# Thematic Weeks: a New Concept in Engineering Education

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**Abstract**

Over the last six years, the Department of Electronics-ICT at the Faculty of Applied Engineering at University College of Antwerp has undergone drastic changes. An academic concept based on a specific profile for applied engineering education was used to develop an educational program in close liaison with local industry. This concept is based upon progressive building and training of research skills. The concept of thematic weeks was introduced to obtain a very good coupling between current research and education. A typical thematic week combines theory, exercises, lab-sessions and a visit to an industrial partner. Speakers from industry and academia are invited to provide a broad and accurate view of the topic in hand. During each week, the students work on a single project. The Master's students are actively involved in organising the thematic weeks. This has two positive consequences: development of managerial skills and very intensive student involvement. The paper includes several case studies, presenting a selection of the topics from the academic year 2007-2008.

**Index terms:** Thematic weeks, current research, week-long project, managerial skills, student involvement.

## I. Introduction

The transformation of tertiary education in Flanders into the Bachelor/Master format is combined with a process of academisation. All academic education institutes will perform and produce research in order to be integrated into the structure of Universities. The main challenge for applied engineering education exists in the combination of functioning on an academic level and within the structural setting of a University without losing its specific identity and close liaison with local industry.

Applied Engineering Institutes need to develop a curriculum that covers the span between training and teaching essential hard skills, the acquisition of research skills to comply with the requirements of the latest Educational Laws and developing soft skills, as requested by the economic field in its role as future employer.

Industry in the Antwerp region is very much in need of job profiles that are oriented towards improvement, organisation, maintenance and supervision of production processes, based upon a balanced mix of hard and soft skills [1] [2]. Hard skills include technological and scientific competences, whereas soft skills include a solid knowledge of economic processes and structures combined with communicative skills.

Profiles oriented towards research and development are fairly rare and not to be filled by Masters in Applied Engineering but rather by Masters of Science. On the other hand, educational law still requires that Masters in Applied Engineering obtain research skills, in order to carry out research.

Applied engineering education chooses a more contemporary concept in order to create integration between education and research. Education and research are two separate and yet very connected and mutually supportive activities. In our particular educational concept, described in section IV, research skills are taught and training given through educational activities that are also based upon interdisciplinary work.

In a renewed curriculum, we have tried to implement this challenging span into a balanced educational program and this process has a substantial pedagogical component [3] . An academic educational concept that implies imbedding research into educational activities is often based upon the so called von Humboldt doctrine [4], that dates from the early 19th century and poses the ideal unity between education and research in a particular way i.e. an academic teacher is firstly a researcher and his or her academic freedom is based upon the idea that any research activity has a strong and particular educational value for students whereby the student takes the role of a "co-researcher" [5] [6].

The remainder of this paper is structured as follows: section II describes the context in which the thematic weeks are organised, section III describes the recent history of University College of Antwerp, section IV describes the concept of the thematic weeks, section V illustrates the role of the organising students, section VI shows concrete examples of several thematic weeks, section VII illustrates the process of evaluation of students and their evaluation of ourselves and in conclusion, section VIII lays out the our plans for the forthcoming academic years.

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## II. The Context

In order to obtain the most suitable design for educational activities, that enables both academisation and integration of research into education activities, the Applied Engineering Electronics-ICT program is based upon three different principles:

- Specific academic profile for applied engineering education
- Design of the educational program
- Close liaison with industry

### *A. Academic Profile for Applied Engineering: Specific Definition of Research*

The process of academisation is based upon a proper and specific definition of the meaning of scientific research in this particular domain. This definition differs considerably from the traditional definition of fundamental research as conducted in Flemish Universities. It creates opportunities to protect the identity of applied engineering by profiling applied research in close co-operation with industry. Research activities and output in the domain of applied engineering have to be application oriented and inter-disciplinary.

Application oriented: The student does not have to reprove fundamental scientific basics, but practise up translation and dissemination of technology and science in the relevant industrial field.

