Professionalizing Academic Industrial Designers

Daan Vos

Graduation Report

MSc Science Education and Communication & MSc Strategic Product Design

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TU Delft
Delft University of Technology

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Preface

Double-Degree Graduation Project

I attended a double-degree master program at the Delft University of Technology (DUT). That means that I combined two master programs, namely Science Education and Communication (SEC) and Strategic Product Design (SPD), into one program. This double-degree program required me to integrate the graduation projects of both masters into one graduation project. This graduation report is about that integrated graduation project.

Together with my supervisors I defined two graduation assignments that share the theme 'professionalizing academic industrial designers'. For the SEC graduation project I looked into how the DUT can effectively support Industrial Design Engineering (IDE) students and alumni in their professionalization efforts. For the SPD graduation project I developed a writing education method that is tailored to academic industrial design education and I looked into how a brand can make the learnings from this project operational for other education development projects for academic industrial design education.

The combination of these two assignments was mutually beneficial. The SEC graduation project provided me with a feral understanding of industrial designer professionalization thereby prepared me for the SPD graduation project that included a concrete case of industrial designer professionalization. Furthermore, I encountered a reoccurring problem in industrial designer professionalization during the SEC project, namely that the 'proposition' of academic industrial design education is unclear. What academic industrial designer professionalization should include thereby also becomes unclear. The SPD project provided me with time to dive into literature about this topic and to actively seek out during the writing education method development which difficulties this problem brings and what one can do about it. Also, I could apply competences that I learned in the SPD master program to the SEC graduation project and vice versa. I used 'design reasoning' in the SEC project, for example, and I applied my understanding of communication in the development of the writing education method. The master programs also shared topics like branding that were part of this integrated graduation project.

Who Should Read What

I intended this graduation report for multiple target groups. The first target group is my *supervisors* and *case clients*. I divided the report into two parts that each report on the graduation project of one master. I reported the SEC graduation project in 'Part I: How to Professionalize Industrial Designers Effectively' and marked all headers of the report for the SEC project with **blue**. I reported the SPD graduation project in Part II, III, and IV and marked all headers of the report for the SPD project with **purple**. The appendices have the same division in color. The easiest reading order for this group is to first read the main report parts and then to read the appendices that interest them. The main report references to the relevant appendices.

The second target group is the participants and other people who helped me with the graduation project. People who helped me with the SEC graduation project may be mostly interested in 'Part I: How to Professionalize Industrial Designers Effectively'. I suggest that you read at least the introduction, the conclusion, and the recommendations chapter and any other chapter that interests you. People who helped me with the SPD graduation project may be mostly interested in 'Part III: Professionalizing Academic Industrial Designers in Written Communication Competence'. I suggest that you read at least Chapters 1, 3, 5, 6, and 9 to get an overview of the project and its outcomes.

The third target group is people who are interested education wise. 'Part IV: Branding Starting Points for Designing Academic Industrial Design Education Methods' may be most interesting to you as that part discusses the difficulties in developing education methods for IDE and how one can approach that. You can look in the table of contents where you can find information about how I came to those insights or use the references in Part IV.

The fourth target group is academically interested people. The academically most relevant parts are the teacher analogy and the development of the Industrial Designer Professionalization Model in Chapter 4 of Part I of this report and Part II that presents a design philosophical essay on what makes academic industrial design competence. I suggest that you read the introduction of each part before you read further.

The fifth target group is generally interested people. I suggest that you scan through the table of contents to see which report parts interest you and that you read the introduction of each part to see which chapters interest you. The

introductions will give you an overview of what I did in each part of my graduation project.

Acknowledgements

I want to thank my supervisors for their tireless support throughout the whole project. Each one of them would always make time for me when I needed that, despite their overflowing busy schedules. You were all a true inspiration to me and made me grow professionally beyond my expectations. I want to thank all the people who made time for me to help me with my project by giving interviews, feedback, or any other kind of support. Without your help, this graduation project would not have become anything close to what it became now. And last but definitely not least I want to thank my wife Marieke, my parents, and my other family and friends for their tireless support throughout my studies. I could not have completed my studies without them.

Delft, 18/08/2014, Daan Vos

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Part I: How to Professionalize Industrial Designers Effectively

A Qualitative Study into Two Cases of Professionalization Efforts

1 Introduction

1.1 Background

Students make the first step in their career preparation at the Delft University of Technology (DUT) Industrial Design Engineering (IDE) faculty. They attend academic education to acquire a certain level of competence in the field of industrial design. They look at which kind of assignments interest them and what they are good at. And at the end of their education, they look for opportunities to start their careers; either working for an organization or as an entrepreneur.

Alumni need to continue their development. They need to develop competences, skills, and knowledge. They will want to progress to more challenging work, get a better office and salary, and so on. I.e. they want to reach certain professional standards. They want to professionalize themselves.

The DUT plays an important role in these two stages of professionalization. The IDE faculty can adapt study assignments to the professional field, involve companies, and give attention to career preparation. The DUT Career Centre (CC) can help students with their study choice and career preparation, also after their studies. The Alumni Office keeps contact with alumni and organizes alumni events. The IDE faculty offers master classes for alumni. And so on.

Supporting professionalization of IDE students and alumni is a comprehensive activity that involves multiple DUT parties. These parties share the responsibilities for supporting professionalization. No party is mainly responsible. Furthermore, DUT parties differ in opinion about to which extent the DUT should support professionalization as the DUT is an *academic* institute, not a professional institute. These factors can complicate the organization of professionalization activities.

1.2 Two Cases

The DUT CC and the DUT IDE faculty each provided a case concerning professionalization of IDE students and alumni. Both parties recognized a need with students or alumni that is not fulfilled. Both parties work actively on their offers for those needs.

The DUT CC sees that IDE students in particular experience difficulties in presenting themselves to future employers. These students find it difficult to explain which competences they learned in IDE education and what they can offer to the employer. A study by SEO Economisch Onderzoek (2013) into market opportunities for recent alumni confirms this. The study found that industrial design alumni on average apply 12.7 times to get 3.9 interviews whereas, for example, informatics alumni apply 3.2 times to get 2.9 interviews and electrical engineering alumni apply 5.2 times to get 4.2 interviews. This problem is relevant since most students find a job through an existing vacancy (36%). The CC wanted recommendations on how she can prepare IDE students better for presenting themselves to employers.

The DUT IDE faculty develops cutting-edge knowledge and expertise and wants to offer that to industrial designers in the field. The DUT IDE faculty already offers professionalization activities to alumni, for example master classes on different topics that alumni can attend. Yet, the alumni's professionalization needs are unclear to the faculty and the faculty wants to know how she can effectively reach alumni with promotion. The IDE faculty wanted recommendations on how she can offer professionalization activities to alumni effectively.

These two cases focus on different stages of professionalization and partly overlap, see Figure 1. The DUT CC case focuses on the period from the end of bachelor education until after graduation when the alumni find a job. The DUT IDE case focuses on the period that starts after graduation and lasts as long as the alumni work actively on their career.

1.3 A Qualitative Study

I conducted a qualitative study into industrial designer professionalization to become able to give recommendations for the two cases. I needed insight in how industrial designer

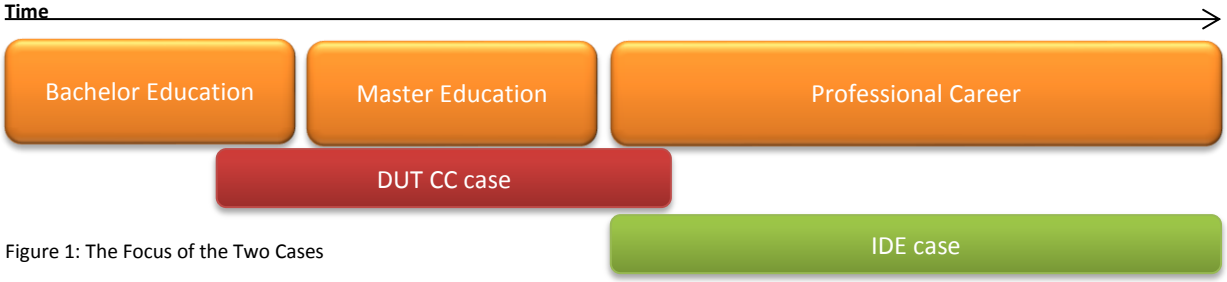

Figure 1: The Focus of the Two Cases

professionalization takes place in practice. I needed insight in IDE students' and alumni's needs concerning professionalization. And I needed insight in CC and IDE professionals' experiences with providing professionalization activities.

