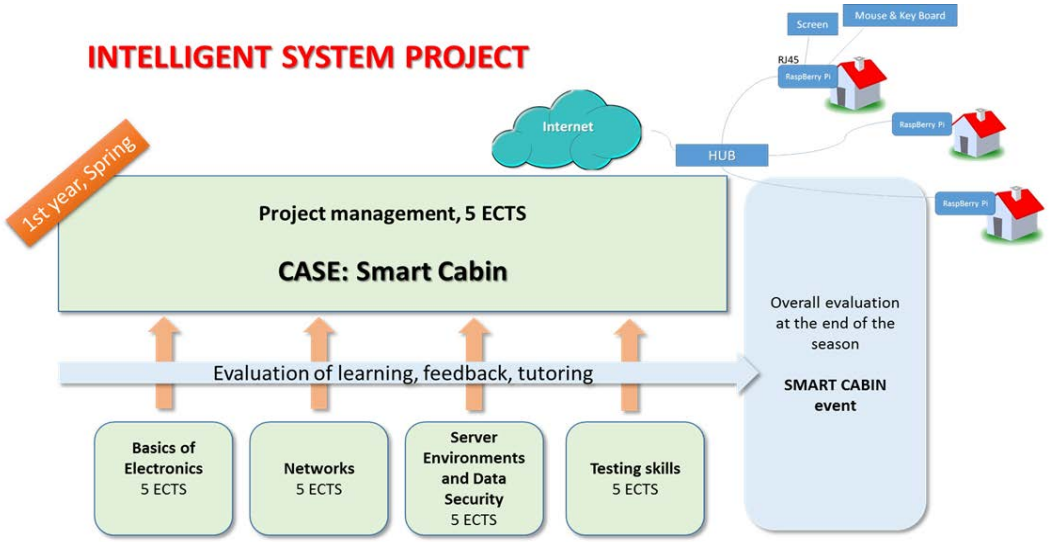

Fig. 3. Smart Cabin - project to first year student in spring semester 2016

The automation system simulation implementations built by the student project teams are presented at the end of April at the own house automation fairs of ICT degree programme. Sites and house miniatures are combined together to create a functioning city. Network infrastructure will be built to the city providing an Internet access to properties and allowing control and monitoring houses via the Internet application. Snapshots from the fairs are shown in Figure 4.

Fig. 4. Snapshots from Smart Cabin Exhibition

2.2 Bit Factory

Second year courses and their learning objectives provided starting points for the implementation of the Bit Factory project. Themes were mainly based on product development process and entrepreneurship. Topic and assignment were created around the theme of project development. Project was phased according to the SCRUM method. Sprint reviews were held at the end to each sprint by the teacher team acting as a customer.

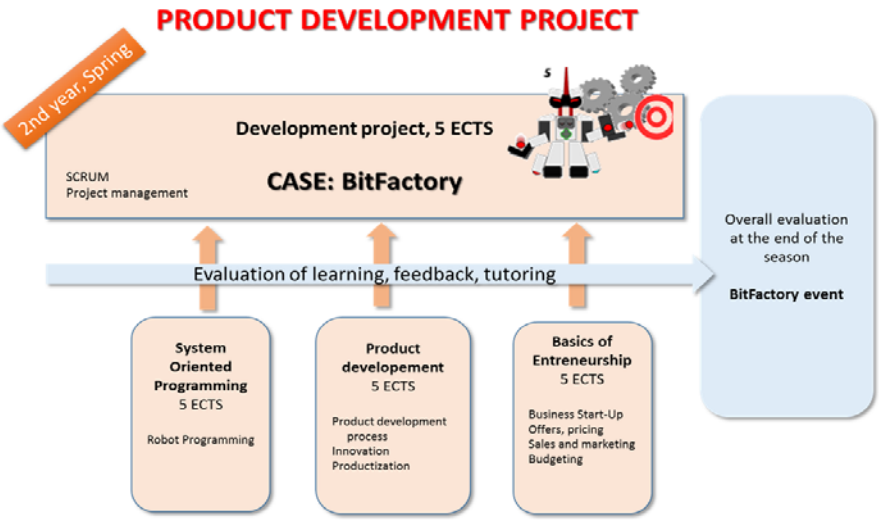

Fig. 6. Bit Factory - project to second year student in spring semester 2016

The student teams established "companies" and produced the documents required. Teachers were representing a fictional company called Bit Factory Ltd. The company requested an offer for the new product of automatic packaging and transport system (AGV, Automated Guided Vehicle). Calls for tender attempted to simulate the real-world practice and described the factory environment, the requirements set for the conveyor, as well as the factors affecting the purchasing decision. The conveyor is supposed to separate six ping-pong balls in two different colors to transport platforms and deliver them to the target area by evading the obstacles along the way. Students' companies responded to the call for tender. Offers were reviewed and feedback was given.

