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USING THE HANZE MODEL FOR CURRICULUM DEVELOPMENT TO OPTIMIZE DESIGN PROJECTS IN THE BACHELOR CURRICULUM PROGRAM PRODUCT DEVELOPMENT

Jan CORREMANS and Werner COPPIETERS
Artesis University College Antwerp, Design Sciences, Product Development

ABSTRACT
The integration of human, technological and economic aspects in product design is considered to be the most important competence of an industrial designer. A designer has to integrate aesthetic aspects, usability, mechanical and operational aspects, production techniques, ecological aspects and aspects such as price setting, market positioning, etc. First and second year bachelor students find it rather difficult and confusing to unite all these aspects within an integrated design project. To monitor the progression of the student's overall design competences in a better way, we tried to rethink the composition of design projects of the bachelor program, based on the Hanze model for curriculum development.
The Hanze model for curriculum development is created by the Hanze University of Groningen. Its foundation lies in the merging of different educational models and is based on the idea that the integration of competences should be built up gradually throughout the bachelor years.
The first part of this paper focuses on the benchmark of the different design projects in the bachelor curriculum Product Development at the Artesis University College Antwerp applying the principles of the Hanze curriculum model. The second part illustrates a design project of the second bachelor year, where the principles of the Hanze model are applied and integrated in the design brief. The limitation of the assessed competences in the different design projects in the first and second bachelor year seems to be a good choice and allows the students to study the concerned topics with sufficient depth.

Keywords: Curriculum development, bachelor program, design education

1 INTRODUCTION

Designing products for a consumer or a professional market requires an integrated and methodological approach. Multiple authors underline this statement [1],[2], and stress the importance of the integration of a technological, an economic and a human related dimension in product design [3]. In the integrated product development approach, none of these areas is considered to be subordinate to another, and none is seen as the exclusive driving-force behind novel solutions. Moreover, each of these above mentioned dimensions cover different sub-aspects. The technology component includes aspects such as production method, assembling, mechanical system, choice of materials, construction, etc., the human related component includes among others ergonomics, shape and aesthetics, user behaviour and functionality, and the economy component covers aspects like price, market definition, competition, distribution concept and so on [3].
Experienced designers automatically think in an integrating way, but our experience tells us that freshmen and students with little experience find it difficult and confusing to unite multiple aspects in a design. The theoretical course design methodology, spread over the three bachelor years, provides the students with the necessary background about integration issues, but the major challenge in design education is to put this integration into practice. The bachelor design projects in Antwerp are based upon this integration principle. A valuable starting point, but over the years our projects became more complex, due to the fact that, when a number of students perform better than the expected level, faculty tend to adapt the expectations and set the standards to a higher level the next academic year, by introducing more complex subjects, or by adding extra competences to train per project. Eventually, most of the initiated projects required the integration of almost all competences, and the final grade

became an average of a large number of scores, one often compensating the other. Conclusion: time for a revision. In our search how to reshape our bachelor curriculum, we analyzed several models for education development, and were inspired by The Hanze Model, a suitable model to introduce a balanced system to gradually build up integrating competences in our different design projects.

2 THE HANZE MODEL FOR CURRICULUM DEVELOPMENT

In order to develop a new curriculum for industrial design education, one can appeal to different educational models. The 'Leerlijnenmodel' (Learning Line Concept) by De Bie and De Kleijn [5] is interesting because it arranges an integral learning line (projects and work placements), a conceptual line (courses), a practical training line (workshops), a practical line and a study career counselling line. But it lacks some coherence in the spread of the study periods. The 4C/ID model (Four-Component Instructional Design model) [6,7,8], is an instructional design model typically used for designing and developing substantial learning and/or training programs for the development of competencies or complex skills. It's basic assumption is that blueprints for complex learning can always be described by four basic components, namely learning tasks, supportive information, procedural information, and part-task practice. The 4C/ID model anticipates less the completeness of a curriculum and the assessments. Project based learning [9] concentrates on project based working and collaboration between students. Positive in this model are the strong and relevant professional assignments, weaknesses are the cohesion of the projects in the curriculum, and the combination of competences and tasks. Interesting in these three models is that they share the same vision on education: integral projects should form the backbone of a curriculum. Starting points are core tasks, hierarchy in skills and competences.