A qualitative study could provide insight into these matters as I needed qualitative insights into professionalization that I could generalize for these two cases. Design research method starting from solution conjectures does not provide such deep insights. Quantitative research would first require qualitative insights. A qualitative study does not result in concrete solutions, but it can lead to recommendations on which steps the involved parties should take to improve the situation.

I formulated the following main research question for the study:

> *How can the Delft University of Technology effectively support the professionalization of Industrial Design Engineering students and alumni?*

I took the following steps to answer this question:

a. I searched for available literature about industrial designer professionalization. I found none.
b. I made analogy with teacher professionalization. That analogy provided starting points to continue the study.
c. I conducted semi-structured interviews with IDE alumni about their current professionalization efforts and which difficulties they encounter in that.
d. I conducted semi-structured interviews with CC and IDE professionals about their experiences with offering professionalization activities and which difficulties they encounter in that.

These steps provided complementary perspectives on the main research question. The results partly overlapped and partly complemented each other. So I could apply inductive reasoning to answer the main research question and I could compare the research results to check their quality.

I formulated the following sub-research questions to structure the study. These questions reflect the steps that I took:

1. Which starting points does academic literature offer for industrial designer professionalization? (step a + b)
2. What do Industrial Design Engineering alumni do to professionalize themselves? (step c)
3. What makes Industrial Design Engineering alumni's professionalization efforts effective? (step c)
4. What do the Career Centre and the IDE faculty envision for the professionalization of Industrial Design Engineering students and alumni? (step d)

With an answer to these questions I could draw conclusions with regard to the main research question. I continued to look for solutions after that:

a. I applied abductive reasoning to define a solution space.
b. I formulated solution ideas.
c. I conducted semi-structured interviews with the previously interviewed alumni and CC and IDE employees about whether such solutions would match their needs.
d. I changed and improved the solution ideas with their feedback and formulated recommendations for the two cases.

Figure 2 illustrates the research set-up and how I progressed to recommendations:

1.4 The Report Set-Up

Chapter 2 presents the theoretical framework for the study. Chapter 3 explains in detail the methods that I applied. Chapter 4 presents the research results. Chapter 5 discusses the research results. Chapter 6 draws conclusions and answers the main research question. Chapter 7 explains how I continued looking for solutions and which outcomes that provided. Chapter 8 presents recommendations for the two cases. Chapter 9 provides my personal reflections on this part of my graduation project.

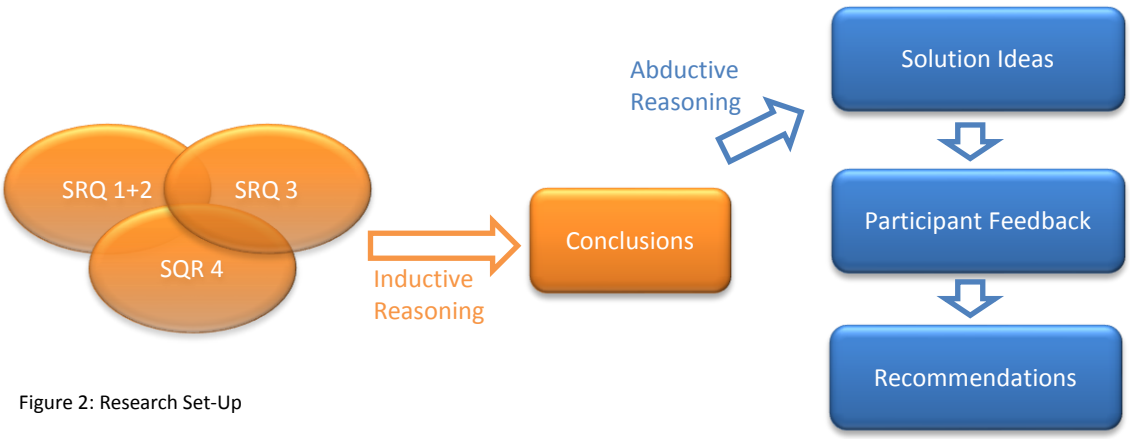

Figure 2: Research Set-Up

2 Theoretical Framework

The main research question needs further clarification to give a clear interpretation to that question. The concepts 'professionalization' and 'professional development' should be defined. The case clients and their role in the DUT organization should be introduced. And there should be a description of the 'academic industrial designer and of which factors play a role in his professionalization efforts. The three subsections in this chapter deal with these points respectively.

2.1 Professionalization and Professional Development

Professionalization is a key term in this study to describe the group of activities that academic industrial designers attend to become better professionals. This includes development of skills, competences, and knowledge. This also includes getting more challenging assignments, a better salary, a higher professional status, a wider professional network, and so on.

I used the following definitions from literature for professionalization to define professionalization and professional development:

> "*Professionalization* is normally understood to refer to the process whereby an occupation increasingly meets the criteria attributed to a profession. *Professional development* refers to the process whereby a practitioner acquires and improves the knowledge and skill required for effective professional practice. It is generally assumed that professionalization involves professional development and that the beneficiary is the client." (Hoyle, 1982)

> "The attempt to gain the characteristics associated with professions was usually called 'professionalization' – an occupational strategy sometimes termed the 'professional project'." (Whitty, 2000)

So, in other words, professionalization is about becoming a 'good' professional – reaching certain standards – and professional development is a process that is part of professionalization – focuses on developing skills and knowledge. The standards for being a 'good' academic industrial design professional are ill defined and unclear as academic industrial designers end up in all kinds of work. Atkinson (2012) illustrates this:

> "There is a developing awareness of the interconnected nature of design, its connections with other disciplines and the convergence of different design disciplines as boundaries are increasingly contested and transgressed."

The IDE faculty does have general norms and criteria for education such as the Meijer's criteria (Meijers et al. 2003) and learning goals for its education programs. The diversity of actual study and work assignments is yet so great that reaching consensus on a concrete standard proves problematic. I studied this topic deeper in Part II of this report.

What we should learn from the definitions is that academic industrial designers participate in activities to become better professionals and that they need to live up to social standards of what the bar is for being a good professional. This does not provide much information to continue the study on as these are general insights. This study needed to look closer at these aspects to obtain a more concrete picture of the situation.

2.2 The Case Clients

2.2.1 The Delft University of Technology Career Centre

The DUT CC helps DUT students and PhD's to consider new studies options, career opportunities, and finding a job after studies or PhD. The CC offers career skill related counselling and workshops for this purpose (TU Delft Career Centre, 2014). The CC has a different perspective on student development as she focuses on career preparation whereas the faculties mainly focus on academic education, not the students' future careers.

2.2.2 The Delft University of Technology Industrial Design Engineering Faculty

The DUT IDE faculty presents itself as follows (M&C, 2014):

> "The Faculty of Industrial Design Engineering stands for: creating successful products people love to use.

> Our mission is to contribute to the knowledge, skills, methods and professional attitudes in the field of integrated product development. We aim to achieve this through education and research at an internationally recognized scientific level, as befits our status as part of the Delft University of Technology. The Faculty of Industrial Design Engineering's concern is to study, innovate and improve the development of durable products and their related services for people, on the basis of the balanced interests of users, industry, society and environment."

The IDE faculty educates students and employs researchers to achieve this mission. This mission statement implies that the IDE faculty contributes to the field of integrated product development by preparing students to contribute what they learned to that field. Hence there is ground to argue that the IDE faculty should support its students' professionalization. Professionalization of alumni also contributes directly to the faculty's mission.