Interdisciplinary: The research policy of the Antwerp Association of University and University Colleges (AUHA) [7] stipulates a contemporary research concept that stimulates inter-disciplinary research and co-operation between different domains. This concept totally agrees with applied research as conducted in Applied Engineering Institutes. Therefore, applied engineering research is not performed in order to discover, but in order to invent. The researcher conducts short term production innovation and improvement related research. He evaluates projects using different criteria: industrial relevance, usefulness, durability, cost/quality relations, safety, environmental issues and well-being. More specifically, improvement and innovation is created by analysing existing technologies and applying them in new contexts in order to generate other or new functions and by optimising existing technologies through changing or renewing applications and implementations. Therefore meta-cognitive skills and knowledge of research methods are very important.

### *B. Educational concept: Construction of sound learning Environments for the Teaching and Training of Research Skills*

Applied engineering Electronics-ICT education has developed a specific educational concept for creating and stimulating academisation through:

- Progressive Building and Training of Research Skills
- A Proper and Specific Position of Research Skills in the Competence Profile and Education Program of Applied Engineering

*1) Progressive Building and Training of Research Skills:* The teaching process has three different phases:

*a) Phase 1: Basic training:* The educational concept is research-led: education program is based upon scientific and knowledge domains build on research output. The educational process is oriented towards understanding research and meta-cognition [8][9].

*b) Phase 2: Finalising academic Bachelor education and Bachelor's Thesis:* The educational concept is research-oriented: Equally important is the knowledge itself, as a result of research processes and specific research skills that are necessary to develop knowledge.

*c) Phase 3: Master education and Master's Thesis:* The educational concept is research-based: it is mainly based upon research activities rather than upon pure knowledge. Staff research activities are highly integrated into education activities. Role differences between professor and student fade in order to create meaningful interaction that enables full research participation by students.

Through progressive development of research skills the academic Bachelor obtains research skills on a starting level, even though the Bachelor education emphasises technological and scientific skills. Gradually the extent of research skills and the interaction with research activities increases and thus the Bachelor education prepares for the Master education where research skills will be obtained on a proficient level in a balanced integration of research and education activities. This concept is illustrated in Fig. 1.

*2) A Proper and Specific Position of Research Skills in the Competence Profile and Education Program of Applied Engineering:* By providing a learning route that bundles research skills throughout the different domains of the educational program, it is made transparent where and how research skills are taught and trained. By linking the different domains in the educational program e.g. Electronics, Multimedia, ICT and

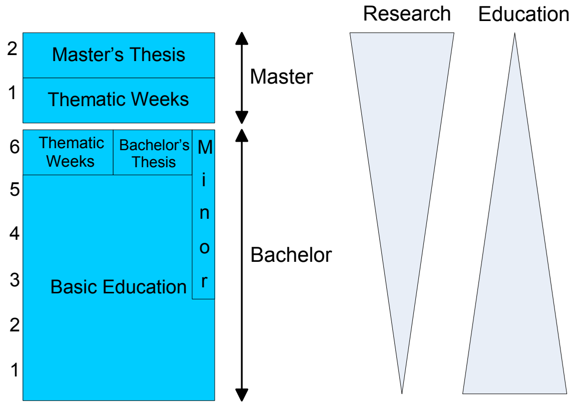


Fig. 1. Model Trajectory and Relationship between Research & Education.

Business, with specific research groups, interaction and integration of education and research skills can be obtained. This concept is illustrated in Fig. 2.

The learning routes start from an idealist jobprofile of the Master student in Applied Engineering in the 21st century, who needs to acquire three basic qualities. He/she has to be a:

- Technological expert
- Researcher
- Professional

In order to obtain these three basic qualities, the educational program is constructed around three major learning routes that increasingly teach and train competences and enable students to obtain the three basic qualities of the competence profile. Through this particular learning process, the trainee engineer is able to function on a junior level in a professional context and to move towards different senior job profiles.