Seasonal project finally took place in the exhibition and the students' accomplishments were presented to and evaluated by the jury. An example of the Lego robot and exhibition stand example can be seen in Figure 6.

Fig. 6. Snapshots from Bit Factory exhibition

2.3 eSLED

Capstone project represents a more demanding skill level and is targeted to third-year students. Topics are reviewed by local industry. eSLED topic and assignment for the spring 2016 capstone project was provided by Arctic Power laboratory of the Lapland University of Applied Sciences concerning eSLED research and further development. The eSLED project is based on earlier product development projects described in publication of Kantola, Karjalainen and Alakunnas [3]. Plan of the seasonal project for third year students can be seen in Figure 7.

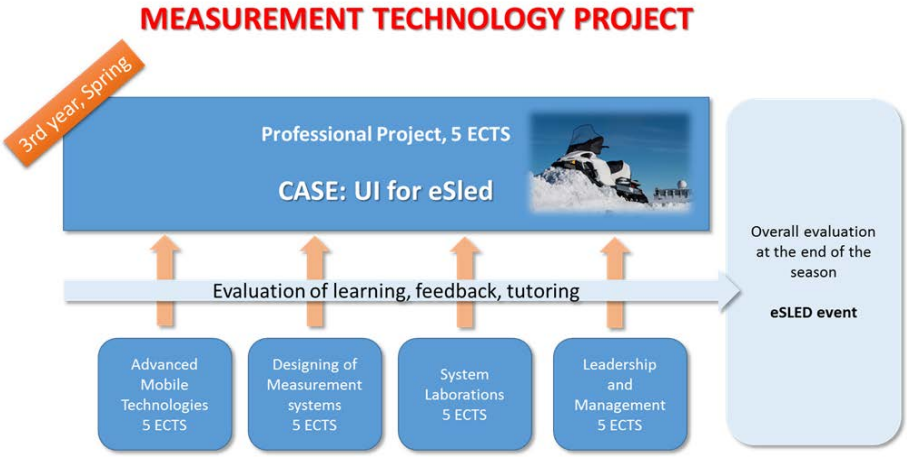

Fig. 7. eSLED project to third year students in spring semester 2016

eSLED is built around an electric snowmobile. The project contains demanding measurement and control technology, transfer of measurement data, and visualization of data for mobile user interfaces.

Project topics are related to electrical measurement, analysis and control systems. The six project groups received assignments to build a micro-computer as well as mobile graphical user interface, data acquisition and control/adjustment. Project groups' daily work consists of guided laboratory classes. In addition, students have free access to the laboratories allowing independent work and development of project. In Fig. 9 there is a snapshot of a weekly laboratory session.

Fig. 9. Third year students doing their product development of eSLED on spring semester 2016 (photograph: Kenneth Karlsson)

SUMMARY AND ACKNOWLEDGEMENT

The integrated curriculum is applied in Lapland University of Applied Sciences via project based learning. The projects presented in this paper are Smart Cabin, Bit Factory and eSLED which were all implemented in 2016. The Smart Cabin project was aimed for first year students and got positive feedback from the students. The main idea was to familiarize the students to IoT and some of its technologies. The second project was called Bit Factory. In Bit Factory the students used sensor data of the robots in programming. The students also got experience on entrepreneurship during the project. The capstone project was called eSLED and it was targeted for third year students. As a project, eSLED was the most demanding. The students got experience on many aspects of electrical measurement, analysis and control systems.

Overall, students found the new teaching method rather demanding and time consuming but on the other hand very rewarding. The teachers in turn thought that the season projects with integrated substance studies increase requirements for pre-planning and manuscripting, yet found the new method better, since the students gained knowledge on how to manage projects and large entireties.

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