2.2.3 The Delft University of Technology as Umbrella Organization

The CC and IDE faculty are part of the DUT that functions as an umbrella organization:

- The DUT includes more faculties in other technical disciplines.
- The DUT includes other organizations that support professionalization, like the Alumni Office and the Valorization Centre.
- The DUT includes organizations that support organizations in their efforts to offer professionalization activities, like Marketing & Communication and FMVG (property management).

Professionalization of students and alumni is a shared responsibility between these organizations, which complicates the matter. Recommendations for the two cases need to deal with this organizational situation:

- There is unclearness about who should do which tasks
- There is no one mainly responsible, so there can be confusion about who should take the lead or coordinate in which situations.
- Cooperation is difficult as organizations do not always know what others are doing.

2.3 The Academic Industrial Designer

With the term 'academic industrial designer' I refer to someone who attends or attended academic industrial design education and/or is active working as industrial designer on an academic level. This leaves two unclear concepts: 'academic industrial design education' and 'industrial design work on an academic level'.

2.3.1 Academic Industrial Design Education

Industrial design education at an academic level developed itself in the past decades. The proposition of a*cademic* industrial design education is not clear though. The focus of industrial design education was traditionally on the integration of engineering, ergonomics, design, and business in product development. This is still the focus of professional industrial design education. The focus of academic industrial design is also on integration and includes scientific research from various scientific disciplines, complex social situations in which product development takes place, and integration with other design disciplines such as service design. Atkinson (2012) expresses this situation well (see Section 2.1). The IDE faculty cannot give a clear account of the IDE proposition. This makes clarifying what academic industrial designers should be capable of at the end of their education difficult.

2.3.2 Industrial Design Work on an Academic Level

Practice shows that academic industrial designers end up in all kinds of jobs. There is no clear career perspective for academic industrial designers and so there is no clear profile of the academic industrial designer:

- Many recent graduates start in a 'traditional' design job but move up to other work positions.
- Alumni end up in jobs in design, research, business, and all kinds of other jobs. Such jobs can be completely unrelated to industrial design.

This study included only alumni who attended education at the DUT IDE faculty and nowadays have 'traditional' industrial design jobs to deal with this indistinctiveness. This was necessary to have enough cohesiveness between the participants to make the research results comparable. Their work may not be 'academic' though and this group may not represent the needs of the whole group of academic industrial designers.

2.3.3 Professionalization of the Academic Industrial Designer

The theoretical framework could not fully clarify the main research question and by that give sufficient support to structure the research results. I therefore used the research results from Sub-Research Question 1 to identify the main factors that describe the academic industrial designer's professionalization situation. The purpose of this was to give the reader a clearer and coherent overview of the research results: I categorized the research results of each sub-research question according to these factors to make them comparable with each other. This was for communication purposes only; this was by no means a form of hypothesis-testing.

The following four factors describe in short the academic industrial designer's professionalization situation (also see Figure 3):

1. The academic industrial designer's own needs to become a better professional (blue circle).
2. Parties that influence the social standards of being a 'good' academic industrial designer (red pentagons).
3. Available professionalization activities that suit the academic industrial designer's needs (green shapes).
4. Parties that offer professionalization activities for academic industrial designers (red pentagons).

Professionalization activities may be tailored to academic industrial design or be generic and useful to academic industrial designers amongst others. What parties want to offer to academic industrial designers also influences the offers. Factor 4 is interrelated with Factor 2 as the parties who offer activities also influence what 'good' academic industrial designers should learn.

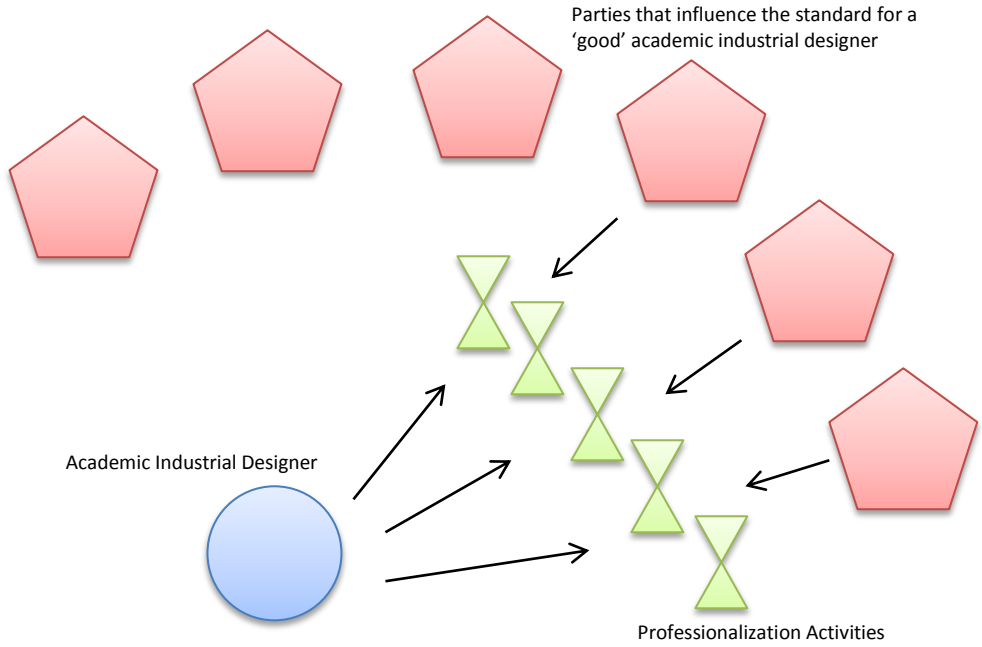

Figure 3: Factors of the Professionalization Situation

3 Method

The sub-research questions provided structure for the study. I split the study into three phases:

- Section 3.1 describes the methods that I applied in the first phase where I conducted a literature study to answer Sub-Research Question 1.
- Section 3.2 describes the methods that I applied in the second phase where I conducted semi-structured interviews with academic IDE alumni to answer Sub-Research Question 2 and 3.
- Section 3.3 describes the methods that I applied in the third phase where I conducted semi-structured interviews with CC and IDE employees to answer Sub-Research Question 4

Section 3.4 motivates the choice for a qualitative research approach in more detail.

3.1 Literature Study

I first conducted a literature study into industrial designer professionalization. Literature does not distinguish between a professional and an academic level of industrial design so I could only search on industrial designer professionalization in general. This was in line with the sample selection that I made: academic industrial design alumni who do professional (traditional) industrial design work. I searched with the keywords from Table 1 first on Google Scholar and then on Scopus and Web of Science. I searched on journal paper websites with suggestions for related articles as well. I could not find earlier research into industrial designer professionalization specifically. Appendix 1.1 presents the results that I found on related topics. So this search did not provide me with starting points for understanding industrial designer professionalization.

I then decided to look for literature on professionalization for another discipline and to make an analogy with that discipline. I expected that jobs with a similar complexity require similar professionalization processes. An analogy could provide starting points to obtain an overview of which factors play a role in professionalization. Those starting points enable me to discuss those factors in the interviews with IDE alumni and DUT professionals.

An analogy with professions like engineering that are close to industrial design is possible but then the differences and similarities between the two professions are difficult to distinguish as there is much overlap. One can easier make a sharp analogy with a profession that is 'further away' as the differences are clearer. Teacher professionalization is well-documented and the teacher profession is clearly different from industrial design. I expected teacher professionalization to have a similar complexity to industrial designer professionalization though. An analogy with the teacher profession therefore was a logical choice.