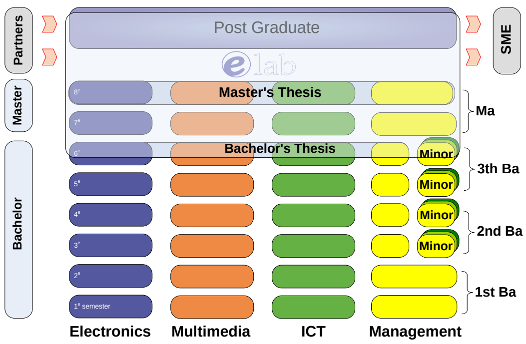


Fig. 2. Structure of the Electronics-ICT Curriculum.

## *C. Industrial liaison and co-operation*

The different needs of the industrial and business fields, are recognised in the competence profile of applied engineering Electronics-ICT, without losing critical reflection upon the values of the personal development of each student as a human being. The program technique is competence based [9].

The introduction of competence based education in tertiary education is a result of the need to adjust higher education to the most recent developments in the labour market. Strategic policy of industrial organisations is strongly based upon the analysis of different competences that are responsible for the growth of the corporate position of the company [9].

Based upon these strategic analyses, the basic competences of an organisation can be defined and used for the construction of job profiles, competence profiles and education programs. This technique was used to develop the basic qualities of the competence profile and the learning lines in the education program. For each learning line the most suitable learning environment to teach, train and evaluate specific competences was selected. A knowledge based and dynamic society produces a labour market that has a specific need for highly qualified and multi-functional personnel, that is able to train itself through lifelong learning. This labour market is in need of graduates who possess not only considerable knowledge, but are also able to cope professionally with new, different and unknown situations. In addition to a solid technological knowledge, they need to apply various communicative and problem solving skills and be able to co-operate within different teams. All these skills and matching attitudes are integrated in the soft skills learning route of the competence based educational program of Applied Engineering Electronics-ICT.

Through carefully selected educational activities, the educational program offers optimal opportunities to obtain soft skills and managerial competences in a non-typical schoolroom manner that suits training methods in an industrial or business environment. In this perspective the concept of thematic weeks was developed and introduced into the educational program. This concept reconciles the defined three principles of an adequate education program for applied engineering in an exceptional manner: a specific academic profile, learning research skills through education activities and a strong liaison with industry.

## III. Historical Context

Over the last six years, the Department of Electronics-ICT at the Faculty of Applied Engineering at University College Antwerp has undergone drastic changes. Traditionally we were a *"Hogeschool"*, a typical Belgian form of higher-education, where engineers in different fields acquired their industry-oriented education. The curriculum consisted of two lower years, called *"kandidaturen"* and two higher years *"ingenieursjaren"*. In the first year, the students followed several introductory courses covering a broad field of engineering - from thermodynamics to material sciences to software development. This initial year was organised in co-operation with three other Engineering Departments; Construction Engineering, Chemical Engineering and Electromechanical Engineering. In the second year, the students chose one specific department with a completely different curriculum. The Electronics-ICT curriculum covered several disciplines: analog and digital electronics, telecommunication networks, software engineering and industrial control systems. When the Bologna Declaration was signed and changes impending, our faculty chose to re-think and re-develop our curriculum. The 2+2 year program was changed to a 3+1 year program. The first year, with its very broad scope was replaced by a first year focusing on the basics of Electronics-ICT. As a result, many courses could be moved to a lower year. The net result was that most of the Electronics-ICT related courses from the four year curriculum were reorganised as a three year curriculum with some courses cancelled and others added. With this re-organisation, the former fourth year had now become available for new educational activities. This complete reorganisation was steered by a complex quality control system, which is briefly introduced in section VII-D. Motivated by the Bologna declaration, we wanted to shift our focus towards a more research-oriented curriculum as motivated in section II.