The program 'Bachelor of Business Administration in International Facility Management' of the Hanze University Groningen (the Netherlands) developed the "Hanzemodel for curriculum development [4], a model that combines the three models described above. The Hanze model initiates a curriculum composed of blocks (fig 1). In each of these blocks students have to execute a certain task (integral project). By addressing levels to the different bachelor years, the core tasks are practiced several times and at different levels. The level determines the number of competences to assess. The model starts from the idea that the integration of competences should be gradually built up throughout the bachelor years. In year 1, three competences are assessed per integral project, in year 2 four competences, in year 3 five competences. In the graduation phase, almost every competence is assessed. By determining the core-task and the related competences per project, the qualitative content of the curriculum can be controlled and guaranteed.

	Block 1	Block 2	Block 3	Block 4
Year 1 level 1	Core Task A C: 1,2,3	Core Task B C: 1,4,8	Core Task C C: 4,5,6	Core Task C C: 2,5,6
Year 2 level 2	Core Task B C: 1,3,5,6	Core Task D C: 1,2,6,8	Core Task A C: 3,4,6,9	Core Task C C: 2,4,5,7
Year 3 Level 3	Internship C: 1,5,8,9		Core Task A C: 2,3,5,6,8	Core Task E C: 3,4,6,7,8
Year 4	Minor		Graduation Phase c: 2,3,5,7,8,9	

Figure 1. Scheme of the relationship between the five Core Tasks (A-E) and the nine competences of the program Bachelor of Business in International Facility Management of the 'Hanze University Groningen

3 USING THE HANZE MODEL AS A REFERENCE TO OPTIMIZE THE DESIGN PROJECTS IN THE BACHELOR PROGRAM

Design projects in the bachelor program product development at the Artesis University College Antwerp are organized in blocks of six weeks. Compared with the facility management program of the Hanze University Groningen, a great similarity can be noted. Both programs are offered as blocks and initiated as project based learning.

In the context of an external audit (February 2009), we inventoried and analyzed the set-up of the design projects of the bachelor program. One of the outcomes was the following statement: although the level of difficulty of the projects increases over the years, the same competences were assessed in almost every project, in line with the general idea that human, technologic and economic aspects should be integrated and assessed in each design project. The consequence was that the students' design results of the more complex design subjects (2nd and 3rd years) became superficial, probably due to the six week time limit and the increasing complexity of the assignments. This was in contrast with our expectations. Second year and third year students should design with more depth and detail.
Trying to optimize the teaching objectives of the design projects, we chose the Hanze model as a reference framework to overview, adapt and improve the content of the different design projects, and the joint assessment system. Therefore we listed up the key competences divided over the three domains and composed a matrix to lay out the actual situation. This gave us an overview of the assessed competences per design project over the years (fig 2 left).
The findings of observations were as we expected: apart from one or two design projects, too many competences per project were assessed in the first and second year, and there was no balance between the assessed competences over the different design courses. An additional conclusion was that no economic competences were assessed in the first bachelor year's design courses.

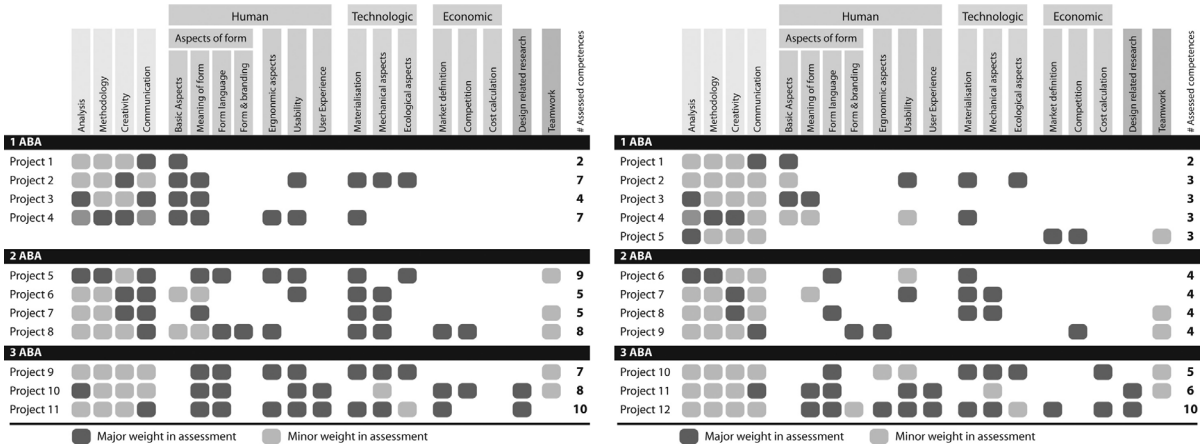

Figure 2. Assessed competences per design project (left: status before the benchmark with the Hanze model, right: after the benchmark with the Hanze model))

Subsequently, we applied the basic principles of the Hanze model to the composition and the content of the bachelor's design projects, taking into account the restraint of the assessed competences per design project in the first year, the increase of the number of assessed competences over the next years and a better balance of the competences over the projects. We also introduced a new design project focusing on the economic aspects of product development (fig 2 right).

