

# A STUDY INTO STUDENTS' INTERESTS IN INDUSTRIAL DESIGN ENGINEERING USING A GENDER PATTERN ANALYSIS

**M.D.C. Stilma, E.C.J. van Oost, A.H.M.E. Reinders, A.O. Eger**

## **ABSTRACT**

This paper describes first year students' interest and motivation towards the field of Industrial Design Engineering (IDE) at the University of Twente during three years (2002-2004). Data was gathered systematically based on students' interest to aspects of IDE: technology, styling, ergonomics and marketing. Students' arguments were analysed with help of a theoretical framework, based on: 1. a basic phase model of product development (I/design-product-use/market) and 2. value patterns (virtuosity, economic, and user/need values). Results show varied and gender patterned interest in the mentioned four aspects of IDE. Significant gender differences were also found in type of arguments students used to motivate their rate of interest. Results of this paper can be used for a didactical educational review. They too may be relevant to enhance insight into the differentiating values of people in design practices.

*Keywords: student interest, gender, industrial design engineering*

## 1 INTRODUCTION

The programme for Industrial Design Engineering (IDE) at the University of Twente (The Netherlands) is a young educational programme that started in 2001. They were eager to gain insight in their student population and started a study in 2002 on the attitude of first year students towards their study and future profession. A first year course was developed to stimulate the students' awareness of and reflection on IDE. Students' opinions, interests and motivations were elicited by written questionnaires and small group discussion meetings. The course and the study evolved over three years, based on the results of the previous years.

This paper focuses on the written questionnaire and in specific the students' grading and motivation of their interest in four constitutive aspects of IDE (technology, styling, ergonomics and marketing), in order to adapt in future the curriculum. The empirical outcomes show significant differences between male and female students. Therefore, gender was chosen as a central focus for analysis in this paper.

## 2 RESEARCH CONTEXT AND METHOD

In total, 184 IDE first year students, of which 48 female (26%), participated in this research. This accounts for 53 students (12 female) in 2002/2003, for 67 (18 female) in 2003/2004 and for 64 students (18 female) in 2004/2005.

To determine students' interest in IDE, distinct aspects of IDE were used to gain more detailed results. Data was gathered systematically, based upon four aspects of the so-called "four leaf clover model" by Van Eyk [1]. The aspects concerned here are:

technology, styling, ergonomics, and marketing. Students of all three years could grade their interest in the four aspects from 5 (very interested) to 1 (no interest at all). In the first year (2002/03), students were only given the opportunity to grade their interest. From the second year on, the students were also asked in an *open* question to *motivate* their grading. This study is based on the numerical grading over all the three years, whereas for the analysis of the students' motivation, only data of the generation 2003/2004 was available.

### 3 STUDENTS' INTEREST IN THE FOUR ASPECTS OF IDE

Figure 1 and table 1, show that the aspects styling and technology are most popular among the IDE students (with grading of resp. 4.3 and 4.1). Ergonomics and marketing score substantially lower (both 3.4). However, when taking gender into account, different patterns of interest of male and female students are revealed. Female students grade ergonomics significantly higher ( $p < 0.001$ ) than male students, making it their second favourite aspect of IDE. Among male students, ergonomics ends in the bottom position. The grading of interest in the aspect technology shows a significant gender-difference ( $p < 0.001$ ) as well. Here, differences in opinions per gender are less, as female students still prefer technology above marketing. Grading of styling and marketing are similar for both genders.

Table 1. Statistical tests: IDE students' interest in IDE aspects: mean and significant difference per gender (grading 1 – 5, with 5 highest interests) (generations 2002/2004).