For the analogy I first looked for literature and then made the analogy. I searched with the keywords from Table 1 on Google Scholar first and then on ScienceDirect and the Teaching and Teacher Education journal website with suggestions for other articles. I summarized the scientific articles' conclusions and what they imply for industrial designer professionalization in Appendix 1.2. I summarized the conclusions from reports from professional organizations and what they imply for industrial designer professionalization in Appendix 1.3. I separated those as there were differences between the groups. Reports from professional organizations took individual differences between teachers into account, for example, whereas scientific literature looked for generalizable patterns and ignored differences between teachers. I made an assessment of the analogy's quality in Appendix 2. The analogy provided me with starting points for the interviews with alumni and professionals. That allowed me to answer Sub-Research Question 1.

Industrial Designer Professionalization	Teacher Professionalization
Industrial designer professionaliz(s)ation	Teacher professionaliz(s)ation
Industrial designer professional development	Teacher professional development
Industrial designer education	
Industrial designer development	
Industrial design lifelong learning	

Table 1: Keywords Literature Search

3.2 Interviews with Alumni

I conducted semi-structured interviews with IDE alumni about which professionalization activities they participate in and what makes those activities effective. With these insights I could answer Sub-Research Question 2 and 3 and build a more generalizable understanding of industrial designer professionalization.

3.2.1 Interview Procedure

I conducted semi-structured interviews of around twenty-five minutes with eight IDE alumni. Semi-structured interview was a suitable method to cover all topics and to give flexibility to move into other topics or directions in case participants gave unexpected insights. The interview guide is available in Appendix 3. Appendix 4 provides the interview transcripts from these interviews.

Control questions in the interviews allowed verification of the adjusted focus due to the analogy. These control questions included closed questions on whether certain topics are relevant (e.g. 'Do personal preferences play a role in choice for professionalization methods?' to check whether personal preferences is a relevant topic) and open questions to allow for unexpected insights (e.g. 'Do you want to add something to the interview?' to check if I missed relevant topics).

3.2.2 Sample Selection

The interview participants all work in the industrial design field or a related design field and attended education at the faculty of IDE at the DUT. They finished graduation between 3 years and multiple decades ago. There were both participants who work or worked for organizations and participants who work or worked as an entrepreneur. The interview participants included four men and four women. Two participants, entrepreneurs, built their company together and by that they also worked together for almost their entire career. This provided an opportunity to see and discuss the influence by other people on one's professionalization. Section 5.2 discusses this matter.

3.2.3 Data Analysis

To analyze the data, I applied open coding to the data and then I grouped the codes. I developed the set of codes myself while analyzing the data. Following, I looked for relationships between the codes and structured the codes into a model. These steps are similar to grounded theory as Verhoeven (2011) describes, yet the starting assumptions differ since I brought early focus in my results by applying the teacher analogy to predetermine the interview topics. Appendix 5 provides the codes with their respective quotes that resulted from the analysis.

I discussed the assigned codes with a master student who first coded a part of the transcripts himself. We compared the codes and discussed the meaning of them after that. We concluded that we came to codes with the same meanings in light of the research question. The only differences were in the detail of the descriptions: one of my codes could comprise several of his codes and vice versa. This stimulated reflection on the appropriate level of detail for the codes.

3.3 Interviews with Employees

In the third phase, I conducted semi-structured interviews with two CC and one IDE employees to find out what experiences they have with providing professionalization activities to students and alumni and with what makes those activities effective. With those insights I could answer Sub-Research Question 4, namely how these employees envision an improved situation for student and alumni professionalization.

Research with students was desirable to find out how they experience their professionalization needs, yet this was not feasible time wise. Furthermore, CC and IDE employees have an overview of large groups of students and have insight in misconceptions that students have, whereas students may not be fully aware of the real problems they face.

3.2.1 Interview Procedure

I conducted semi-structured interviews of around twenty-five minutes with two CC employees and one IDE employee. Semi-structured interview was a suitable method to cover all topics and to give flexibility to move into other topics or directions in case participants gave unexpected insights. The interview guide is available in Appendix 3. Appendix 6 provides the interview transcripts from these interviews.

3.2.2 Sample Selection

The CC interview participants both had multiple years of experience with career counselling for academic industrial design students and alumni. The IDE interview participant had multiple years of experience with career preparation of academic industrial design students in IDE education. The interview participants included one man and two women.

3.2.3 Data Analysis

The analysis of the interview transcripts included grouping data according to the interview topics and coding the data groups. I developed the set of codes myself while analyzing the data. These codes represent the answers to the interview questions and with these answers I could answer Sub-Research Question 4. Appendix 7 provides the codes with their respective quotes.

3.4 Motivation Qualitative Approach

This study applied a qualitative approach. Other approaches are possible, though, and the choice of approach influences the contents and characteristics of the research findings.

The motivation for choosing a qualitative approach lies in the formulation of the main research question. This question demands a causal description and evaluation of professionalization processes. By definition, qualitative research is suitable to answer such questions as it is able to discover and describe phenomena and its variables (Silverman, 2006).

Quantitative research might also give insights into the main research question, but that approach needs well formulated hypotheses and variables to start the study which are not available for this research. Quantitative research might be a proper follow-up after the qualitative study to find measurable confirmation of the research findings, but this is not possible within the available time budget.

Another approach would be to not first research the professionalization processes but to start from known solutions and testing them with trial-and-error. This approach is common in professional practice. A main advantage is that one can deploy solutions early on and make quick advantage of earlier developed solutions. Evaluation is the method to build understanding of the professionalization processes after each trial period. The disadvantage of this approach, however, is that it brings a narrow focus in the process early on. It tests specific approaches in specific cases and evaluation therefore mainly brings understanding of the specific case only: it is an abductive method (Roozenburg & Eekels, 1996) and therefore is not likely to elicit full understanding of principles that one can use to deduce effective professionalization solutions in other cases. A qualitative approach requires more effort at the start of the project and its results are wider applicable since it works from a causal understanding of the professionalization phenomenon.

4 Results

This chapter presents the results of the three research phases:

- Section 4.1 presents the literature study results and relates them to Sub-Research Question 1.
- Section 4.2 presents the results of the interviews with IDE alumni and relates them to Sub-Research Question 2 and 3.
- Section 4.3 presents the results of the interviews with the CC and IDE employees and relates them to Sub-Research Question 4.

4.1 Literature Study

This section presents the results that I found concerning Sub-Research Question 1: Which starting points does academic literature offer for industrial designer professionalization? Sub-Section 4.1.1 presents the results from literature on industrial designer professionalization. Sub-Section 4.1.2 presents the results from the analogy with teacher professionalization.

4.1.1 Results from Industrial Designer Professionalization Literature

As Chapter 3 mentions, I found no literature on industrial designer professionalization. I looked for literature about industrial designer professionalization in general as literature does not distinguish between academic and professional industrial designers. I did find literature on topics that are related to industrial designer professionalization. Appendix 1.1 gives an overview of these results. I divided that literature into three categories to show how they relate to industrial designer professionalization.

I found literature about professionalization of the industrial design field as a whole. This literature looks at how the field developed from an amateur field into a professional and an academic field. Swann (2002), for example, explains how the design profession developed into a professional field and how a reflective approach to the design activity – action research - can improve accountability of design professionals.

I found literature about the 'psychological profile' of the industrial designer. This literature looks at what happens inside the mind of the industrial designer; at competences or design thinking, for example. Lewis and Bonollo (2002), for example, identified professional skills in design and argue that education does not meet the needs of professional disciplines.

I found literature about industrial design education. This literature looks into the practice and quality of industrial design education and how one can improve that education. Hirsch et al. (2002), for example, discuss the benefits for education of collaborating with professional designers.

