

# Entrepreneurship for engineering students at Tromsø University College

A. Gjengedal<sup>1</sup>, V. Alvarstein, B. Fossheim, S.A.R. Pedersen and A.P. Rudi  
Tromsø University College/Department of Engineering and Economics, Tromsø, Norway

**Index Terms:** Business Establishment, Entrepreneurship, Problem based learning.

**Abstract:**

*Entrepreneurship (Business establishment) is a 20 credit point (ECTS) course during two semesters in the second year of the engineering education at Tromsø University College. In the first semester the students establish teams, generate and select a business idea and develop a business plan with a budget. In the second semester the students run the business and close it at the end of the semester. The paper describes the background for the course, goal, contents, teaching methods, assessment methods and experiences with the course. Statistics and examples of businesses are presented. The first week is a kick-off seminar where the teams are established, business ideas are generated, the ideas are evaluated, and the best and realizable ideas are selected. During the first semester the business plans are developed and presented for a panel of representatives from local business, innovation system and the tutors to get feedback. The teams also make a plan for the entire course. Lectures on diverse subjects are given, such as presentation techniques, marketing, intellectual property rights, economics (budgeting and accounting), business organization and board responsibilities and work. Several local entrepreneurs have presented their experiences in the process of establishment of new businesses as guest lectures. There is also a seminar on commercialization of new products and research results.*

*In the second semester the businesses are run under the concept of “Junior Achievement-Young Enterprise Norway”. The semester starts with a one day practical course in economics (a game called Economy Illustrator) where the teams have to go through the life cycle of a new entrepreneurial business. During the semester there are lectures on economics (accounting), web design and ICT, guest lectures on raising capital (investors), and on ethics in business. Each team has to design a web page with information of the student business, products and services offered.*

*At the end of the semester the student businesses are presented for other students and representatives from local business and innovation systems. A report (formed like an annual report) and accounts for the running period are produced and are part of the assessment. The student businesses can be divided into two categories: Development of new products and services, and import and marketing of new products in the local market. Examples are given. Students who do not run a student business have to make a case study on entrepreneurship. The course uses project work and problem based learning. Assessment and experiences are discussed.*

## I. INTRODUCTION

Entrepreneurship (Business establishment) is a 20 credit point (ECTS) course during two semesters in the second year of the engineering education at Tromsø University College. The College has four different engineering educations: Automation Engineering, Nautical Engineering, Processing and Gas Technology, Security and Environment Engineering. The Entrepreneurship course is compulsory for all of them as well as for the bachelor program in Societal Security and Environment.

### A. Demand for new business and entrepreneurship

The Norwegian economy is still very strong because of oil and gas production, and the oil price has doubled the last year. But as described in [1], a study of innovation and entrepreneurship, high costs of living, high salaries, high interest rate, high exchange rate for the Norwegian currency (NOK) and low unemployment makes it difficult for traditional industry (like paper production), to compete in the international market. More official Norwegian statistics can be found on Statistics Norway [2]. This result in traditional businesses are closed down or moved to low cost countries, and it is a fast restructuring process in the industry. This gives a high demand for innovation and entrepreneurship resulting in establishment of new industry and business. The course will give the engineers the competence for establishing new businesses.

### B. Entrepreneurship network and competitions

“Junior Achievement-Young Enterprise Norway” (JA-YE) [3] founded in 1997, is an organization that teaches business skills to students of all ages. Through their programs, students are given the opportunity to

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

run a company and to develop their business skills. The businesses are included in the register of companies as a “student company” (SB) with special rules (no VAT or tax as long as the turnover do not exceed 17500 Euro (140 000 NOK), and a maximum operating period of 12 months). All participants must be older than 18 years old, and the share capital can not exceed 2500 Euro.

The concept of Student Company is quite new. In spite of this, in 2007 168 companies run by University College students were registered in Norway. A total of 604 students were involved in these companies. This shows that the concept has is well established in higher education. In Europe 15 countries now use the student company concept. This figure is increasing every year.

JA-YE arrange several competitions for best business plan, best business in different categories, and there is also a European championship.