		"I am interested in ..." (scale 1-5)			
<i>Mean:</i>		Technology	Styling	Ergonomics	Marketing
All:	N = 184	4,10 <sup>(2)</sup>	4,35 <sup>(1)</sup>	3,38 <sup>(3)</sup>	3,36 <sup>(4)</sup>
Females:	N = 48	3,69 <sup>(3)</sup>	4,31 <sup>(1)</sup>	3,92 <sup>(2)</sup>	3,45 <sup>(4)</sup>
Males	N = 136	4,25 <sup>(2)</sup>	4,36 <sup>(1)</sup>	3,19 <sup>(4)</sup>	3,33 <sup>(3)</sup>
Test Statistics (a): Mann-Whitney and Wilcoxon: significant difference per gender, $a < 0,05$					
Asymp. Sig. (2-tailed)		0,000	0,302	0,000	0,499

(n=1,...,4) order of students' interest; (a) Group ing variable: females - males

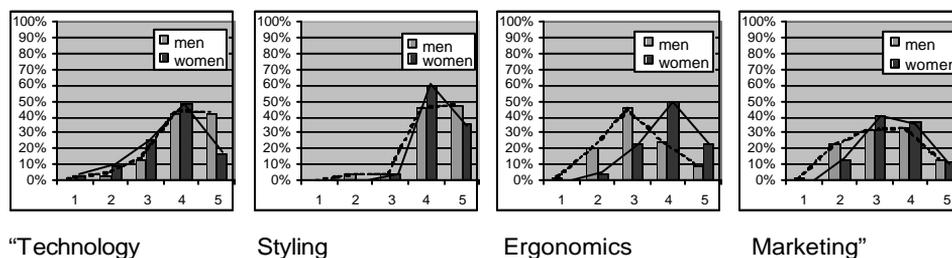


Figure 1. The interest in IDE of male and female IDE-students (generations 2002-2004). Horizontal: positive increasing gradation of interest from 1 to 5. Vertical: percentage of opinion per grade from 0% to 100%. N total = 184, N male = 136, N female = 48.

#### 3.1 Gender patterns in students' grading of interest

From figure 1 and table 1, it was concluded that the interest-profiles of male and female IDE students significantly differ. These differences are in line with wider cultural

gender patterns that males show more interest in technology whereas females prefer human and social dimensions [3]. This result is not obvious as these respondents are a self-selected group of students – male and female – who have chosen a technology-related IDE study. Societal gender processes already hamper many girls to choose this type of study, causing a relatively low participation of female students. Apparently, similar gender patterns in interest were manifested *within* this selective group of students. Therefore, a gender analysis of the students’ underlying motivations to their grading of interest seems relevant.

## 4 STUDENTS’ ARGUMENTS FOR GRADING THEIR INTEREST

### 4.1 Framework for analysis

To analyse and compare the students’ arguments, a conceptual framework was needed that allowed to categorise the type of student motivations in the four aspects of IDE. A very basic model of product development and use was applied. This was based on the distinction between the design context in which a product is created, the product itself, and the context in which users appropriate a product into daily activities (schematically presented below). This model is used in Technology Studies to study the socio-cultural relation between design and use of concrete products [4, 5].



Figure 2: basic model of product development for locating student’s arguments

The students’ arguments were categorised, based on the locus of the argument in this scheme. The hypothesis is that female students would more often – related to all four IDE aspects - mention the relevance for users, considering their relatively high interest in human and social aspects. Next to this model, a three set of values involved in the practice of technology, was used as developed by Arnold Pacey (*virtuosity values, economic values and user/need values*).[2]. In our western culture, virtuosity values (prestige, mastering, performance) have a high masculine connotation, whereas the user/need values (care, stability, risk-avoidance) are more related to femininity.[6] The hypothesis is that the arguments of male students will more often be rooted in virtuosity values, whereas the female students would prefer arguments based upon user/need values.

#### 4.1.1 Methodology

The argument analysis is based on one generation of students (2003/2004) consisting of 49 male and 18 female students. As some students did not fill in their argument the number of respondents will be somewhat lower (On average, four male and two female students were missing, with a slightly variation over the four aspects). The space in the questionnaires to fill in arguments was limited, therefore in the majority of cases the argument had a singular character or has one clear focus (e.g. *“it is nice to create and experiment”*). These cases were relatively easy to categorise. However, more complex were also given. Some had the structure of *“... but...”* or *“....., if ....”*. In most cases this was a *positive* argument (which was used for categorisation) followed by a *negative* (often personal) motivation. (e.g. *“it is important for good products, but I don’t like it”*). A few students gave multiple arguments that did not easily fit to one of the categories. In those cases, the students’ main argument was interpreted. As these cases were limited, the methodology was accepted as valid by the authors.