## IV. The Concept

A typical thematic week combines theory, exercises, lab-sessions and a visit to an industrial partner. Speakers from industry and academia are invited to provide a broad and accurate view of the topic in hand [10]. During each week, the students work on a project. This results in an intense workload for both students and teachers. The topics of the thematic week are always current research topics of one or more of our researchers. This ensures that the thematic weeks evolve very quickly, following the current research trends.

### *A. Theory*

Most subjects that are covered during the thematic weeks are quite advanced. As a result we usually start with several lectures to introduce the subject in hand. This theoretic introduction is very similar to a traditional theoretic lesson - the only difference is that the teacher is an academic or an industrial researcher with current and practical experience of the topic. Additionally, this allows us to give live demo's and to references to current research projects and papers.

### *B. Exercises and Lab Sessions*

Most exercises are of an introductory nature and sometimes, tutorials are used to allow a very fast learning curve. The lab exercises and lab sessions are specifically chosen to teach the students the necessary skills to allow them to complete their week-long-project with satisfactory results.

### *C. Guest lectures and Excursions*

Speakers from industry and academia are invited to present recent research projects or new developments. When the topic lends itself to an excursion with a large added value, the students visit a local company or research laboratory.

### D. Week Project

The students work on a weekly project - usually these small projects are completed within three or four days. The project-report deadline is set for Sunday evening, which allows the student to work on the report during the weekend. The final deadline for the completed project is at the end of the semester, when the students hand in their portfolio. The use of portfolio's in the thematic week is described in section VII.

## V. Student Involvement

One of the main strengths of the thematic week is student involvement. Master students specialised in the weeks' topic are involved in the organisation of these weeks. The implication of this student involvement is that the organising Master students are responsible for the lab sessions, quality control and improvement of the current thematic weeks which will be explained further. Most of the organising students have experience in one of the research topics, mainly due to the fact that they completed their Bachelor's Thesis in the research lab.

The objective of these thematic weeks is that all the organising students who have been working in the same research group will work together and prepare a thematic week for the other students. Details of the organising student's thesis can often be presented as a case-study. This case-study can also be useful for the project week, especially when they have to work with specialist software. It's useful that the organising students have experience with this software. Particularly if the software has been written by the organising students who are able to solve problems/answer questions. During this week the organising students, professors and researchers give theoretical lectures and when the theory is finished, the students then work on the lab sessions. These lab sessions are prepared by the organising students and their practical experience of the subjects allows them to assess whether the assignments can be completed within the time that the students are allowed. The organising students contact a company that they can visit with the other students and that is related to the topic being covered that week. The majority of this work is done in close collaboration with a researcher.

These weeks enable the master students to improve their soft skills in organising, managing and motivating their fellow students and feedback enables them to assess their own performance - good or bad. This is used for quality control, described in section VII.

## VI. Case Studies

The case studies in this section present a selection of the topics from the academic year 2007-2008.

### A. Wireless Sensor Networks

During a single week, the students were introduced to the new research field of Wireless Sensor Networks (WSN). A WSN is a network formed by a large number of small autonomous nodes which are capable of sensing their environment. These nodes typically sense temperature, light, vibration, acceleration and battery voltage. The measured data is transported through a wireless network towards one or more control panels or base-stations. The nodes co-operate to achieve optimum performance: fine grained sensing, low power consumption, long network lifetime or very short response times. The development of WSNs is currently a challenge in three different domains: low-power hardware design, efficient network and protocol design and the design of feasible and attractive end-applications. All three domains were covered within this thematic week. The week started with a general theoretical overview of the possibilities of WSNs, the main focus being on the networking aspects of WSNs. An engineer from GreenPeak Technologies Inc. presented their current work on low-power integrated circuit design for custom WSN nodes. Several typical WSN deployments further illustrated the feasibility of WSNs. A researcher from the University of Ghent presented the results of a recent research project [11] in which a security and monitoring system for theatre environments was developed. The focus of this presentation was on networking aspects, specifically, the links between medium access control and power consumption.

