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INNOVATIVE, SUSTAINABLE INTEGRATED PRODUCT DESIGN
-MASTER PROGRAM IN DEVELOPMENT
IN CO-OPERATION BETWEEN UNIVERSITY AND BUSINESS

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Introduction

The Norwegian Agency for Quality Assurance in Education, NOKUT, was established by the Norwegian Government in 2002 and commenced its activities on 1 January 2003. NOKUT is an independent government body. Through evaluation, accreditation and recognition of quality systems, institutions and course provisions, the purpose of NOKUT is to supervise and help to develop the quality of higher education in Norway. This implies new challenges for the different institutions.

Educational institutions in Norway will through this new setting operate as market-players in another way than earlier. To be recognised in the market of education all institutions need a clear profile. Another important challenge pointed out by the Norwegian government is the need for entrepreneurship and innovation to create value and new businesses. The institutions are also expected to be players both locally, nationally as well as internationally.

To meet these new challenges, a strategic process at Akershus University College, (HiAk), has decided that Innovation and Sustainability shall be developed to be the main theme of our University reputation as well as core part of our student competence. This decision along with the directions from NOKUT, leads to interesting possibilities for the Faculty of Product Design. In particular, Hiak has given our faculty the opportunity to develop a new master program in addition to our existing bachelor study in product design.

The purpose of this paper is to present the process of developing this new master program as well as the final result, the program for *master in product design and innovation*. To identify a balance between theory and practice has been very important to us in this process, in order to achieve the expected level of knowledge and skills. This work has been inspired by our vision to educate students with the competence of being both change agents and product designers. As important in all product development processes, the user-orientation has therefore been of highest importance during the process of designing a new master program. Students in bachelor programs, former students, teachers and researchers from other faculties at HiAk, government, business and other stakeholders have been, and are closely involved within the whole process of developing our new master program – *Product design and innovation*.

However, to be able to translate the strategic and regulatory directions from Hiak and NOKUT into pedagogic and operative terms for all students and collaborative networks linked to the Faculty of Product Design we need to specify how we understand *innovation, sustainability, integrated product design* and *co-operation* between university and business. The following chapter presents therefore the main terms used in this paper and discusses the relation between them.

Discussion of discourses: terms

Innovation

To our University innovation has throughout decades been understood as any new discovery, form and function developed through experimentation with materials. By materials it is here understood to be wood, glass, metals and any kind of plastic materials. Our teaching has traditionally been based on a combination between art and design theory and design methodology linked to specific projects or tasks defined by tutors or assigned by cooperating businesses. Therefore, in certain cases, some of our staff members find it rather peculiar that innovation, to some extent, has come up as a “new” buzzword, as the idea has existed for generations. However, as innovation is a term widely discussed for the time being, interesting clarifications has come up during discussions at our faculty. During discussions many

of our teachers has been forced to speak out and write down their deep founded tacit knowledge on innovation and material experimentation. At the end of a series of internal workshops, discussed in more details in the two next chapters, the following definition on innovation has been agreed upon by all staff members:

Innovation is not only about having new ideas, but also the capability to realize the whole process from concept to final product – having value creation as the overall goal of all activities.

In more details, we have further defined that;

We will teach our students to have the competence of being change agents and product design innovators in businesses. Our students shall be able to make a difference wherever they are employed in society. They shall be able to identify needs, find good, sustainable solutions to products, as well as implementing long term value creating solutions.

Sustainability

With innovation defined, the last part of this definition introduces *sustainability* as the other important area of focus at Hiak. In the report “Searching for Solutions”, Beatrice K. Otto (Draft, 2002) collected views on sustainability from many different researchers and representatives from companies. As stated by Ehrenfeldt in this report:

Sustainability is a radical way of thinking. In my view it is fundamentally different from solving environmental problems. It's a future-oriented vision – flourishing. Once I did a workshop, and the consensus was that sustainability was just too complex for people to talk about, it turns people off. We came up with a metaphor which was 'flourishing', as a definition and a vision of what's going to happen when they stick the chocolate in their mouths

Staff at Faculty of Product Design share Ehrenfeldts ambition to turn sustainability into a future-oriented vision that is associated with operative and playful opportunities. Additionally, at Hiak, we seek to make sustainability a way of reflection in scenario envisioning workshops, allowing our students to enjoy and share the creativity and feeling of being able to contribute to a sustainable future. Students are a fundamental group of importance in the purpose of innovation as they have not yet locked into set lifestyles, and will carry sustainable patterns throughout life. They are thus an important group both for implementing ways of thinking, working and acting, as well as a group to address new sustainable solutions in society as a whole. The potential to educate students with the idea of sustainability as a way of life has to be recognized as fundamental in all development of educational programs. Therefore, sustainability is a part of our thinking and suggested solution sets in our educational programs at all levels at Hiak.