## 4.2 Analysis of the student's arguments for each of the four IDE aspects

Below, for each of the four IDE aspects, the type of categorisation and the distribution of arguments over the different types of categories are shown in tables 2 to 5. Differences in percentages are indicative rather than distinctive.

### 4.2.1 Technology

Table 2: Students' motivation concerning Technology; Female N=16; Male N=46

Type	Female/ Male	Examples of arguments
I/ designer	<b>F: 8 (50%)</b> <b>M: 26 (56%)</b>	<i>"I am a man"(m)</i> <i>"I have always been interested"(m)</i> <i>"I do find it interesting, but sometimes it is boring"(f)</i> <i>"I find it very interesting to find solutions for certain problems"(f)</i> <i>"It is interesting how things are put together"(m/f)</i>
Product	F: 5 (31%) M: 11 (24%)	<i>"Technology is an important part of a product"(m)</i> <i>"The way products work is interesting"(f)</i>
User/ market	F: 3 (19%) M: 9 (20%)	<i>"Technology should make a product work properly and satisfy the expectations of the consumer"(f)</i> <i>"Technology has great influence on society"(m)</i> <i>"Technology that serves people is fun"(m)</i>

Quantitative results differed significantly between both genders. Even though the division of arguments across the used framework was almost similar for both genders, relatively more female students used *negative* arguments (19% females compared to 2% males). And within "I/ designer/ production", male students gave more personally focussed opinions. No 'typical' virtuosity arguments were given.

### 4.2.2 Styling

Table 3: Students' motivation concerning Styling; Female N=16; Male N=45

Type	Female/ Male	Examples of arguments
I/ designer	F: 3 (18%) <b>M: 28 (62%)</b>	<i>"I like styling, I am interested in drawing, sketching and design"(m)</i> <i>"I love nice things and these begin with good styling"(m)</i> <i>"I find it great to put my emotion and experience in a product"(m)</i>
Product	<b>F: 11 (69%)</b> M: 12 (27%)	<i>"Products gain value by good styling"(m)</i> <i>"Styling is the business card of a product"(f)</i> <i>"I like to take care that the a product is attractive for its styling, not its functionality only"(f)</i>
User/ market	F: 2 (13%) M: 5 (11%)	<i>"A nicely styled product can contribute to a positive living environment and in this way to a positive good feeling"(m)</i> <i>"With styling one can make an agreeable living environment"(f)</i>

This IDE-aspect scored highest in interest. However, the type of arguments students used differed substantially between male and female students. The majority of male students (62%) mostly formulated arguments from their personal perspective and motivation. Most female students (69%) argued from the quality of the product in relation to its market/user environment. Only a few students, male and female, argued their interest in styling with relevance for user needs.

### 4.2.3 Ergonomics

Table 4: Students' motivation concerning Ergonomics; Female N=14; Male N=46

Type	Female/ Male	Examples of arguments
I/ designer	F: 1 ( 7%) M: 20 (46%)	“It is important, but I find it boring”(m) “It is dull and it hampers your design”(m) “Ergonomics is a necessary evil for a designer, it confines your freedom”(m)
Product	F: 1 ( 7%) M:12 (27%)	“It is important for the usability of a product”(m) “Ergonomics is a factor that makes or breaks a product”(m)
User/ market	F: 12 (86%) M:12 (27%)	“It is important to design products for people, so you have to know what people want, are able to, etc.”(f) “It is interesting to see how people use products”(m) “People must be able to use their products in a healthy way”(f)

Not only quantitative rating differed significantly between both genders, also the used type of argument. Almost all female students motivated their interest in ergonomics positively with its relevance for users. Almost half of the male students argued from their own interest or from the designer's perspective, mostly in a (very) *negative* way (dull and boring). Five male students even explicitly argued ergonomics as a hindering factor in the design process. None of the female students used negative arguments here.

