

EDUCATIONAL DESIGN PROJECTS IN ACTUAL PRACTICE DESIGN 6: THE INTEGRAL DESIGN PROJECT

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ABSTRACT

The faculty of Industrial Design Engineering at the University of Technology in Delft (the Netherlands) offers a special five-year educational programme, which leads to a Masters degree in Industrial Design Engineering (IDE). At a theoretical level, this educational system covers disciplines such as engineering, design (study of form), products/systems ergonomics and innovation management. With an educational philosophy of 'learning by doing', there is also a strong emphasis placed on practical training. For this reason, the core of the curriculum is composed of a series of six design projects, before the graduation project.

The subject of this paper is the evaluation of the Design 6 project over the last five years. Design 6 is a project that is conducted in close co-operation with industry and which heavily depends upon the teamwork of students. The project lasts six months, starting at the strategic level (company and market analysis) and ending with the design (and prototype) of a new product, and a production- and marketingplan.

Every project is evaluated by sending a questionnaire to the company involved. In general, the companies were satisfied with the results of the projects. Positive comments are made about the design, originality of the product and the pleasant cooperation with the student groups. However, a difference in expectations and importances can be recognised between the companies and the faculty.

Keywords: Design education, design in industry, project-team, evaluation of projects

1 INTRODUCTION

Design 6 or the Integral Design Project is the last design course before the final master project of the Delft Industrial Design Engineering curriculum [1]. Intended to confront the students with daily practice in industry, it is a complete innovative product development process carried out in cooperation with an industrial company. This paper presents the research into the opinion of companies that have experienced an Integral Design Project (IDP). The eighteen members of the IDP staff know each for themselves what the quality is of the four to eight projects they are tutoring per year, but an extra effort has to be made to get an overview of the total of about forty projects per year.

The evaluation of the IDP projects is meant to answer two questions:

1. What are the strengths and the weaknesses of the IDP projects in the eyes of the entrepreneurs?
2. What changes have to be made considering both the opinion of the entrepreneurs and the goals of our education (the educational goals are not always in line with the interest of industry)?

2 THE IPD COURSE

2.1 Organisation

Each student is member of a team of four to six students. Every team is composed as multi-disciplinary as possible, which means that every Msc specialization has to be represented in every project group. Each team gets an assignment of an individual industrial company. All companies receive a manual that clearly defines both Industrial Design Engineering and the specifics of the IDP projects. The agreement between the faculty and the companies are every time the same: the company provides insight in actual practice, some days of time, and three thousand Euros; the company gets: scenario's for the future, a lot of ideas for future products, a concept design, insight in design theory, and the right of patent.

The assignment is formulated by the IDP canvasser in cooperation with the company, and consists of three parts: a short introduction about the company, a definition of a problem, and the assignment itself, which is in every project the same text.

Every project of the course starts by means of a general introduction twice a year and lasts one semester. Each team member has to spend about 340 hours in the project, (that is about 20 hours per week).

The project team works in a studio facilitated by the faculty IDE. Each project group has two lecturers: a 'coach' and a 'detached critic'. The coach is supposed to be standing by on daily basis and to be present at the presentations at the company. The detached critic reads and assesses the written reports. All lecturers are experienced in industry.

2.2 Content

Starting with a strategic analysis of the company, resulting in a design assignment, the project concludes with making a prototype of the designed product and a plan for market introduction.

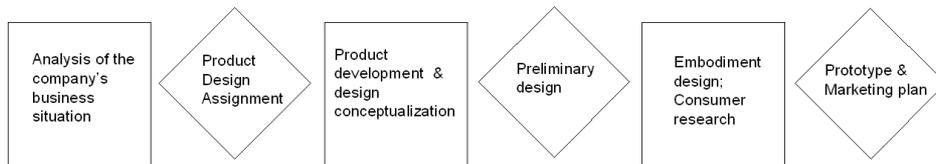


Figure 1. Formulating the assignment

The planning of the project prescribes at least four communication and presentation moments with the company: first at the start, the acquaintance, second after the strategic analysis, the presentation of the product-design assignment, third the presentation of the concept design, fourth and last the presentation of the final design, prototype etc. In between these moments the project group is free to call, e-mail, or visit the company as often as necessary.