As consequence, sustainability is one of the main driving forces behind student projects at Hiak and is one of the most important premises for good product design. Totally new solutions have to be found to achieve sustainability. Ways of satisfying needs have to change. Radical changes on both the supply and demand sides are necessary. Effecting this change will require new thinking. Innovation is about change and new thinking. Sustainability has hardly been taken into account within the innovation community up until now when searching for, and judging the sustainable quality of new solutions. The need for bringing innovation and sustainability more closely together is therefore vital.

Furthermore, raising sustainable design from a technical problem to a problem simultaneously considering economical, ecological and social needs is necessary. This way, the product designer considers the whole system and is able to design innovative systems or products.

Integrated Sustainable Product Design

Considering sustainability, it is our suggestion that a product designer will not be able to optimize the total sustainable value of any given product, if that total value has not been considered and calculated in the early design phase. In this case, the Faculty of Product design sees it uttermost important to not make sustainability into a specific compulsory teaching module, but rather make sustainability as a subject linked to all studies involved with integrated Product Design. Here, integrated Product Design is understood to include all stages involved with production, use, disposal and reuse of a given product. As shown in Figure 1.1 we view sustainability as a fundamental part of integrated product design, introducing innovative sustainable design and upfront thought design for reuse. That is, *integrated sustainable product design* is viewed as an overall design tool in the early design phase, applied to reassure that sustainable solutions are identified at all levels in the forward channel and product take-back channel. Figure 1.1 also introduces an interesting picture in terms of “change in roles” concerning

the supply-side and demand-side. Considering the marked opportunities that lie in the reuse of products, one will find that by the time industry realize fully the concept of reuse, industry itself will become the demand-side of used products, while customers becomes the supply-side of used products. These changes of roles are one of the most important premises for teaching sustainability in our educational program and will be included as one of several subjects in the module of *Industrial Ecology*. (For further discussion on Industrial Ecology and reuse opportunities for business and industry, see Lisæth, A. [1998]: An analytical foundation for designing industrial ecological set-ups by reusing products into new product development, NTNU, Norway).

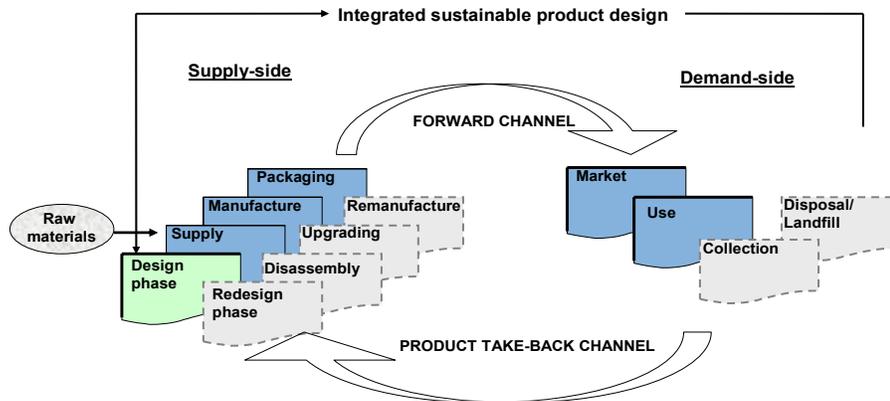


Figure 1.1 Integrated product design as tool in the early design phase for reassuring that sustainable solutions are identified at all levels in the forward and product take-back channel

Preliminary summary

Returning to the focus in this paper, the title; innovative, sustainable integrated product design – master program in development in co-operation between university and business, the clarification of terms outlined above, helps to map out areas of cooperating with business. Although there are numerous tasks and ways to co-operate with business, our clear profile will be recognized by co-operative projects with businesses which enables master students to create value in all activities of product design and innovation. Value is here meant to include, economical, ecological, sustainable and social values. And last, but not least, we will teach students that integrated sustainable product design is the very purpose of innovation, and that this way of performing their profession will be their set lifestyles. This way we hope that our student will carry sustainable patterns throughout life, and this way, sustainability will be the driving force behind innovation and become one of the most important premises for good product design.