### 4.2.4 Marketing

Table 5: Students' motivation concerning Marketing; Female N=12, Male N=44

Type	Female/ Male	Examples of arguments
I/ designer	F: 2 (17%) M: 20 (45%)	“I am not interested; it feels like selling air”(m), “I am fascinated”(m) “I like to palm off things”(m) “It is of course the nicest if you can see your own product in use; marketing is a means that can help here”(f)
Product	F: 10 (83%) M: 13 (30%)	“Marketing can help put your products on the market”(m) “Selling of products must be done, but I prefer to be concerned with the market”(f) “I prefer to take into account the market and to design products, it is better others see to it that it can be sold”(f)
User/ market	F: - ( 0%) M: 11 (25%)	“Interesting how people look at products”(m) “I am curious in what is appealing to people and why”(m)

In the case of marketing, about half of the students (45%) argued (half of them *negatively*) from the “I-/designer” point of view, whereas most female students (82%) argued from the product to market point of view. Some male students used explicitly a virtuosity type of argument, focussed on influencing the market for their own benefits. Female students seem to have a limited view on marketing (“only selling”), as they like to consider the market but do not see it as a part of marketing. This may also contribute to the fact that no female students argued from the user/market perspective.

### 4.3 Gender patterns in student's arguments

Each of the IDE-aspects show specific gender patterns in types of arguments. With respect to marketing and ergonomics, the type of arguments that students used is in a way surprising. In both domains, one would expect a majority of arguments located in the user/market cluster, as these aspects clearly address issues in this domain. With

ergonomics, a strong majority of female students indeed valued the user orientation however, only a minority of male students did. With respect to marketing, the outcome is even more eye-catching. Here, none of the females and only a quarter of the male students argued from the user or market perspective. In general, male students (about half of them) more often argued from a personal or a designer's perspective compared to the female students (~20%). Females tended, more often than males, to argue from the point of view of the quality of a product and from the user perspective.

## 5 CONCLUSION AND RECOMMENDATION

Considering the IDE-student interest in IDE, grading appears towards 1. styling, 2. technology, 3. ergonomics and 4. marketing. Among these results significant gender patterns emerge. Quantitative results show more interest in ergonomics by females and more interest in technology by males. Qualitative results reveal the different perspectives among all four aspects of IDE. Male students more often argue from a 'I/designer' perspective. Females tend more often to argue from a 'quality of a product' and from a 'user' perspective. With marketing, students seem to have a limited view on this field. From a didactical point of view, it is important that the perspectives of both genders are taken into account, as education should be optimal for all. If IDE education finds it important to stimulate equal student interest in all four aspects, a gender specific approach seems to be relevant as well, given the results of this study. The same conclusion holds for the relevance to educate students with a *broad perspective on design processes*, covering the whole range of design context, product and use context. Here, the didactical challenge is to stimulate especially male students to develop such a broad perspective. Information of this study may also be taken into account to enhance insight in the differentiating values of people as applied in design practices.

## REFERENCES

- [1] Van Eyk in Arthur O. Eger, *Van het eerste uur – grondleggers van de Faculteit Industrieel Ontwerpen*, Faculteit Industrieel Ontwerpen (TU Delft), 2004
- [2] Pacey, Arnold, *The culture of Technology*, Basil Blackwell Publ., Oxford, 1983
- [3] Stienstra, Marcelle, *Is every kid having fun? A gender approach to interactive toy design*, Twente University Press, Enschede, 2003
- [4] Oudshoorn, Nelly and Trevor Pinch, *How users matter*. MIT Press, 2003.
- [5] Smit Wim A. and Ellen van Oost, *De wederzijdse beïnvloeding van technologie en samenleving*, Coutinho, Bussem, 1999
- [6] Connell, R.W. *Gender and Power. Society, the Person and Sexual Politics*. Oxford University Press, 1987

Contact information and co-authors information: ir. Margot D.C. Stilma<sup>1\*</sup>, dr. ir. Ellen C.J. van Oost<sup>2</sup>, dr. Angèle H.M.E. Reinders<sup>1</sup>, prof. ir. Arthur O. Eger<sup>1</sup>

1. Industrial Design Engineering; University of Twente, The Netherlands

2. Centre for Studies of Science, Technology and Society; University of Twente, NI

\* Corresponding author: Margot Stilma; m.d.c.stilma@utwente.nl; tel.: +31(0) 53 489 3072