Tromsø University College is also member of local and national networks that address innovation and entrepreneurship (described in [1]) like Innovation Net, FORNY, Europrice and Venture Cup.

## II. COURSE DESCRIPTION

The course was planned in 2006 and held for the first time in 2006 - 2007. Before 2006 the engineering students had three courses which were merged to Entrepreneurship: “Project management” (5 credit points), “Introduction to Information and Communication Technology (ICT)” (5 credit points) and “Business and management” (10 credit points). Much of the contents from the old courses are retained. The following description is an abbreviated version from the curriculum of automation technology engineering [4] in 2007 – 2008.

### A. Objectives

The objectives of the course are to give the students knowledge of entrepreneurship, how to establish and run a new business, practical training in project work, and introduction to business administration, general knowledge and practical use of ICT.

### B. Contents

Business plan, marketing strategy, establishment and running a (student) business, budgeting and accounting, sale and price calculation, economic simulator, project planning and management, data collection and analysis, ethics, presentation techniques, ICT tools, computer architecture, computer network and communication and web design.

### C. Teaching methods

The course is organized as a project with different project faces and the students work in groups of 3 to 6 students. There are lectures and seminars on selected subjects. The students who select business establishment must register the business in Young Enterprise Norway [3].

### D. Assessment

For students running student business the assessment consist of project plan (passed), business plan (25 %), web page design (10 %), business accomplishment (25 %), individual exam (25 %) and individual process (15 %). For students writing case study the business accomplishment is exchanged with the case study report.

### E. Learning methods

The faculty emphasizes project work and problem based learning as part of the education, and about one-third of all instruction is organized in this manner. The model for project based learning was described in [5] as it was in 2000. Project and problem based learning are used throughout the course. Problem-based Learning (PBL) has been used as a method of learning for several semesters at Tromsø University College (TUC) for several years in Logistics (described by Alvarstein and Johannessen [6]) and other courses at the Business College. The object of the learning method has been to make students have an active way of becoming problem solvers. The article shows as well other topics and classes that has used PBL as a main learning model.

PBL can be seen as a method were the task is to address a problem and figure out what kind of knowledge one needs to know to address the specific problem (Woods [7]). The goal is to challenge the students by confronting them with problems that have to be solved. Other authors focus on the small group learning

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

process rather than linking to the problem itself. Bjørke [8] list the small group environment as the cornerstone of PBL. In small groups students take more responsibility and ownership of their learning needs. In a controlled group design study were Luft [9] refers to a study by Grib and Webb, he summarizes that the students got a higher understanding and comprehension of the problem rather than memorization. Compared to traditional teaching, several other benefits from the PBL approach can be advantageous like carry through a work task with working colleagues, leading efficient meetings, practice leadership skills and develop respect of different stands (Bjørke [8]).

In a good learning environment, each person achieves an individual understanding of the tasks at hand. It incorporates new knowledge, skills and understanding. Woods [7] points out that knowledge is best achieved through action by analyzing and combining different pieces of knowledge.

The fast changing society, globalization and the information flow challenges students in a different way than earlier. Organizations delegate decision-making and striving to become less bureaucratic. Customers challenge the traditional supply channels and value channels in eg. the transportation industry. (Alvarstein, Johannessen [6]). Norwegian businesses are mostly small and medium sized, with less economic freedom to employ highly skilled and costly professionals. They also tend to believe that traditional students are too theoretical in their education and contain too little practical experience and problem solving skills. One has to look no further than the newspaper ads to read key words like project/problem skills and group/ team skills. These are common arguments to support the idea of a problem oriented approach.

In the Entrepreneurship class we have tried to convey the idea of using some parts of problem based learning skills to make the students capable of becoming problem solvers, and the way to do it is to start and run their own company.

Fronter [10] open learning platform (originally developed in Tromsø, the company has now it's headquarter in Oslo, and the software is used worldwide) is used in information and communication with the students. Reports, lectures, templates and guidelines for project and business plans, budgeting and accounting are presented in Fronter. Students work (project plans, business ideas and plans, budgets and accounting) are sent in in Fronter. There are also tools for group work and document archiving.