The Process – Work flow 1; Overall work plan

On the basis of term clarification the following chapters will introduce the process of developing our new master program in product design and innovation. Our work has been conducted through several workshops and interviews with all involved parties, Students in bachelor programs, former students, teachers and researchers from other faculties at HiAk, government, business and other stakeholders have been closely involved in developing our new master program. In this paper we will not lay out all details concerning individual interviews and workshops, but rather sum up the main results that favour the progress of our work.

In August 2004 one Associate Professor was assigned to work with developing a new master program in product design and innovation full time. First of all, one overall plan, introducing phases/milestones and issues to be discussed in the development process was drawn as a “one page overview” to be presented to all involved parties. (See Figure 1.2). Key to this plan was to establish and maintain ownership to the overall framework for designing the masters program, and make sure that all stakeholders had a similar and clear picture of the tasks ahead. Additionally, it was of great importance that all involved parties knew exactly where and when and in what context their contribution was

important and valued. Finally, an agenda for continuous feedback to the leadership of Hiak on work progress was set, in order to maintain ownership to work progress and decisions, until the final program was established.

As shown in Figure 1.2 the plan for establishing a final master in product design and innovation is represented by four main phases: They are as follows:

Phase 1; *Define framework for designing master program*

Including three sub categories:

1. Define milestone plan for delivering a complete master program
2. Adopt framework provided by the government
3. Define areas of strength and focus at Hiak

Phase 2; *Secure necessary integration of subjects, systems and organization*

Including five sub categories:

1. Define key competence systems and roles
2. Define areas for cross interdisciplinary cooperation
3. Define systems for quality assessment
4. Specify targeted cooperation with industry/business
5. Specify targeted international cooperation

Phase 3; *Make agreements and develop systems and routines for evaluating compulsory practice in cooperation with business and public sector*

Including two sub categories:

1. Negotiate and establish contracts with industry/business for realizing compulsory practice
2. Document synergy according to agreements with industry/business on routines and evaluation

Phase 4; *Finalize system for quality assessment and publish the new master program. Design process and routines for assessing applicants to the new master program*

Including three sub categories;

1. Make clear necessary regulatory demands and announce new master study
2. Process and finalize applicants
3. Send application to Nokut

Suggested process for designing the master program in product design and innovation at the Akershus University College (AUC) – from August 04 to March 05

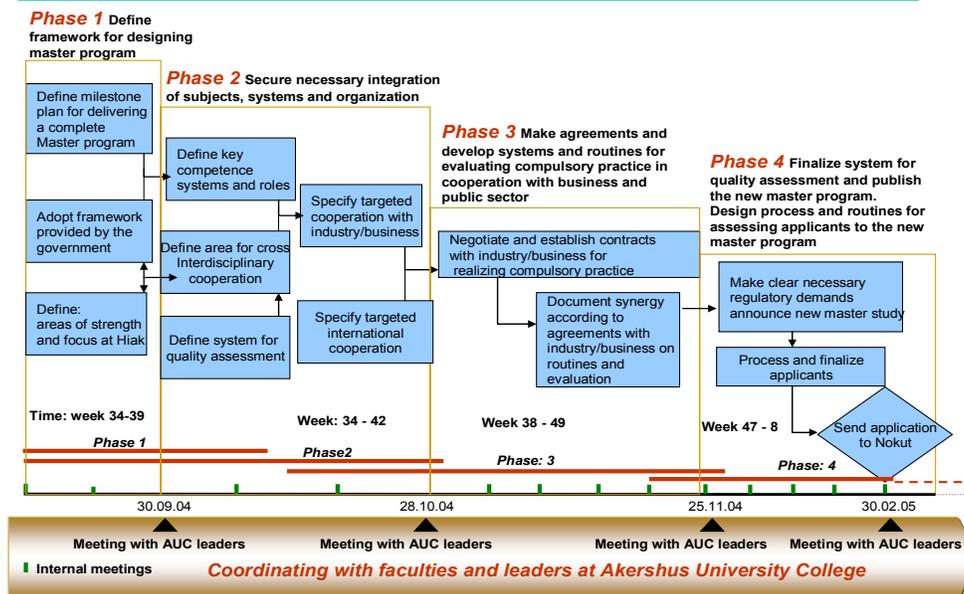


Figure 1.2 Suggested process for designing the master program in Product Design and Innovation at Hiak

Finally, as shown in Figure 1.2, the overall plan for developing the master study is carried by a horizontal arrow, illustrating the importance of faculty meetings and meetings with the leadership of Akershus University College (Hiak). All meetings are scheduled for input, feedback and decision making according to each of the phases listed above. The continuous and frequent meetings secured ownership, rapid work progress and vital quality assessment of each of the working phases (1 to 4).