4 CONCLUSIONS OF THE BENCHMARK

Before the assessment of the design projects with the Hanze model, the final mark of the students' design projects was calculated as an average of a large number of equally important sub-quotations, assigned to different competences. Because we made no difference in the hierarchy of the sub-quotations, when students performed poorly for a specific core competence, the insufficient grade for this competence was often compensated by other scores. After adaptation, less competences are assessed in one design project, the mutual division of the assessed competences over the projects is more in balance, and there is an increase in complexity over the 3 bachelor years. For each design project course a specific evaluation template was created. The ratio/proportion of the key competences in the overall score was increased, creating the opportunity to detect specific underdeveloped skills more easily. The new system guarantees more depth in design, but still it needs further elaboration:

- the spread of the competences over the different design projects is not totally in balance yet and needs tuning
- a number of competences are overexposed, while others stay underexposed e.g. more attention is needed to the economic competences.

5 FOUR COMPETENCES ASSESSED, RESULTS OF A BACHELOR PROJECT

The choice to limit the number of assessed competences in a design project to four in the second year, allows the students to study the concerned topics more thoroughly. An example of one of these projects is the 'form' and 'ergonomics' project (project 9 in fig. 2 on the right) that integrates the design aspects of form, human ergonomic aspects, and market competition. The fourth competence assessed is communication. Obviously, every design project is based on a methodological approach, and no project can grow without proper analysis and creativity, but these competences form only a minor part of the overall score (grade) for this design course.

5.1 Project Overview

The 'form and ergonomics' - the last project in the second semester of the second bachelor year-, is organized in a block of 6 weeks, and scheduled one day a week. It represents a workload of 4 ECTS (European credits). About 18 to 20 groups of 3 students attended the course. In the first phase students act as a team. They analyze the market competition of the products to design and create a new brand with corresponding visual identity and brand values. In the second phase, each student individually designs a product that fits in the preconceived branding and visual identity criteria.

5.2 'Form and Ergonomics'

With regard to 'form', we push the students to go beyond the merely aesthetic aspects: in the design brief, we introduce the idea of brand identity, and assign the students to develop a consistent company identity with a company name and logo, brand values and a visual product identity. The idea is that products are a medium of communication between brands and consumers [10], and that products can be designed to carry explicit and implicit design cues [11],[12]. As a brand, you have to distinguish yourself from your competitors, and build up a consistent portfolio. A recognizable and consistent visual identity can be used as a solid base to create new products within the same range in the near future. A major job for the product designer is the translation of the brand values into a 3D form, in order to establish the right communication between brand and consumer. This translation should incorporate explicit and implicit design features. In a brand identity, the explicit design features are the most recognizable, and recognition takes place when a brand repeats a certain kind of form language in different products. Mulder-Nijkamp [12] developed a conceptual framework to divide the explicit design features in three levels: main form, medium design features and detailed elements. Implicit design features, reflecting the brand values, are harder to determine and cannot be distinguished separately, they are 'hidden' or 'concealed' but understood by the consumer while looking at the overall product. In order to create a successful brand identity, the implicit and explicit design features should be in line with the positioning of the brand among competitors. A high class look is contradictory with a bottom-of-the-market position, or a joyful and exuberant brand identity does not tally with e.g. an undertaker or a manufacturer of high qualitative medical instruments.

Figure 3. Left: the company logo, middle: corporate identity elements, right: market competition axis system

To gain insight in the market and to take economic aspects of their brand design into account, students are instructed to analyze the competition and visualize the market position of their own developed brand within a general brand axis system. Figure 3 shows results of the student's work: a brand identity definition for a series of binoculars. On the left the brand identity elements including form recommendations and brand values, in the middle an axis system placing the new binocular brand among the market competitors, and at the right a final result of one of the students' binocular design.