#### *F. Tutor team and mentors*

The tutor team (the authors) gives most of the lectures, evaluate the students work and are tutors for three to four groups each. The tutors have long experience from several branches of Norwegian the industry and public services (patent office, computer manufacturing and services, computer centre, business managers of different trades, etc.) as well as teaching and tutoring at university colleges.

Every student business also has a mentor from local businesses or public administration. The involvements from these actors are important as one of the goals of the student company concept is to give knowledge in business life.

### III. RUNNING THE COURSE

This chapter describes the course as it was run in 2007 – 2008 (until May).

In the first semester the students establish teams, generate and select a business idea and develop a business plan with budget. This first phase is called a pre-project, and the students make a project plan and run this phase as a project. In the second semester the students run the business and close it at the end of the semester.

#### *A. Kick-off seminar*

The first week in the first semester we run a kick-off seminar where the teams of 4 to 5 students are established, business ideas are generated (in a creative process), the ideas are evaluated, and the best and realizable ideas are selected. All lectures in other courses are cancelled this week. The idea is to give the teams a good start of the project. During the first semester the business idea is further developed and first versions of business plans are presented after two months work. In addition to intensive team work, lectures are given on project planning and management, creative processes, “from idea to business” – how to establish new businesses, how to write a business plan, and presentation of the Yong Enterprises concept [3]. Each team is assigned a tutor from the teacher team.

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

## B. First semester

During the first semester the business plan is worked out as a project task. One month later the students presents the plan for a panel of representatives from local business and innovation system and the tutors. The purpose is to give further training in presentation and to get feedback from professionals working with business plans. The teams also make a plan for the entire course. At the end of the semester the business plans are delivered for assessment. Based on experiences so far and feedback the students have to choose to establish a student business or to write a case study in the second semester.

Lectures on diverse subjects are given, such as presentation techniques, marketing, intellectual property rights, economics (budgeting), business organization and board responsibilities and work. Several local entrepreneurs have presented their experiences in the process of establishment of new businesses as guest lectures. A former student has established a company together with his industrial collaborator from the main project of his engineering education. The business idea is based on using Radio Frequency Identification (RFID) with sensors in transportation and storing of food and other products which are sensitive to temperature variations. Another guest speaker presented the establishment of wine a making factory in Tromsø.

There is also a seminar on commercialization of new products and research results.

## C. Second semester

In the second semester the businesses are run under the concept of “Junior Achievement-Young Enterprise Norway” (JA-YE) [3] as a “student company” (student business, SB). The semester starts with a one day practical course in economics (a simulator or game called Economy Illustrator [11]) where the teams have to go through the life cycle of a new entrepreneurial business.

During the semester there are lectures on economics (accounting), web design and ICT, guest lectures on raising capital (investors), ethics in business, and product design.

Each team has to design a web page with information of the student business, products and services offered. They also have to log all the activities in the business like notice of meetings (project and board meetings) and minutes, monthly economic reports etc.

At the end of the semester the student businesses are presented for other students and representatives from local business and innovation system. A report (formed like an annual report) and accounts for the running period are produced and are part of the assessment.

Students who do not run a student business have to make a case study on entrepreneurship.

## IV. EXAMPLES OF BUSINESSES

The student businesses can be divided into two main categories: Development of new products and services, and import and marketing of new products in the local market. Businesses in the first category are preferable as they usually offer larger challenges and more learning for the students. We will present four student businesses in the development category (Envitae SB, Tromsø Offshore Services SB, Magnet SB and Blundibåt SB) and one in the import and marketing category (NASCH SB).

In 2006-2007 eight student businesses were established and two groups wrote case studies. In 2007-2008 11 student businesses were established, and three groups wrote case study.

### A. *Envitae SB*

Envitae SB [12] was the best student business in 2006-2007. It was established by six students from the process and gas study.

The business idea/mission of this company is based on the lack of engineers Norway experience today. The idea is to offer a link between industry and people with higher education in technological subjects. The company wanted to bring out new educated engineers to companies suffering under the low number of engineers. Having information of the competence and job wishes of the new educated engineers as well as what kind of competence the company is searching for, the student company could act as a kind of intermediary to help the student and the company to find a good match. The primary focus is offshore, oil and gas processing and automation engineering, but they can supply engineers for employment in other areas as well.