For the project, the students were split in three groups. Each group worked on a project within one of the three domains. The first group designed and produced a printed circuit board for a WSN node, using ZigBee technology on XBee integrated circuits. The second group developed several low-level applications using TinyOS 2.0 on a TPR2440 TelosB WSN nodes. Typical applications included temperature monitoring systems and alarm systems. The third group wrote a monitoring and control tool for a WSN base-station: a graphical user-interface connected to a MySQL database. At the end of the week, the three groups of students presented their work to their fellow students.

### B. Grid Computing

The term “grid computing” refers to an infrastructure of cluster computers, geographically spread among different locations, but connected to each other by a fast network. The success of grid infrastructure is based on the development of a middleware technology, a software layer above the usual operating system, which makes distributed computations possible. In the field of high performance computing, this approach is an interesting economic alternative, when compared to the investment required in a large super-computer.

Course material in grid computing can be grouped into several knowledge areas. A recent publication by Jens Mache and Amy Apon [12] identified five areas: cluster and grid administration, security, Grid programming, Grid usage and Applications and Parallel Computing. We asked ourselves what we could cover in an week-long “grid computing course” and unsurprisingly, the first course began with a general overview of the overall concepts, while at the same time introducing new definitions and terminology. The high level architecture of the Glite middleware was introduced. The Glite middleware was born from a collaborative effort of several academic research centres participating on the European EGEE project (Enabling Grids for E-science. Having explained the more theoretical parts of grid computing, this lecture expanded on how todays applications are enabled for grid computing. At the end of this first presentation some strengths and weaknesses of grid computing were discussed with the students to assist in the motivation of their interest in grid computing.

In a second lecture we introduced the students to the BEgrid. The BEgrid is the Belgian grid infrastructure [13], currently spanning five computing clusters, located among the main Flemish Universities, including a small testbed infrastructure at our own institute. The BEgrid infrastructure is coordinated by BELNET , the Belgian National Research Network. This presentation formed the theoretical background to a more practical one day hands-on session, to ensure that the students were able to start basic job submission and data handling. The next day, a visit to the BELNET headquarters was undertaken and BELNET engineers gave presentations about the Belgian and European research networks: BELNET & GEANT. Although these sessions were not strictly oriented toward the main topic of learning grid computing, an external visit with accompanying presentations was appreciated by our students. While the hands on exercises was a first step towards possible real world applications, we decided to incorporate two illustrative grid applications. On the one hand a presentation by a private company: Johnson & Johnson, illustrated their successful experiments in the setup and use of a commercial grid infrastructure for drug discovery. On the other hand, a presentation by a researcher from the University of Antwerp, illustrated the use of a grid infrastructure in the context of HDVC, high definition video codecs [14]. A final one day session was foreseen, where the students could experiment with computing-intensive jobs. Our idea was to disseminate the results of a recent Master’s Thesis, where research was conducted on 3D rendering in the context of computer animations. In this exercise the students used our local grid infrastructure to submit render jobs to the BEgrid. The students’ task was to monitor the status of the jobs, verify the results and report possible errors and failures. In actuality, this experiment was not so successful. The complexity of the complete infrastructure necessitated us to prepare, in advance, a well defined exercise, where the creativity of the students was limited. However, while this experiment could be a fine example of the usefulness of a high performance computing infrastructure, the simultaneous submission of all these jobs by our students resulted in a heavily overloaded grid infrastructure and very long waiting times. Although a single week was too short for successful real world experiments, students received a well balanced overview of current grid technology: general concepts, a one day hands-on, research issues and industrial use of grid infrastructures.