So there is a gap in the available literature on this topic. The found literature 'touches' the topic but does not provide concrete insights into industrial designer professionalization. The presented categories also overlap with each other: they transgress into each other. Figure 4 illustrates this situation. So literature did not provide starting points for research into industrial designer professionalization

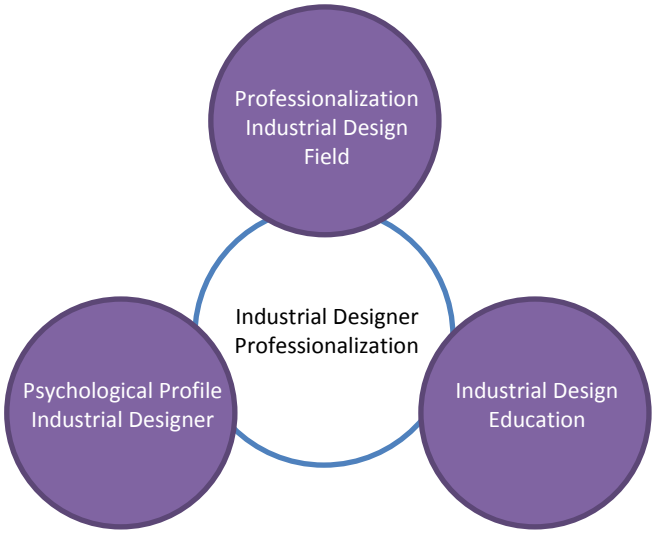

Figure 4: Literature Gap Industrial Designer Professionalization

4.1.2 Results from the Teacher Analogy

As Section 3.1 explains, I made an analogy with teacher professionalization to get starting points for my study into industrial designer professionalization. The teacher analogy partly fills the gap in literature this way as Figure 5 illustrates. Appendix 2 presents my assessment of the analogy's quality: to which extent the different professions are similar and whether the analogy's implications for industrial designer professionalization are plausible. I found literature from scientific magazines and professional organizations into teacher professionalization. Appendix 1.2 and 1.3 present conclusions from the literature and what they imply for industrial designer professionalization. There are differences between these sources though. Professional

organizations take differences between teachers into account, for example, whereas scientific literature seeks to generalize such aspects.

I divided the literature study results along the four factors that I presented in the theoretical framework that describe the academic industrial designer's professionalization situation (see Sub-Section 2.3.3). Table 2 presents the starting points that the analogy provided. The remainder of this sub-section gives the full overview of results with references. I marked results from literature from professional organizations in that overview with an asterisk (*).

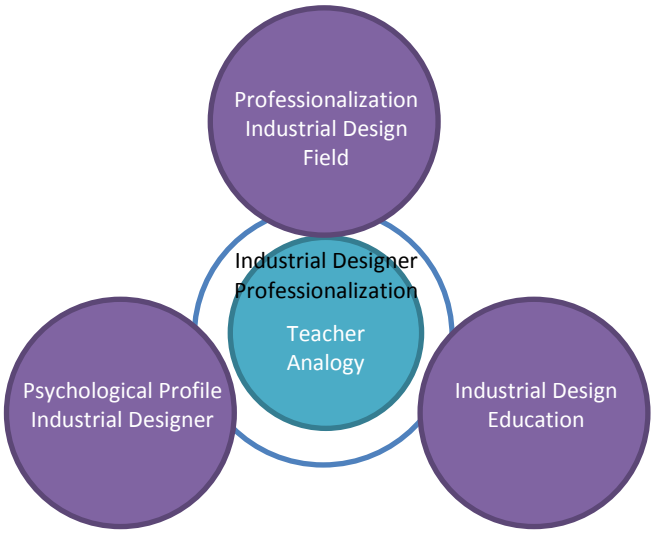

Figure 5: Analogy in Literature Gap Industrial Designer Professionalization

Starting Points Industrial Designer Professionalization
Factor 1: The Academic Industrial Designer's Own Needs to Become a Better Professional
Professionals have different needs and need personalized professionalization activities.
Professionalization should be integrated with daily work.
Having experienced professionals lead less experienced professionals in their professionalization gives mutual benefit.
Factor 2: Parties that Influence the Social Standards of Being a 'Good Academic Industrial Designer'
The social context inside and outside of the organization influences the 'agenda' of professionalization.
The organization has a responsibility to provide vision for professionals' professionalization.
The organization should involve the professionals in setting the professionalization agenda.
Factor 3: Available Professionalization Activities that Suit the Academic Industrial Designer's Needs
Professionals need limited and clear learning goals, on-demand access to time and resources, and support from their organization.
Professionalization is a continuous effort that happens throughout each working day.
Self-reflection is important for professionalization.
Professionalization in groups is effective since it allows for dialogue and cooperation, which stimulates self-reflection.
Professionalization in groups needs proper and flexible structure.
Factor 4: Parties that Offer Professionalization Activities for Academic Industrial Designers
Literature does not take this perspective and thereby gives no starting points.

Table 2: Overview Starting Points

Factor 1: The academic industrial designer's own needs to become a better professional.

- In case of organization wide professionalization, it is important to involve the professionals in setting the agenda to allow them to personalize their own learning (Nielsen, 2008; Starkey et al., 2009). This step is necessary to ensure that the professionalization efforts meet the professional's personal needs and expectations.
- Professionals prefer to learn on-the-job and to shape these efforts to their own needs and expectations. Professionals are more likely to participate in professionalization if they have a positive attitude to their job (Nielsen, 2008; Nir & Bogler, 2008).
- More experienced professionals can benefit from taking a leadership role in professionalization. It helps them to further develop themselves, while there also is a mutual benefit for less experienced professionals who learn from the experience of the more experienced professionals (Taylor, Yates, Meyer, & Kinsella, 2011).
- For professionals who reached at a national standard of professionalization, it is likely that improved professional competence; financial gain; and self and external validation are motivating factors to further develop themselves. With increasing age (starting from their 40's), it is likely that the factors financial gain and external validation have less impact (Hildebrandt & Eom, 2011).
- Professionals need personalized learning goals and individual coaching (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Teurlings & Uerz, 2009; Zijlstra et al., 2011). As professionalization is a continuous, cyclic process and learning on-the-job makes professionalization

relevant, it is important to integrate professionalization efforts with daily work (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Teurlings & Uerz, 2009).*

- For professionalization it is effective to have experienced professionals share their experience with less experienced colleagues. In the process of professionalization it is also important to give experienced professionals the recognition they deserve (Vrije Universiteit Amsterdam, 2009; Zijlstra et al., 2011).*

Factor 2: Parties that influence the social standards of being a 'good academic industrial designer'.

- Professionalization is part of a larger context in which social and political mechanisms influence the 'agenda' of professionalization (Popkewitz, 1994; Kaasila & Lauriala, 2010). One should take into account the parties that influence what the standard for professionalization is, the organizations for who the professionals work, politics on the work floor, the professional's own agenda, and so on.
- The organization should provide vision for professionalization and should include the professionals in setting the agenda for professionalization (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013).*

Factor 3: Available professionalization activities that suit the academic industrial designer's needs.

- The right conditions need to be present in order for professionalization to be effective. Professionals need limited and clear learning goals, on-demand access to time and resources, and support from their organization (Nielsen, 2008; James & McCormick, 2009; Buczynski & Hansen, 2010). Also, embedding professionalization directly in working practice is an important condition (Nielsen, 2008).
- Professionalization is partly an individual effort – autonomy - and partly a group effort - collegiality. Finding a balance in this is necessary for effective professionalization (Clement & Vandenberghe, 2000; Butler, Lauscher, Jarvis-Selinger, & Beckingham, 2004; Kuijpers, Houtveen, & Wubbels, 2010).
- One should not understand professionalization of professionals as singular acts, but as a continuous effort that happens throughout each working day: both on the working floor and in professional networks. Providing opportunities for professionalization should align to this understanding of a continuous effort (Hudson-Ross, 2001; Knight, 2002).
- Professionalization in groups is effective: in professionalization communities and in networks. They provide opportunity for cooperation and dialogue, which stimulates reflection (Jenlink & Kinnucan-Welsch, 2001; Butler et al., 2004; Snow-Gerono, 2005; Nielsen, 2008; Starkey et al., 2009; James & McCormick, 2009).
- These groups need facilitation and proper structure to function effectively (Jenlink & Kinnucan-Welsch, 2001; Starkey et al., 2009; Levine & Marcus, 2010). Professionalization networks are more effective if they focus on (self-) reflection and if they exploit instructive subgroups and network meetings with a strong content focus that stimulate enthusiasm (Hofman & Dijkstra, 2010). It can be difficult to maintain professional development networks over time, so these groups need to be flexible in reshaping themselves (Hudson-Ross, 2001).
- Professional inquiry groups are one effective format for professionalization (Crockett, 2002; James & McCormick, 2009). In an inquiry group a group of professionals observe and then together reflect on each other's work.
- ICT solutions, such as forums, can be helpful for professionalization communities to function, since it can stimulate critical discussion (Prestidge, 2010). Blogging to support reflective practice probably has little potential for professionals in their professionalization efforts (Killeavy & Moloney, 2010). Participation in online professionalization communities is more effective if the participating alumni combine it with face-to-face meetings (Matzat, 2013).
- Self-reflection is important for professionalization (Inspectie Van Het Onderwijs, 2013).*
- Organizations need to support professionals in professionalization efforts. They need to create the proper culture and provide the time, resources and opportunities that professionals need for professionalization (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Zijlstra, Meerman, & Van 't Hooft, 2011).*
- Organizations can put minimum demands of competence in place and minimum demands for organization divisions to support professionalization (Vrije Universiteit Amsterdam, 2009)*
- Professionalization in groups is effective: it supports cooperation and reflection through dialogue (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Teurlings & Uerz, 2009;