The Process – Work flow 2; Develop framework for the master program

In parallel to work flow 1, we needed to frame the concept of a new master program in product design and innovation. Two main ideas were important to us.

First, we wanted to design a master program that could easily be understood and adopted by international university co-operators. Moreover, we wanted to design a two years master program, represented by four semester modules, each counting at least 30 ECTS (European Credit Transfer System). That is, each semester module of 30 credits may consist of one or several individual subjects (counting for example 10, 15, 20, or 30 credits), that could easily be replaced, put together or separated, depending on student qualifications or student exchange opportunities. The goal is to provide for that exchange students, participating in mobility programs, can receive full credit for all academic work, successfully carried out at any of our partner institutions.

Second, we strongly believe in the value of practice during studies. Accordingly we wanted to have at least a four month compulsory practice period included in our master program. Our aim is that master students at the Faculty of Product Design will not be able to start final exam before they can document that a four months practice period has been successfully fulfilled at any of our partner businesses.

Figure 1.3 shows the preliminary sketch that was drawn to include main modules and practice period before final exam in the last semester for the master program. Furthermore in Figure 1.3 the master program will embrace a combination of three study areas:

1. Project based studies
2. Theoretical studies
3. Material studies

The three study categories are not supposed to be viewed separately, but rather as system of study

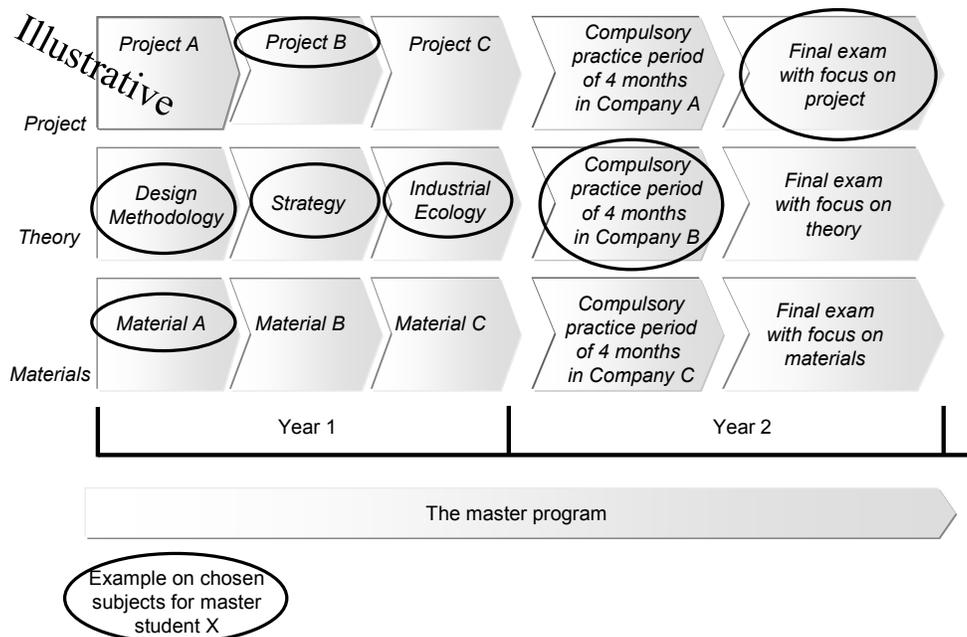


Figure 1.3 Conceptual framework for the master program in product design and innovation

elements, based on which each master student can design individual master program under firm tutorial guidelines. In effect, master students will be able to “shop” modules/subjects according to capabilities and interest and furthermore, students will be able to include exchange programs in their studies if desired subjects are not offered at Hiak, but are offered at our co-operative universities.