### C. Real-time Location Systems

Real Time Location Systems (RTLS) are used to locate and track devices equipped with a simple, inexpensive RF interface. RTLS can be implemented in almost all situations where location tracking is needed and today it is being tested and used in different sectors. One of them is the healthcare sector where medical personnel can track patients, staff and assets such as medical equipment which in turn enables emergency response to be both more efficient and faster. RTLS also provides increased patient safety, increased throughput, better staff utilisation, reduced need for inventory, improved work-flow, reduced errors and improved revenue use. Other places where RTLS are implemented are supply chain management, distribution centres, tracking of staff and visitors in buildings, etc. The goal of a recent research project was to create a RTLS application based on existing technology for a healthcare centre to secure quality of care of the patients [15].

The different ways of tracking can be divided according to their accuracy, technology used and corresponding range - the latter was used to set up the planning for the RTLS thematic week. Starting from global positioning (GPS, GALILEO) with the general principles of Satellite communication and navigation taught by the Managing Director of DSP Valley (a technology network organisation, focusing on the design of hardware and software technology for digital signal processing systems) the students moved into national positioning systems (GSM, UMTS) to end up with local positioning systems (WiFi, ZigBee,) deployed on a big site or company. The theoretical sessions were in perfect balance with the hands-on week project in which the students needed to build their own RTLS application, based on the Ekahau positioning server.

The students were split in several groups and developed their own end-user tracking application in C#. Through existing middleware, developed by the RTLS research group, they were able to get the positioning coordinates from the Ekahau positioning Engine. Their assignment was to visualise these on a blueprint of the lab. As an extension they combined their WiFi tracking solution with a RFID access control system, by means of a virtual RFID reader. The idea was to indicate when a given person accesses a room. They were free to extend their application as much as possible. Through this exercise the students were able to combine two different RTLS technologies into one end application. Finally, a related company visit to Newtec (A research and development centre and manufacturer of satcom solutions) was undertaken.

A similar program was also used in a two week European Intensive Program (PoRaC), organised for a limited number of international students from our Erasmus partners. In the future our consortium is planning to expand this program to an European Curriculum Development project.

### *D. Medical Image Processing*

The field of medical imaging is expanding rapidly, however, there is still scope for discovery, which gives us the opportunity to provide our students with the skills they need for this specific market. Medical imaging is a term that covers a wide variety of applications for acquisition, processing and handling of the obtained image. This why we chose to initiate the students with a package that gives an overview of the techniques used in the "image processing pipeline". We do not claim to offer the answers to the questions on how to solve a specific problem, but we do give the elements that can help the students to find these answers. This is why, for example, an overview of the "image processing pipeline" is given and as a direct result the student is able to solve problems and have direct answers more easily. In order to see and feel the real power of all the handled techniques, workshops and trainings are organised.

Due to the fact that the medical image processing market is so diversified, it would be a mistake to focus on just one element. This is why we invite guest speakers from the various Universities in Flanders to come and talk to our students about their research. (e.g. Ewout Vansteenkiste of the Department of Telecommunications and Information Processing at the University of Ghent , Jan Sijbers of the Department of Physics at the University of Antwerp and as a counter balance we invite key-players in the industrial market to provide an overview of the achievements, opportunities, and the challenges yet to come within the field of medical image processing. (e.g. Johnson and Johnson and Materialise)

Combined with all this, study of techniques, workshops and training is organised using mainly MATLAB [16] and Mimics [17] software, so that during the week, students get to see the world of medical image processing in a different and more enlightened mode.

### *E. Non-Technical Weeks*

In higher education a trajectory in any specialised field starts out with a theoretical framework -which forms a firm foundation for the real life applications that come later in the trajectory. However, often the practical applications are missing altogether due to the fact that curricula and weekly rosters do not always give the teacher enough time to present the students with a comprehensive project. Finding a different project for each student is also not an easy task.

The solution to this conundrum is two pronged - firstly drop the weekly roster and secondly co-operate with professionals in the field, which is exactly what we have done in the field of management and communication.