Envitae SB won the price for best business plan in the North Norwegian Venture Cup competition in 2007. The business is established as an ordinary company with three staff members and office in Tromsø.

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

### B. Tromsø Offshore Security SB

Tromsø Offshore Security SB [13] was established by five students from the process and gas study. The business idea is to develop a breathing “lung” with supply of breathing gas and a CO<sub>2</sub> cleaning unit. The lung will make possible secure evacuation of personnel from (under) water and rooms filled with smoke. The product will be offered to manufacturers of survival suits, escape masks, rescue vests and other rescue equipment. The uniqueness of the lung is higher capacity, smaller size and lower weight, and this makes it easy to integrate in existing rescue equipment.

Health environment and security is an important part of working life, and there are improvement potentials on this area. In helicopter transport to and from offshore installations the personnel use survival suits with an integrated breath lung with the capacity of one minute breath. The breathing time is too short in an emergency at sea. The new lung will extend the breathing time considerably (at least five minutes) without increasing the size and weight of the equipment.

Because of possible request for patent the technology in the lung can not be published yet. The lung has been successfully tested in cooperation with Tromsø University Hospital. The SB has got a lot of sponsors for further development of their product.

Tromsø Offshore security was nominated to represent Tromsø University College in the Norwegian competition for Student Businesses. They won first price for best accounting.

### C. Magnet SB



Fig. 1. Prototype of metal detector. Place your shoe on the black field, and if there are any metal in it, the alarm sounds.

Magnet SB [14] was established by three students from the Societal Security and Environment study. The business idea is to develop a metal detector for shoes that can be placed in front of the security control at airports so that the travellers can check their shoes in advance. If metal is detected, they can take off the shoes in the control. This will save time for the travellers. The prototype is working and was demonstrated at the local exhibition at Tromsø University College in May. Magnet SB has an agreement with Tromsø Airport to test the product.

### D. Blundibåt SB

Blundibåt SB [15] (it means sleep in boat) was established by three students from the automation technique study. The business idea is to develop and sell an alarm system for (recreation) boats (or other objects). The system is based GPS (Global Positioning System). If the boat drifts off from a fixed position radius (the mooring or anchor breaks), the alarm is turned on. The system will increase the security when the crew is sleeping. The product is easy to use (three buttons and a display), with low power consumption. The prototype is finished and working, but the product is not ready for the market yet. The company has established a web shop where it is possible to order the product.

### E. NASCH SB

NASCH SB [16] was established by five students from the process and gas study. The business idea is to be a serviceminded and profitable business that is marketing and selling neoprene products. The products are imported from China and can be ordered by e-mail. The articles are jackets, disk (My Book) protection for transport, can coolers, sitting pads etc., and it is possible to order products with company name, logo and advertising.

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

## V. EXPERIENCES AND CHANGES IN THE COURSE

In this section we will sum up some of the experiences from the very successful student businesses to those who failed for some reasons. All of these experiences are realistic and will often happen in establishment of ordinary businesses. It is far cheaper to do these mistakes in establishing a student business. Some experiences related to running the course are also included.

- **The project is not realizable.** A good and promising business idea, but when the business plan was finished, it showed that it was not realistic to start a student business. The costs for the establishment were too high, or the time (one semester to one year) was too short.
- **Late registration.** Some student businesses waited too long (to December) to send the registration to Young Enterprise. This led to late registration because of a long queue in the registration process, and the business could not be established with legal papers and bank account. This led to late ordering of products and delay in marketing and selling of the products.
- **Late delivery of products.** Even if the ordering of products were done early (in December), the products was not delivered in time to start marketing and sale. The worst example is that the products are not delivered until May, and the business is closed with no sale activity.
- **Student drop out.** Several groups has experienced that members of the group have dropped out form the course. This means more work for the rest of the group and plan-revision.
- **No response in the market.** The business plan and products or services seemed promising, the business made good marketing activities, but it did not result in sale. It is possibly the market research has been too weak.
- **Product and software developing takes too long time.** Time problems have also resulted in late delivery of services or products (as in several other projects) and have delayed marketing and sale.
- **Team work is hard and time consuming.** This is the largest project (and course) in the second year; it lasts for the whole year (two semesters).
- **Optimistic budget and plans.** Activities takes more time and costs more than estimated in budget and plans. The budget and plans have to be revised in the second semester.
- **Early introduction of the course.** At the end of the semester (in May) it is introduced for the next year's students. It takes time to generate profitable business ideas, and you need a lot of ideas to find a good one.