Figure 1.3 presents an example. For instance student X has a deep interest for the theoretical aspects of product design and innovation. Based on interest, student X choose to relate his/hers master program, in the first semester, to one of three materials categories; wood, metal or plastic materials, combined with the theoretical aspects and tools involved with Design Methodology. In the first term of the second semester, student X includes Project B combined with specific strategic subjects. In the second term of the second semester, the same student chooses to focus on all aspects involved with Industrial Ecology. In the second year student X combines a set of theoretical aspects with a practice period of at least four months at company B. In the last semester of the second year, student X choose to finalize his/hers degree program with focus on project work, combined with development of a three dimensional formed product. According to the theoretical dimension, as focus of the exam, the student have the opportunity to combine his/hers thesis with developing a three dimensional formed products. However, if a master student chooses the material dimension of his/her, master study, the final exam must include the development of a three dimensional formed product.

The Process – Work flow 2;

Framework for the master program including one conceptual based approach, one material based approach and the dimension of research

Returning to the overall framework for the master program, shown in Figure 1.3, Figure 1.4 shows that the basic concept of modular studies along the three dimensions: projects, theory and materials, has again been divided into two main study approaches. That is, our master program in product design and innovation will offer one conceptual based approach (3) and one material based approach (2). This means that for students, with competences and interest for one of the two approaches, will be able to choose one main approach for their degree studies, including selection of modules (subjects) along the three dimensions: projects, theory and materials. This has been done in order to resolve the classic and traditional combination of artistic insight, technical skills and craftsmanship on a master level, in addition to theoretical, social, economical and ecological issues. Both the conceptual based and material based approach will equally resolve the overall goal for good design in our culture.

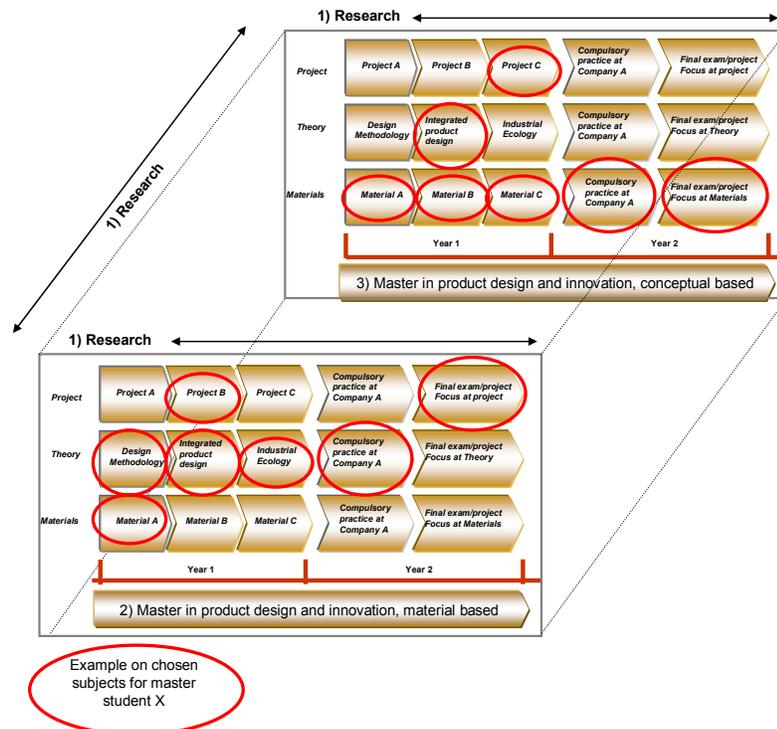


Figure 1.4 Framework for the master program including one conceptual based approach, one material based approach and the dimension of research

Finally figure 1.4 shows that research will be initiated along three directions. First, along the conceptual based approach (3), second along the material based approach and third, along the line/subjects of overlap, between the two master degree approaches (1)

The Process – Work flow 3: The master program in Product Design and Innovation

Figure 1.5 present the final master program in Product Design and Innovation. Before discussing the details in figure 1.5 it is important to present the process of getting all the subjects and elements in place.

In mid September of 2004, a series of interviews and workshops was initiated, in order to include all academic staff at the Faculty of Product Design in the process of designing a master program. All staff members are running courses at our existing bachelor degree program. Thereby, each of them are equally important consultants in drawing the pedagogic map of the master degree program, as well as important team player in teaching their representative courses at master level. All members had individual interviews with the project leader for designing the master program. 18 staff members were asked the same following three questions:

1. What do you believe should be the main focus of the master program in product design and innovation?
2. What do you believe are the most important classic subjects that should be taught in the master program of product design and innovation?
3. What subjects at master level are not covered for by existing academic staff and how do you think we should include these subjects in the master program?