Zijlstra et al., 2011). Professionals appreciate it and it supports common learning goals as well as individual learning goals (Teurlings & Uerz, 2009).*
- Professional inquiry groups are an effective method to professionalize. Giving quality feedback, however is not easy (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013).*

Factor 4: Parties that offer professionalization activities for academic industrial designers.
- This literature does not take the perspective of the parties that offer professionalization activities and therefore does not provide insight into this matter. The theoretical framework explains which parties in the DUT offer professionalization activities.

4.2 Interviews with Alumni

This section presents the results that I found for Sub-Research Question 2 and 3:
- What do Industrial Design Engineering alumni do to professionalize themselves?
- What makes Industrial Design Engineering alumni's professionalization efforts effective?

Sub-Section 4.2.1 presents the industrial designer professionalization model that I synthesized from the participants' responses. This model gives an overview of the activities that IDE alumni participate in and the factors that influence the effectiveness of these activities. Sub-Section 4.2.2 explains how the model relates to the four factors of the theoretical framework that describe the industrial designer professionalization situation. Sub-Section 4.2.3 provides the code table of the interviews with IDE alumni.

4.2.1 Industrial Designer Professionalization Model

The participants described in which professionalization activities they participate and what makes those activities effective. This resulted in a concrete overview of professionalization activities for industrial designers. This also resulted in an overview of factors that influence the activities' effectiveness. This furthermore resulted in an overview of factors that influence the industrial designer's choice for which activities they participate in.

I grouped the results into five categories:
- *Professionalization activities* that industrial designers participate in.
- *Content related effectiveness aspects* that concern the activity's set-up and the content focus.
- *Psychology related effectiveness aspects* that concern the mental state of the industrial designer and the people around him.
- *Mandatory drivers* that force the industrial designer to give certain professionalization aspects priority, regardless of his personal opinion about the matter.
- *Choice drivers* that result from personality and opportunity, on the basis of which industrial designers make different choices about which activities they participate in.

These categories stand in relation to each other. The drivers influence what the industrial designer deems to be important to learn and what gets priority. Effectiveness aspects influence the quality of a professionalization activity's result. Figure 6 shows these relations and gives an overview of the activities and factors that the participants mentioned. Table 3 in Sub-Section 4.2.3 gives an explanation of each activity and factor.

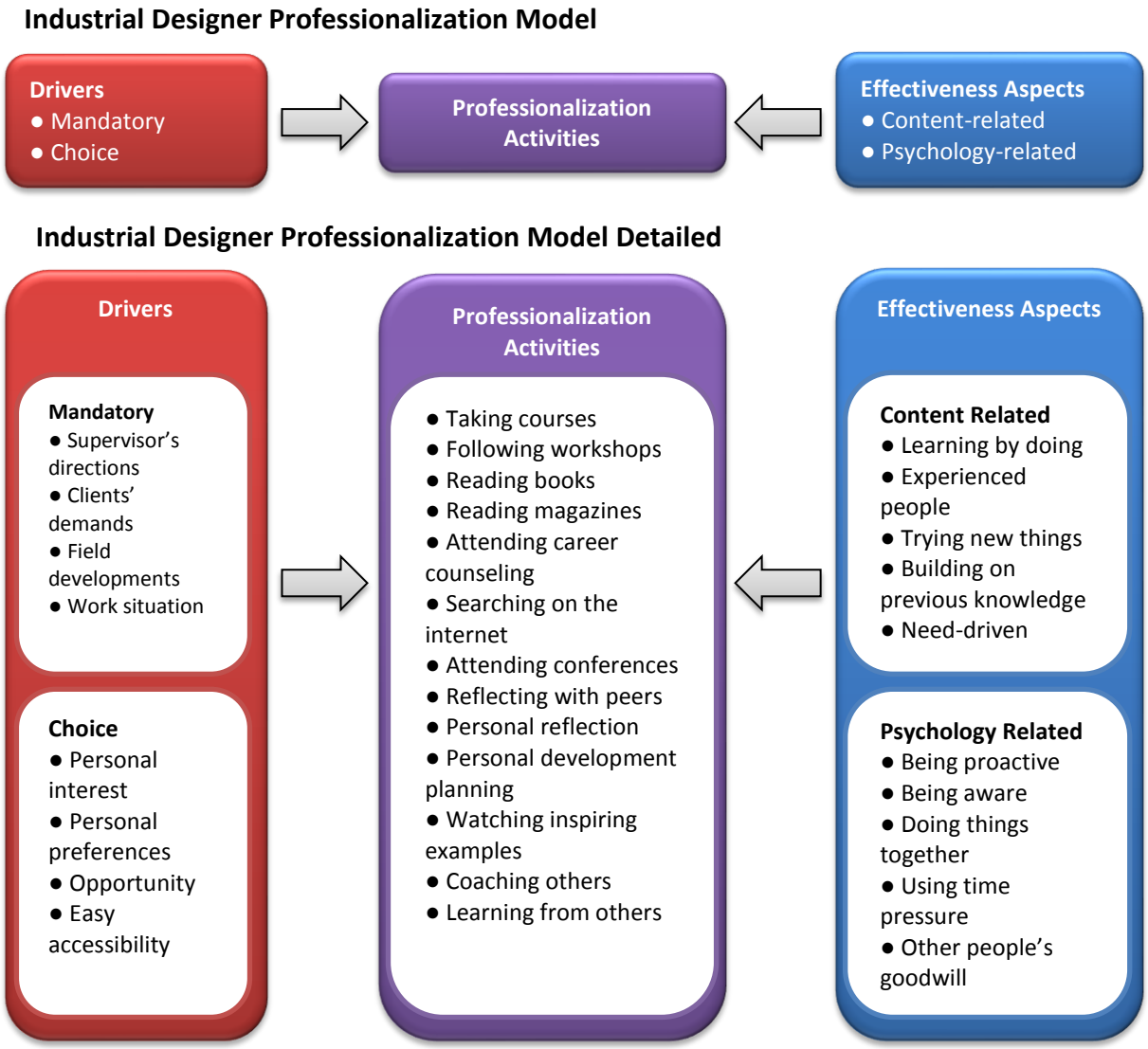

Figure 6: Industrial Designer Professionalization Model

4.2.2 Categorization to the Four Factors

The results show that 'Factor 1: The academic industrial designer's own needs to become a better professional' is essential for the choice for professionalization activities:

- Industrial designers seek to professionalize themselves when they want to improve themselves or improve their situation after they experienced a concrete need for that. Industrial designers cannot give priority to professionalization activities without such a need. Activities that they participate in without a need for that activity are not effective.
- Industrial designers first of all seek activities that fulfill their specific needs.
- Individual preferences also play a role in the choice for activities but have less priority.
- Being aware of one's needs and a proactive attitude are necessary for effective professionalization.