The flowchart indicates that the project group has to formulate an assignment for product development, and the fact that the company has specified some field of development, contains an implicit problem: it is possible that the project group find an assignment in another field then the company has specified. The project group is

conscripted to confer on the decision about an assignment, but that is not a guarantee for agreement. This grows hardly ever into a real problem because the company is told at forehand that this risk exists. The project groups take the interest of the company into account, which means, that if they decide to propose another assignment then specified, they have to explain it in the interest of the company.

Because of this 'second time' of formulating the design assignment, it is necessary that the company supervisor on the project is the one responsible for the product development of the company (see about this subject the 'case' described in .

3 THE COURSE EVALUATED

3.1 Questionnaire

To know more about the opinion of the companies that participated in Design 6 projects (the former IDP), a survey was taken of the opinion of entrepreneurs in 1998 [2]. Since then a questionnaire is handed over after each project. From 1999 to 2004, 121 companies evaluated their project. Most of them have joined our projects for more than once, which we regard as an indication for good mutual relations.

The companies were asked to indicate their degree of satisfaction with three aspects of the projects, and to give comment on the same three aspects. These three issues of the projects were:

1. Degree of satisfaction with ten different aspects of the designed products
2. Degree of satisfaction with the results per phase
3. Degree of satisfaction with communication, cooperation and reporting

In the first three questions, each aspect could be rated on a five-point scale, ranging from 1 (highly unsatisfied) to 5 (highly satisfied), the next three questions were open, to give any possible comment.

The seventh question gave the opportunity to make propositions to improve the Design 6 projects.

The last question was about the satisfaction of the company with the whole project. This also could be rated on a five-point scale.

From 1999 to March 2003, the questionnaire did not specifically ask for the degree of satisfaction with the project. In these questionnaires, the respondents were asked if they were satisfied with the final results.

3.2 Results

3.2.1 Satisfaction with several aspects of the product designed

The first part of the questionnaire focussed on ten different aspects of the designed products. These were:

1. Originality
2. Design
3. Fit in to product assortment
4. User-friendliness
5. Construction / Engineering
6. Environmental concern
7. Production
8. Commercial potential
9. Cost – Price
10. Ergonomics

In 1999 and 2000, the companies (n = 38) were asked to indicate their degree of satisfaction with the first nine aspects. From April 2000, a new questionnaire was introduced where a tenth aspect, Ergonomics, was added. Those questionnaires were filled in by 82 companies.

It shows a major resemblance with the results from questionnaires that were handed out in 1998. In both lists, the order of the aspects is exactly the same. The mean rate of the questionnaires from 1999 to 2004 is 0.24 higher than the mean rate from 1988 to 1998. (3.68 and 3.42 r.).

‘Commercial potential’, is ranked –surprisingly- low (with 3.4) as 8th out of 10. To get an indication of the reason why this is low rated, the commercial potential is related to the two best and the two least rated aspects of the products. Figure 1 shows four scatter plots that visualise this coherence. From left to right, these tables show us that there is an increasing coherence between commercial value and respectively originality, design, cost-price and production. In other words, when a company set a higher value to the design aspects of the product, the commercial value was not equivalently higher valued. There is a stronger relationship between on one hand the commercial value and on the other hand cost – price calculations and production.

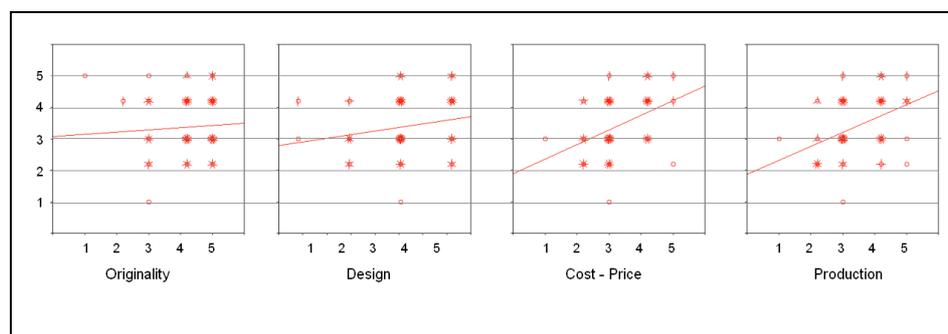


Figure 2. Questionnaire responses

3.2.2 Comments

Good production design and cost price calculation are basic needs for commercial success. The question: “is the commercial potential low appreciated because the products are usually designed for the high end of the market, or because of the lack of time at the end of the project or are the constructive capabilities failing?” will be subject for further research.