*1) Project management:* KBC Bank, a major Belgian financial institution, agreed to accept the Master's students for a week-long course on project management. The seminar was taught at their own premises, using their own instruction manuals and tutors. One of the exercises was centred on the Small Business Project, described in section VI-E.3, that the students were working on. On the whole this seminar was very much appreciated by the students to the extent that they proposed expansion of the scope of the seminar and to place it earlier in their timetables, as described in section VIII. This would then allow them to use the project management techniques acquired while working out their thematic weeks and their Master's Thesis.

*2) Writing a software manual:* Engineering students have a hard time explaining technical matters to the uninitiated. An opportunity to remedy this deficiency presented itself when alumni signalled that they too experienced problems in writing software manuals. As a direct result a project for Master's students was set up. Their task was to write part of a manual for Microsoft Dynamics NAV 4.0. This project encompassed a workload of 3 credit points. At the beginning of the semester the students where told which module in the software package they had to write about and during the next few days they experimented with the package. A professional copywriter explained how students should go about writing the manual.

For the next three months the students individually worked on the project and at the end of the semester students handed in their part of the manual - additionally, they also presented their module in the form of a workshop to their fellow students. The results were encouraging: in an evaluation of the project the students themselves rated the nature of the project as "good to very good". During the workshop they showed an unexpected mastery of the Microsoft Dynamics NAV whilst the manuals proved that the students had followed the instructions of the copywriter effectively.

*3) Small Business Project:* The Small Business Project (SBP) is a format offered to institutions for higher education by the Government of the Flemish community in Belgium. Groups of students are invited to start a company and to work out a business plan for a product or a service. Each group consists of about five students, each with their own role in the company (e.g. Financial Manager or Marketing Manager). While working on the project, the students follow an instruction manual that guides them through the different stages in working out their business plan. In this way they are confronted with the practical problems in setting up a business, surveying the market, creating a real product and managing the logistics side of the business. Successful groups not only succeed in working out the business plan, but also in selling the product or service and making a profit. The really successful turn their small business project into a real business.

Two of the projects received a nomination as "best services oriented SBP":

The project "www.geencursus.be" consisted of the development a website where students can post lecture notes ("geencursus" means "no course" in Dutch). As part of their project students had to find sponsoring (via Google ads) and content (via contacts with student organisations).

The "Smart-Ad" project offers businesses a means (computer screens on campus) to let students know about job openings or any other information they want to spread. The students contacted a number of prospects and succeeded in landing four contracts. They plan to continue the project as a real business after graduation.

## VII. Evaluation, Feedback and Results

In the context of thematic weeks, evaluation encompasses two different aspects. At the end of each week, the teachers are evaluated by the students and at the end of the semester, the students are evaluated by the teachers.

### *A. Student Evaluation*

At the end of the semester, the students hand in a portfolio which they created during the semester. This electronic document contains information on all their projects, a detailed reflection on the organisation of the semester and their own personal contributions. Because the students were actively involved in the organisation, they provide valuable insights which might remain undetected in classical education. This information is used in a Plan-Do-Check-Act (PDCA) cycle to make improvements in the quality of the thematic weeks.

### *B. Teacher Evaluation*

At the end of the week the supporting students and teachers get feedback from the students - effected by completion of a form where the students can grade all aspects of the week. Thus this is an evaluation of the Master students as well as the tutors. The teaching staff can also use this feedback to grade both the Master students and themselves so that they can make improvements in the quality of the thematic weeks. This information is used in a PDCA cycle to improve the quality of the thematic weeks.

### *C. Statistics*

Analysis over the last four years has shown that the introduction of the system of thematic weeks has increased the number of guest lectures in the Master's education from approximately 5 to 40 guest lectures per semester. For the academic year 2007-2008, 26 % of the guest speakers had an academic background, 74 % had an industrial background.

Currently there are no conclusive statistics on the study time, student feedback shows that thematic week force the “less-motivated” to increase their effort during the year. The reason for this are twofold: project deadlines at the end of each week and the difficulty to catch when one or more days are missed.