The results show that 'Factor 2: Parties that influence the social standards of being a 'good academic industrial designer'' plays a decisive role in industrial designer professionalization:

- Supervisor's directions, clients' demands, and field developments reflect the social context that directs industrial designers' professionalization. Industrial designers have to follow these directions. Supervisors and the employing organization bear responsibility for industrial designers' professionalization.
- Experienced people in the industrial designer's social context contribute to the effectiveness of professionalization activities and by their help influence the social standards of being a 'good industrial designer'.

The results give insight in 'Factor 3: Available professionalization activities that suit the academic industrial designer's needs': in which activities the industrial designers pick and what makes those activities effective:

- Industrial designers might participate in any activity that suits their needs. Activities should be adapted to needs, not to individual preferences. Individual preferences are unpredictable.
- Easy accessibility and opportunity drive the industrial designer's pick from the available activities.
- Participating with a group can make the step to participation easier for industrial designers.

The results do not give insight in 'Factor 4: Parties that offer professionalization activities for academic industrial designers' as the interviews did not include this perspective.

4.2.3 Code Table

This sub-section presents the code table of the interviews with IDE alumni. This code table gives an explanation of each factor in the industrial designer professionalization model. I categorized the codes in Table 3 according to the industrial design professionalization model categorization. The table gives an explanation of each code and an illustrative quote for that code. The number beneath each code shows how many participants mentioned the insight from that code.

Code	Explanation/Quote
Mandatory Drivers	
Supervisor's directions 6x	Supervisors – or the organization they represent – give advice and directions for professionalization and monitor and evaluate progress in professionalization. *"Yeah, there is always your manager who follows you and gives advice. With whom you can discuss 'do I go that or that direction?' Human resources also are involved and help you consider the next steps."* (IDA-4)
Client's demands 3x	Independent industrial designers need to follow client's demands in how they professionalize themselves. *"Sometimes my clients say 'can you make a movie clip?' or something like that. Then it is up to me…"* (IDA-1)
Field developments 7x	Industrial designers need to follow developments in their field – their discipline. *"There always is, of course, a discipline in which you are or in which you would like to specialize yourself. And that discipline dictates which knowledge you need for that, knowledge that is added to the discipline, so you can just look that up."* (IDA-2)
Work situation 6x	Your work situation – entrepreneur or employee in a small or large business – influences your possibilities and directions for professionalization. *"My utopia of becoming an employee was that everything would be available in one place instead of all separate assignments; that was what I did before [as freelancer] […] and that is going different from what I expected […] it also has to do with company culture. A small company, at least this company, does not have the financial means to professionalize her employees even though they need it.* (IDA-7)
Choice Drivers	
Personal interests 1x	Industrial designers want and need to follow their personal interests in professionalization. *"So that continuously led to 'guys, what do we need to do, what do we want to do?' On one hand it is need-driven, on the other hand we felt like 'we need to make priorities ourselves'."* (IDA-6)
Personal preferences 8x	Industrial designers have personal preferences in how they professionalize themselves. *"Yeah, I like to figure things out myself. Just with a book for dummies so to speak. Just walking through it step by step."* (IDA-3)
Opportunity 3x	Industrial designers follow unexpected opportunity to professionalize themselves. *"And the funny thing is that you start networking during such a workshop. And by that I also got assignments. It's very weird."* (IDA-1)
Easy accessibility 1x	Industrial designers rather attend professionalization activities that are easily accessible. *"Yeah, that is a very good workshop! But it is easily accessible because it only costs firty-five euros for a half day. So that is attractive to me." (IDA-1)*
Professionalization Activities	
Taking courses 6x	Industrial designers take courses to professionalize themselves. *"I attended a number of educations […] and courses."* (IDA-4)
Following workshops 3x	Industrial designers follow workshops to professionalize themselves. *"[...] one of the things the Kamer van Koophandel offers is workshops. So I followed the 'how can I get assignments?' workshop."* (IDA-1)
Reading	Industrial designers read books to professionalize themselves.

books 8x	*"So annually I read about four, five, six books about various topics. Yeah, that is something I keep doing."* (IDA-2)
Reading magazines 1x	Industrial designers read magazines to professionalize themselves. *"Yeah, and I always buy magazines to stay a little up-to-date..."* (IDA-1)
Attending career counseling 1x	Industrial designers can attend career counselling to professionalize themselves. *"Then I also had some conversations with ---. It is nice then to be able to talk to someone like 'yeah, what is possible now?'"* (IDA-3)
Searching on the internet 7x	Industrial designers search on the internet to learn things. *"I am very dependent on the internet. Without the internet I really feel helpless. So that is my largest source of help."* (IDA-7)
Attending conferences 2x	Industrial designers can attend conferences to professionalize themselves. *"There are quite a lot of conferences. I think I attend one or two conferences each year. Yes, two each year."* (IDA-2)
Reflecting with peers 7x	Industrial designers reflect with peers to consider their situation and to find new directions. *"[...] I think a very important part also is to simply talk to other designers who go in similar directions. And to learn from each other and to build each other up. [...] Just friends from my education so to speak with whom you stay up-to-date and who give you new directions or tips from time to time."* (IDA-5)
Personal reflection 4x	Industrial designers can do personal reflection to professionalize themselves. *"[...] if you can do a bit of self-reflection then you can figure out how you can do things better based on your earlier experiences."* (IDA-4)
Personal development planning 3x	Industrial designers can participate in personal development planning to professionalize themselves. *"I have three evaluations annually […] I have an evaluation where we discuss the planning for the coming year. An evaluation to discuss my progress. And last a performance evaluation on which a number of secudair conditions depent."* (IDA-5)
Watching inspiring examples 2x	Industrial designers can look at examples that they find inspiring to professionalize themselves. *"I am quite a fan of IDEO. So for that I have all their books or articles when they are published."* (IDA-5)
Coaching others 1x	Industrial designers can coach others to professionalize themselves. *"Next year I will hire an intern, for example. So that is someone who I coach in that. In his graduation project. So that is personal development for me: to coach someone in that and to make him comfortable in an organisation and to work on leadership development a bit."* (IDA-2)
Learning from others 8x	It is necessary to have people to learn from in order to progress in professionalization: to ask questions and to discuss matters. *"Actually, one of the most important things is that you have people, that you gather people around you with whom you can discuss things."* (IDA-2)
Content-Related Effectiveness Aspects	
Learning by doing 6x	An essential step in professionalization is applying learnings in practice and learning from practice. *"I think the most important thing if you want to learn something is that you can apply it in practice […]"* (IDA-3)
Experienced people 2x	Industrial designers need access to people who are experienced with the matter at hand to professionalize themselves effectively. *"The convenient thing with different colleagues, in contrast to computers, is that you have quite fast interaction with colleagues. You can deal with matters quite fast. You know quite fast whether someone does or does not know […] not every colleague is knowledgeable about certain matters".* (IDA-7)
Trying new things 2x	Industrial designers need to try new things to effectively professionalize themselves. *"[...] you can stay very much within your own circle but if you only stay in familiar territory you won't develop anyway. So you need to go past your limits a bit but not too much I think."* (IDA-3)
Building on previous knowledge 1x	Effective professionalization builds on previous knowledge. *"But often it is partly recognizing 'hey, I already do this and that' and partly new knowledge."* (IDA-1)
Need-driven 6x	Effective professionalization is driven by needs that industrial designers encounter. *"For me learning things only becomes relevant if I see what I can do with it […] now I decide what I want to learn simply because I encounter a problem or because I come short or because I find something interesting or because I van apply something for clients. So applicability is very important to me."* (IDA-8)
Psychology-Related Effectiveness Aspects	
Being proactive	Industrial designers need to be proactive in order to professionalize effectively. *"It won't come by itself. You need to be very proactive, you need work on it actively yourself and you need*