Company’s comment that the first phase (strategic analysis) takes too long, and is too theoretically. This phase has to be shorter, in order to gain more time for the embodiment phase. Several times the proposal was made to narrow the assignment down. Companies are not always satisfied with the attitude of the design team and they blame the students for not using the information provided by the company.

Very often is the new input from the design team enough for the company to start a new product, based on the results of the project.

The aspects that are most positively evaluated are originality (m= 4.2), design (m=4.1) and fit into product assortment (m=3.9). The first two aspects are general qualities of industrial design students. In the first phase, students allow themselves to come up with any idea possible. Brainstorm techniques are generally used and effective. The products fit most of the cases well in the product assortment. The reason for this could be found

in the fact that students do a lot of research after the company and its environment. Before starting with the actual product design, they are trying to get a clear view of all the activities of the company. Even though this view is not always complete, it's a good start for the product design project; it illustrates the value of the first phase.

3.2.3 Satisfaction with cooperation, communication and reporting

The results of this question are presented in table 1:

Table 1. Satisfaction survey

Aspects	Score (1999-2003)	Score (1988-1998)
Quality of the reports	4.2	4.1
Communication with students	4.1	4.0
Quality of the (vocal) final presentation	4.0	4.2
Knowledge transfer from design team to company	3.9	3.4

3.2.4 Comments

Reports are valued high but nevertheless some critical comments were put down:

The reports are regarded as too big and too theoretical. For this reason they are not always suitable for internal use in the company. Companies prefer short and 'to the point' texts. Reports written in English are evaluated high.

A lot of comments were put down about various aspects of communication within the project. The majority of the companies enjoyed working with the young design team. Some keywords: 'enthusiastic, good mix of interest and intelligence, good cooperation, stimulating process, cooperation was going well'

Some critical comments were mostly about the passive attitude of the students towards the company. Not always companies were informed about decisions that were made, and this caused irritation.

When students needed more information, which was available in the company, they hesitated to give the contact person a call, or to write a short memo. However, companies didn't always have time to help students.

4 A CASE

'How it can go wrong' (the names of the company and the persons are changed).

Taylor's Innovations is founded by Mr Taylor about a year before the start of the Ontwerpen 6 project. Mr Taylor is the former founder of the innovative and successful company Fullbeer BV, a good acquaintance of the faculty. 'The problem' for the students is about a patented, synthetic, collapsible crate for wholesalers developed by Taylor's Innovations. The crate is collapsible in order to save space in return-transport. The company is represented by Mr Taylor and by an employee, Mr Simon, one of the designers of the crate.

As usual the students start with a strategic analysis of the company in its context and decide for three different possibilities for future development. Further development of the crate is second choice. Mr Simon does not agree with the first choice of the students.

After a lot of discussion half of the students wants to give in to the company (because of a tight schedule), the other half wants to do something totally different. The faculty coach, Mr Hunt, proposes to do both for a while, see what will come up, and then make a better founded choice. This happens and after a while the students choose for

developing a product for the transport sector, not with the aim to reduce the volume of return transport, but reducing the volume of full crates (a full crate contains a lot of air).

The faculty coach agrees, because the detailed embodiment design of the patented crate is a task for 'synthetics specialists', but the company prefers the further development of the crate.

The students make a design for filling the crates more flexible and more efficient. In spite of some weaknesses in the design, the faculty tutors assess the design as 'up to the mark' considering the difficulties during the process. The company rejects the design, and assesses the whole project as insufficient.

The students went on with their studies. A few months after the project the company representatives, Mr Taylor and Mr Simon visited the faculty for a frank and straight talk with the faculty coach, Mr Hunt, and the responsible lecturer of the course. A discussion about the aims and interests of both parties was satisfying. The appointment was made to do another project in the near future.

5 DISCUSSION AND CONCLUSIONS

In this last paragraph two issues will be discussed: the first is the relation between the strategic analysis and the feasibility of the designed products, and second the relation between the students, the company and the tutors of the faculty.

The first conclusion has to be that the entrepreneurs have a high value of an IDP project. It is even more positively rated than five years ago, with the same arrangement of the qualities of the products (it is obviously the same course). The higher rating can be a consequence of the higher capacity of the project groups. (changed from 4, to 5 or 6 students per group)

There are some weaknesses. About these, the shortest conclusion can be: the projects should have some more sense of reality. That is expressed by the least validation of the commercial potential, cost price and production, and some remarks with the sense that the projects are too theoretically, the students don't use the knowledge of the company optimally, the reports are too heavy etc.