1) Teaching students integrated sustainable product design.

Although variations in answers, one common goal was by most staff members concluded to be that we will teach students that integrated sustainable product design is the very purpose of innovation, and that this way of performing their profession will be their set lifestyles. The master program should embrace a combination of artistic insight technical skills in combined with social, economical and ecological skills that enable the master students to handle all factors in the design process towards good design in our culture.

2) We shall teach skills and knowledge in entrepreneurship and cross disciplinary teamwork

All staff members agreed upon the idea that classic theory and knowledge about materials should be basic teaching modules in the first semester of the first year of the master program, allowing unconditional experimentation to be fostered in student projects. Yet, it was commonly concluded that traditional craftsmanship should not be a dominant part of the study, as the challenges in our society as a whole, demands more than this, specifically good knowledge and skills in entrepreneurship and cross disciplinary teamwork.

3) Subjects at master level that are not covered for by existing academic staff were listed individually by staff members. Here a selection has been made. Key to the selection of subjects is identification of subjects that support our vision: *To teach students that integrated sustainable product design is the very purpose of innovation, and that this way of performing their profession will be their set lifestyles.* The selected subjects are:

- Philosophy
- Social and human related subjects and
- Management
- Economy
- Strategy

3) Co-teach with the expertise

All staff members agreed that the way to teach these subjects is both with co-operative partners at other Norwegian Universities and develop projects that allow co-teaching with the expertise in business and industry. Co-teaching with collaborative businesses and universities is desired to be based on inviting external tutors to a week to week based teaching program, allowing academic staff to take care of the tutorial work during the whole course period. Master students will also be encouraged to take some of the subjects in exchange programs which will be favourable conditions for growth of new perspectives and ideas.

With question 1-3 discussed and concluded by all staff members, initiatives were taken to design the final master program. At this time, all academic staff members were heavily engaged with contributing to the work and everybody saw the opportunities ahead, both on faculty and individual level. This way, a high level of ownership to develop a final master program was established, and a good further working progress was anchored.

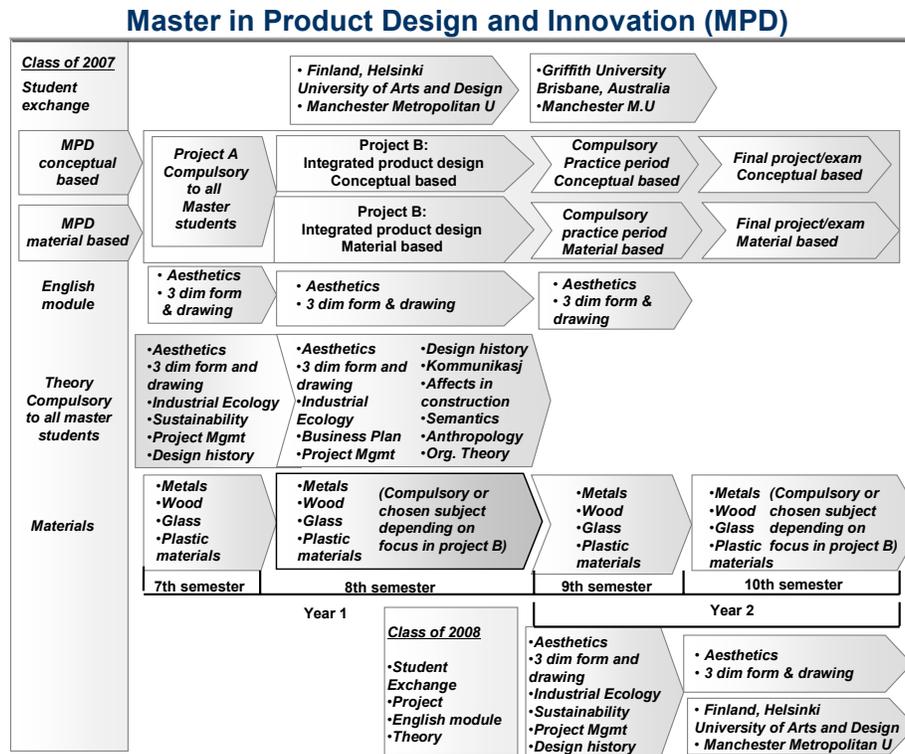


Figure 1.5 The master program in Product Design and Innovation

In Figure 1.5 the master program in product design and innovation is designed in the following way. First, in the left hand column one finds five main elements that have been included in the two years master program. They are:

1. Student exchange opportunities
2. The master program approach divided in two areas of focus:
 - a. a conceptual based approach
 - b. a material based approach
3. English module
4. Theoretical subjects
5. Materials

- 1) The Faculty of Product Design and Innovation has established exchange programs with three universities and are currently working on a joint agreement with Berlin University of the Art. The three established exchange agreements are with Manchester Metropolitan University, The University of Art and Design Helsinki and Griffith University, Brisbane Australia.
- 2) The master program is represented by two main approaches. One conceptual based approach and one material based approach.
- 3) The English module is agreed upon to be Aesthetics with focus on three dimensional forms.
- 4) All subjects of theory have been listed in figure 1.5, divided into first and second semester of the first year of the master program. Specific modules counting for several subjects have not yet been identified.

5) Material courses include metals, wood, glass and plastic materials. Important to note is that in the second semester of the first year, courses concerning materials are only compulsory to the master students that chooses a material based approach in their master program. These subjects are free to choose by the master students that focus on a conceptual approach. In return, the theoretical subjects listed in the second semester of the first year are compulsory to the master students that focus on a conceptual approach, while these theoretical subjects become free to choose for the master students that focus on a material based approach.

Figure 1.5 shows further that the practice period which are compulsory to all students, find place in the first semester of the second year of the master program. This period must be successfully fulfilled before master students will be allowed to take individual exams.

Finally, figure 1.5 shows that by the time Class of 2007 (named after the year the student group is expected to finalize their individual degree programs) starts the period of practice with a company, the faculty will receive a new group of students, which forms Class of 2008. At this time Class of 2008 will follow the same study path as Class of 2007.

Conclusions and perspectives

The most appropriate way to conduct the work with designing a master program is to maintain its flexibility to handle long term changes, as a result of the mutual dependencies between key society elements, mainly business, organisation, culture and university. At the same time, the idea of flexibility must also sustain core teaching and classic professional values in a conditional and clear way. For instance, both written and tacit knowledge reflecting the basic properties of materials like metal, wood, glass, and plastic materials, must be kept well in the teaching and training programs, basically included in specific teaching modules.

The master program is claimed to be valid, based on the good response and the high degree of interest and involvement from all involved parties so far in the designing process of the new masters program. However, the program still remains to be run through for the first time with the pioneer student group, starting up in the fall of 2005, running all through spring of 2007. Therefore, some final considerations, believed to be relevant to any other university involved with designing a masters program in product design and innovation or similar. These considerations are:

- The idea that sustainability should be the driving force behind innovation and one of the most important premises for good product is a beautiful vision. However, there is no substance to that ideology if it is not anchored in real life decisions and that everybody has agreed upon sustainability as a common idea to frame all teamwork. One can all agree that the need for bringing innovation and sustainability more closely together is vital. Yet, the hard work remains. Therefore, the most important mission of developing this master program of product design and innovation is to maintain the energy and involvement by all parties in the whole process and all the time.
- Designing programs for higher education can not be argued as science. As consequence, it is uttermost important to not use a modelling tool that does not allow a cross disciplinary and flexible thinking among involved parties. Dozens of ways to design a master program in product design is always possible, considering the huge variety of cultural and economical frameworks that exist globally. All approaches to design master programs in product design are equally correct.
- Considering the above, the major challenge in designing a master program in product design and innovation is to get the generated framework agreed upon by all involved parties. In this paper we have presented only one generated framework for realising a master program which can be applied by others, as a way to reflect and process similar master programs.
- Even more important, keep always in mind that the main task is to reassure that your best efforts to involve others on a consistent basis is key to a dynamic and creative process for designing the most up to date master program.

- Last but not least, make sure that by the time the program is clear and agreed upon by all involved parties, a new phase in the involving processes begins, namely keeping the intensity and interest to the master program equally high during the first years of running the program. All involved parties are agents to communicate their perception of the results within their individual professional society. Communicate the good though and inspiration is a unique learning and professional opportunity to alter and redirect the master program on a continuous basis.

The objective is now to attain a group of 20 pioneer students to start the new master program in the fall of 2005. The master program will be announced in May 05 and hopefully all pioneer students will have their application accepted and confirmed in late June. Progress and evaluation of our this work will be the purpose of future papers.

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