The ergonomic aspects in this projects aim to go further than the mere application of anthropometric data. Mock ups and breadboards are made to research the critical ergonomic aspects of the human-product relationship. The importance of using physical concept models for functional testing in order to support conceptual design decisions is underlined by multiple authors. [13],[14]. Broek et al state that, in design, models are produced to answer specific questions. And when the conceptual model provides the answer to that question, and the analysis is completed, the model itself becomes redundant. Therefore these models should be tailored to meet as close as possible the necessary requirements, and should be produced with the minimum effort of fabrication [13].
Figure 5 left shows an adaptable physical model to research the optimal ergonomic user concept of a battery powered wrench. By integrating different variable parameters (position and dimensions of grips, weight partitioning and balance), an optimal configuration can be pursued. The photo on the right illustrates the test phase with experimental subjects.

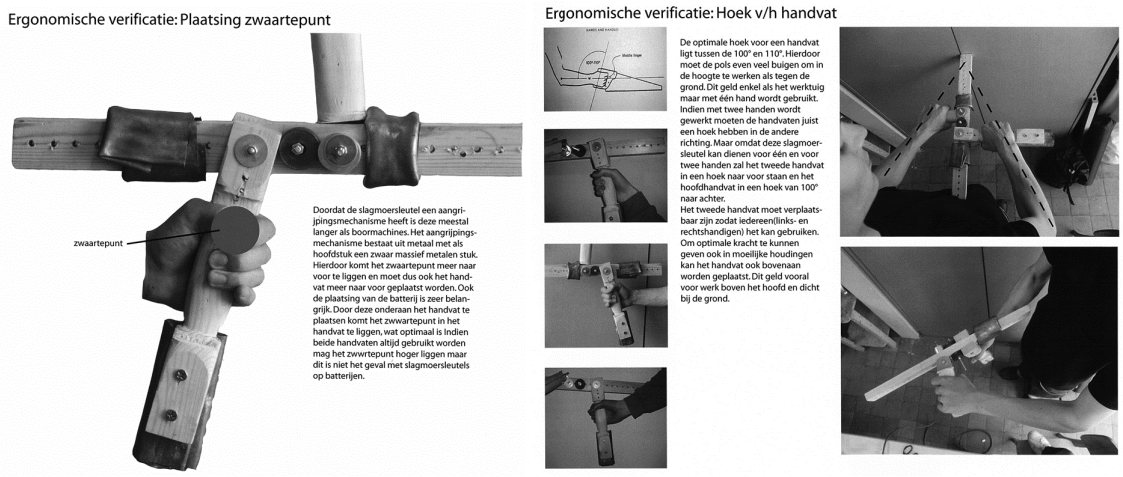

Figure 5. Left: an adaptable physical model to research grip positions and tool balance of a wrench. Right an illustration of the test phase.

Final design results had to be presented in poster format: one group poster to introduce brand name and brand identity aspects, and three posters presenting the individual final design results of every student. The poster format forced the students to present their designs in a simple overview, emphasizing on the main topics and aspects of their designs. A mutual graphic coherence enforced the brand identity.

Thanks to the modus operandi of limiting the number of topics to develop to four in this design course, students had enough time to meet the expected qualifications. Final results show that students can:

- create a new brand with corresponding features, and thus acquire a good understanding of the basic principles of branding (including a proper market position)
- can design a product that fits within preliminary determined corporate identity standards
- can create, design and manufacture tailored physical verification models to research and optimize ergonomic parameters of an appliance
- can integrate the brand identity aspects in an ergonomically verified product concept
- can communicate final design results by means of poster presentations.

6 DISCUSSION

The use of the Hanze model for curriculum development turned out to be a good framework to review the content of the design projects in our bachelor program.
Our expectations that design projects in the higher years should show more depth and detail, was contradictory with the fact that the assignments became more complex, while the provided 6 weeks block system time stayed unaltered. The general idea initiated in the Hanze model to limit the assessed competences in the different design projects seems to be a good pedagogical choice. It becomes more comprehensible for students where to focus on while designing, and the underlying idea of integrating disciplines as the key competence of the product designer remains underpinned.

The adapted design assignment 'form and ergonomics' in the second bachelor year illustrates the benefits of the Hanze model's principles. The assignment now has a better balanced structure, and the elaboration - by the students - of the different aspects involved show a high degree of detail, and prove that the assigned competences are met.
The growing complexity of the projects throughout the years needs further consideration. The organization of the design projects in blocks of six weeks seems to be enough for the design courses in the first and second bachelor year, but an in-depth integration of six competences in one project in the third year requires more time. Another conclusion is that economic aspects remain a little bit underexposed.
Our next challenge in our curriculum development will be to continue to involve more the theoretical courses such as mathematics, economics or structural engineering in multidisciplinary design projects to reinforce the integrated approach.

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