A first reaction could be: this is the best weakness there is. IDP projects are educational projects, with the aim to apply design theories in actual practice.

However, it is good to realize that an educational design project like IDP has to result in a realistic product design, based on a reliable strategic analysis.

The search for realistic new products starts with the strategic analysis of the company in its context, and the commercial potential stays an object of attention during the rest of the process.

Some entrepreneurs suppose to skip the first phase of the project (the strategic analysis), to formulate a concrete assignment and to start the process with the product design process, in order to get a better –more realistic- product design.

This solution is not according to the educational goals. The faculty has the aim to teach the students not only the product development process but also to get acquainted with the decisions that are made before a product development assignment is formulated. Designers have to be aware of the problem for which the product assignment is a solution. This is not only an educational goal; it can be the interest of the company to get a new and broader view of possibilities for the future. Some companies ask in the assignment for that broader view.

The experiences of the staff members confirm that the first phase takes so much time that the last phase (embodiment design, production and marketing) often is finished in a hurry. They realize that the 'fuzzy front end' of a new product development process

provides the least hold on the content of the process. It takes time to get used to it and to take the 'right' decisions.

Nevertheless the staff decided to hold better to the scheme of the course, which means in practice a shortening of the first phase, and more time in the last. In previous years the project group made a plan of their own, in future years the staff will decide on the finishing dates of the three phases of the course.

This all is based on the idea that the embodiment design will be better of with more time. That will be true, but it leaves the remarks about the lack of experience and the lack of inquisition about the knowledge of specialists e.g. the employees of the company.

Lack of experience is an inevitable feature of students. The coach must stimulate the curiosity, by asking a lot more questions about the technical problems in the design, and the company can do the same. This leads to the second topic of this discussion.

Some IDP projects were realized in cooperation with Philips, Audi, Sara lee/DE and KPN, but the fast majority of the projects is done in cooperation with medium and small (with a minimum of twenty employees) companies.

The interest for the different aspects in a new product development process is not for every company the same. Because the majority of the projects are in medium and small companies, there are none or just small design departments, and if there is, this is busy with actual problems. Strategic analysis, future scenario's, considering of alternative product groups, and alternative markets, are for these companies more special then for the large companies. They (the medium and small) can benefit a lot from an IDP project, especially from the first and second phase (concept design).

Every company is very capable in producing and selling their products (otherwise it wouldn't exist). These are the issues of the IDP projects that are criticized the most. Referring to the first issue of this discussion it is plausible that the companies can learn optimally from the students during the first and second part, and the students can learn the most of the company during the last part. Students and coaches should realize that the relation between company and project group varies, to formulate in common sense, per activity, and in particular in the last part the students should use the knowledge and experience of the company.

The appreciation for the three different phases of the project is presented in table 2

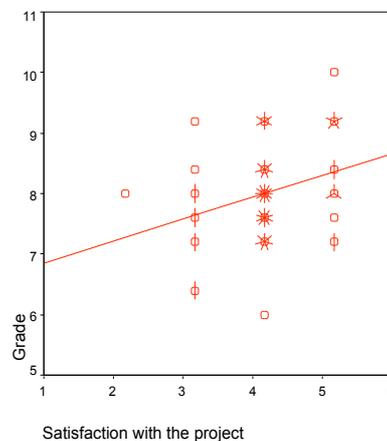


Figure 3. Satisfaction vs grade obtained

The first phase scores 3.7 against 4.0 resp.3.8 for the second and third phase. These are not strong significant differences, but it makes clear that the quality of the strategic analysis in the IDP projects can be improved, maybe with the effect that entrepreneurs in medium and small industry get more appreciation for the importance of that part. Former research [2] showed that small and medium companies have a higher appreciation of design methods and theories as described in the project reports than the larger companies.

The companies do not formally assess the project. The grades in the figure above (vertically) are educational, decreed by the tutors, on a scale from 1 to 10. Figure 4 means the quality is just sufficient to give the students their credit points. Horizontally, 'the satisfaction' is the satisfaction of the companies, on a scale from 1 to 5. The correlation is 'reasonable'. The data give cause to further research into the differences and similarities between the educational assessments and the satisfaction of the companies.

With the new options: a less time consuming first phase, more critical attitude of the tutors, especially in the last phase, and more consciousness about the differences during the project, the expectation is that the students will be even better trained as professional designers.

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