From the first run in 2006-2007 to the second in 2007-2008 we experienced some problems that led to improvements that were implemented.

- **A written exam was introduced.** The tutors experienced that the students specialized in individual project tasks. One student did all the financial work, one the ICT, one the secretary functions, one the planning and project management etc. and there were very little knowledge transfer/learning in the groups. They also split in attending the lectures, one person from each group. To motivate students to get knowledge all aspects of running a student business and to read the syllabus this change was made.

For the next run of the course the following changes are recommended:

- **ICT will be removed from Entrepreneurship.** ICT will be given as a separate course preferably in the first year of the education. This will reduce the total workload and span in contents.
- **Earlier registration and startup** of the business so that it can be run from January. This means more "parallel processing" in the first semester.

## VI. CONCLUSIONS AND FURTER WORK

Statistics from YE shows that people with experience from Student Enterprises are more likely to establish new business (stat). A study of how many of our students will start up new business and or get more education in entrepreneurship. University of Tromsø starts a master program in Master of Science in Business Creation and Entrepreneurship fall 2008 [17]. (From 2009 Tromsø University College will be integrated in University of Tromsø).

Project and problem based learning is time consuming, but it seems to have good learning effect.

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

It is also considered to split the course. One part will be the mandatory business administration and the other entrepreneurship (establishing and run a student business).

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**Arne Gjengedal** received the M.S. (Sivilingeniør) degree in Computer Science from the Norwegian University of Science and Technology (NTNU), Trondheim in 1977. From 1977 to 1993 he had several positions at University of Tromsø (Consultant, Senior Consultant at Computer Centre and Physics Department, Lecturer at Computer Science Department, Senior Engineer at Computer Centre and Computer Science Department). Since 1993 he has been an Assistant Professor of Computer Science at Tromsø University College. Research interests include software engineering, project and innovation management, entrepreneurship, risk analysis and safety management.

**Vidar Alvarstein Vidar** Alvarstein is the head of Business Administration studies and a lecturer at Tromsø University College (TUC). His fields of studies are Strategic Management and Marketing Management, and he has been at TUC since 1996 as a business lecturer.

**Bjarne Fossheim** received the diploma in business administration from the Norwegian School of Management (BI) in 1972. Practiced the next 12 years, where 8.5 years as business manager in retail business, trade and shipyard industry. Since 1985 he has practiced as teacher in business and management at Tromsø University College, 6 of these years as director of studies in economics and business administration.

**Sven Arne R. Pedersen** received the MBA (Master of Business Administration) degree from BI - the Norwegian School of Management, Oslo in 1986, and the MOM (Master of Management) degree from University of Tromsø in 2005. He has 20 years of work experience from management positions in industry and trade. Since 2005 he has been Assistant Professor of Project Management and Entrepreneurship at Tromsø University College.

**Alf-Petter Rudi** received the M.S. (Sivilingeniør) degree in Engineering Cybernetics from the Norwegian University of Science and Technology (NTNU), Trondheim in 1977. From 1977 to 1980 he had position to grant patent at the National Patent Authority in Oslo (The Norwegian Industrial Property Office) and has from 1982 running his own patent agency (Narvik Patentkontor/JURIKON). From 1980 to 1991 position as

<sup>1</sup> E-mail: Arne.Gjengedal@hitos.no

Assistant Professor of Automation at Narvik University College and from 1991 at Tromsø University College. He has been a part of groups running and coaching in different external courses concerning project and innovation management, entrepreneurship and industrial property rights (IPR). Research interests include project and innovation management, entrepreneurship and industrial property rights.