### D. Quality Control Systems

In order to direct the academisation process of higher education, the Flemish Government has developed a new set of criteria [19].

The Association of the University and University Colleges of Antwerp has created a specific tool to monitor and measure the different phases of the academisation processes of each education: Monac.

Quality care of research and the academisation processes is a task undertaken by all the different departments of each University College whilst quality care of the research output is the responsibility of the co-operating University.

The integration of Applied Engineering into the University of Antwerp can only become a reality after an accreditation procedure by the Flemish Government - a part of this procedure is an audit by a officially recognised committee under supervision of VLHORA, the Flemish council for University Colleges [20]. This audit took place in April 2008 but until the publication of the official report, its not possible to give any feedback at this stage of the procedure. However, during the audit the commission asked many questions concerning the concept of thematic weeks, e.g. evaluation, choice of topics, choice of key-speakers and organisation etc. and the oral feedback was both positive and constructive.

## VIII. Future

### A. Next Academic Year

A presentation was given by a selection of Master’s students with comments gathered from the entire class. This provided useful feedback e.g. pressure of work, lectures, etc. together with a proposal for a better balanced structure of the thematic weeks. One of the major comments about the thematic weeks was that only one week per topic was insufficient. The students felt that this restricted the size of the projects that had to be done and thus also restricted the creativity. A couple of days were usually not enough time to produce a really interesting project when a new software package and/or technology had to be learnt.

The new proposal is as follows: we extend the one week per topic to three weeks. This is subdivided in blocks of 1 and 2 weeks. As we have described in section IV, this means that there is one week available for theory, guest speakers and company visits and two weeks for the project. The drawback is that there will be fewer topics that can be handled in the same time span.

We have also assumed that every student receives the course of Project Management as early as possible (preferably in the first week). A better way of integrating this into the thematic weeks, instead of applying it through the Small Business Project alone (see section VI-E.1), was by getting the students write a Project Assignment (PA) of their chosen project. A PA consists of a project description, in/out scope items, milestones, deliverables, a timetable. This requires them to think about the project and helps them to plan it better. It also means that the student can write his own timetable on how to take on the project which should be handed in before the project weeks starts. The advantage is that the supporting teachers/students know which projects will be finished after those two project weeks and it helps them to track every single project from the start. Another possibility is that a supporting student can divide a section of his Master Thesis into small portions which can be used as project subjects. The PAs can then aid the supporting student to make sure all sections are evenly divided among the students who are following the thematic week.

The conclusion is that, although there will be less topic options because of the 3 weeks timescale, we believe this method has all of the advantages of the previous one plus better and more creative projects because of the extended project weeks. Another advantage is that the student can now define his own timetable which should improve his planning skills which is a critical factor when he comes to work on his Master’s Thesis.

This proposal was evaluated by the colleagues involved in the organisation of the thematic weeks and accepted with minor changes of a practical nature.

### B. Future Options

Plans to open up the thematic weeks to external students or even to industry professionals are currently being discussed. As the next step in this concept, the organisation of summer schools for Ph.D. students is envisaged.

## IX. CONCLUSION

An educational concept based on a specific profile for applied engineering education was used to develop an educational program in close liaison with industry. The process of academisation is based upon a proper and specific definition of the meaning of scientific research in this particular domain. This definition differs considerably from the traditional definition of fundamental research as conducted in Universities. It creates opportunities to protect the identity of applied engineering by profiling applied research in close co-operation with industry. This concept, based upon progressive building and training of research skills was described in this paper. The concept of thematic weeks was used to obtain a very good coupling between current research and education. A typical thematic week combines theory, exercises, lab-sessions and a visit to an industrial partner. Speakers from industry and academia provide a broad and accurate view of the topic in hand. During each week, the students work on a single project. The Master's students are actively involved in organising the thematic weeks. This has two positive consequences: development of managerial skills and very good student involvement.

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