6x	*to know where you… what the right things are to do to get there. And not just sitting around and just working hard on the contents of your work and thinking that… that everyone will see that you are really good and that you will get higher up by itself."* (IDA-4)
Being aware 3x	Becoming aware of what you need to improve is a necessary step for professionalization. *"[…] much is in becoming aware because there are a lot of things you already do but if you become aware of it, like 'okay, it is more convenient if I do it like this and like this […]"* (IDA-1)
Doing things together 2x	Attending professionalization activities can be easier for industrial designers if they do it together with others. *"Go together with other people […] That is much easier. Much easier to go somewhere with other people than to go alone. And I think everyone knows enough people to possibly do that. There are always your old classmates and colleagues..."* (IDA-2)
Using time pressure 1x	Industrial designers need proper time pressure for effective professionalization. *"[...] to me effectivity indeed is the part of effort with respect to the output. I think time pressure is an important factor in that […] Too much time pressure leads to bad effectivity, too little time pressure leads to bad effectivity, in between that there is an area where you are forced to make choices so to speak."* (IDA-5)
Other people's goodwill 1x	Industrial designers depend on other people's goodwill to get their help. *"Yeah, your people also have to want you to grow […]"* (IDA-2)

Table 3: Code Table Interviews with Alumni

4.3 Interviews with Employees

This section presents the results that I found concerning Sub-Research Question 4: What do the Career Centre and the IDE faculty envision for the professionalization of Industrial Design Engineering students and alumni? Sub-Section 4.3.1 presents the results for professionalization of IDE students. Sub-Section 4.3.2 presents the results for professionalization of IDE alumni. Sub-Section 4.3.3 presents the code table of the interviews with CC and IDE employees.

4.3.1 Professionalization of IDE Students

The participants explained which difficulties they see with IDE students in presenting themselves to possible future employers. The participants also explained which solutions they tried in the past and which solution principles proved effective. Finally, the participants gave solution ideas for professionalization of IDE students on presenting themselves to possible future employers. Table 4 gives an overview of the participants' responses.

Problems and Solutions IDE Students
Problems of Students
Students can have unrealistic expectations about practice and what they can do there.
Explaining the Industrial Design Engineering program is difficult for students as relating the program to practice is difficult
Industrial design practice differs per country which makes explaining practice on an international level difficult.
Many companies are unfamiliar with Industrial Design Engineering and therefore do not consider industrial designers for their jobs.
Students often lack the experience to know what companies expect from them.
Students can feel that they have to take great effort to explain their education to companies as that is unclear, while it is more important to explain what they themselves can offer to the company.
Solution Principles
Easy accessibility of activities stimulates participation in activities.
Referral by other people stimulates participation in activities.
Having students regard themselves as a project that they need to place in the market for employers is an effective approach.
Only counselling that deals with a relevant need of students is effective.
Counselling should build competence so that students become capable to handle any similar situation without help.
Involving companies in educational projects helps students gain experience with practice.
Solution Ideas
Provide individual career counselling for students and recent graduates.
Give interactive workshops to students at a moment when students need to consider their career.
Use role models to explain to students what Industrial Design Engineering is about.
Ask external guest speakers to inform students about practice.
Have the faculty connect companies to the students to give them a balanced set of companies.
Make a booklet about what Industrial Design Engineering has to offer for society.

Alumni can help students with specific questions from their expertise.
Stimulate internships to help students gain experience with practice they need.

Table 4: Problems and Solutions IDE students

These responses relate to the four factors that describe the academic industrial designer's professionalization situation in the following way:

- The problems of students give an account of 'Factor 1: The academic industrial designer's own needs to become a better professional'.
- The solution principles show how one can adapt 'Factor 2: Available professionalization activities that suit the academic industrial designer's needs' to IDE students.
- The solution ideas are example activities for Factor 2 that proved to be effective. These solution ideas also reflect what kind of activities the CC and IDE faculty have in mind for IDE students (Factor 4: Parties that offer professionalization activities for academic industrial designers).

I asked the IDE alumni that I interviewed about which difficulties they still experience in explaining what IDE is about and what they can offer to employers or clients as industrial designers. These results show which problems alumni with work experience still cannot solve. These 'persistent' problems require a more fundamental solution than workshops and such. Table 5 presents these problems.

The remaining problems show that the IDE proposition is not clear, even with work experience to relate IDE education to. Explaining IDE students the value of their education is therefore fundamentally problematic. Achieving the IDE faculty's mission thereby becomes problematic ("contributing 'knowledge, skills, methods and professional attitudes in the field of integrated product development' through education of students").

Remaining Problems for IDE Alumni
Alumni can only explain to other people what they themselves do. They make their own version of Industrial Design Engineering and adapt that to the situation.
Alumni who studied at different time periods received different education and therefore have a different idea of what Industrial Design Engineering is about.
The name 'Industrial Design Engineering' is confusing for people: the name leads to wrong expectations.

Table 5: Remaining Problems for IDE Alumni

4.3.2 Professionalization of IDE Alumni

The results from the interviews with IDE alumni showed which professionalization activities they desire from the DUT amongst others. The IDE employee explained the IDE faculty's attitude towards alumni and argued how involvement with alumni can be valuable to the IDE faculty. Table 6 gives an overview of the participant's responses.

Value of Alumni Involvement
The faculty searches little for contact with alumni and seems indifferent about it. The faculty therefore misses out on what alumni have to offer.
Alumni can be good role models for students.
Talented alumni can become valuable teachers at the faculty.
Alumni can give insight in the reality of practice as they are part of that reality.
Alumni can help clarify how IDE education is relevant to the industry and what the industry expects from IDE education.
Alumni can provide researchers and students with opportunities.
Alumni can provide the faculty with funds.

Table 6: Value of Alumni Involvement

4.3.3 Code Table

This sub-section presents the code table of the interviews with CC and IDE employees. I categorized the codes in Table 7 according to the topics in this section. The table gives an explanation of each code and an illustrative quote for that code. The number beneath each code shows how many participants mentioned the insight from that code.

Code	Explanation/Quote
Problems for Students	
Students can have unrealistic expectations 2x	Students can have unrealistic expectations about practice and what they can do there. *"What is also part of it is that Industrial Design Engineering students sometimes have a bit ideal ideas about where they could work, what it should look like […] That they sometimes have ideas that not fully align with reality."* (CC-1)
Industrial Design Engineering is difficult to explain 2x	Explaining the Industrial Design Engineering program is difficult for students as relating the program to practice is difficult *"And next to that, when you describe things on your CV and cover letter but also in interviews, it is like: how do you explain your program? And that is very difficult. It is very difficult to make it clear. Because usually it is about... creative ideas and cooperation and users… you know, all kinds of terms are used and at the end of the story it still is unclear to what somebody means."* (CC-1)
Practice differs per country 1x	Industrial design practice differs per country which makes explaining practice on an international level difficult. *"One thing we realized was 'we paint a fairly Dutch picture'. [...] But we found it difficult, especially in the period that internationalisation increased […] to paint a picture for Chinese students for example."* (IDP-1)
Companies often are unfamiliar with Industrial Design Engineering 2x	Many companies are unfamiliar with Industrial Design Engineering and therefore do not consider industrial designers for their jobs. *"No, companies who employ industrial designers or do real industrial design work know what Industrial Design Engineering is. But there are a lot of companies who are looking for marketeers of sales people or maybe more strategic people or… any kind of problem solver you need, they do not know they can hire an industrial designer for that."* (CC-1)
Students are unfamiliar with expectations from practice 2x	Students often lack the experience to know what companies expect from them. *"Let me say it like this: almost all students who come here – and we see a lot of them, over two thousand last year – do not know so well how the world of practice turns. [...] And that is logical because you cannot know! You cannot know what a company wants and how they want that and what they think is important. [...] You have not gained that experience, not gotten the chance to obtain that knowledge."* (CC-1)
Students should present themselves not their education 1x	Students can feel that they have to take great effort to explain their education to companies as that is unclear, while it is more important to explain what they themselves can offer to the company. *"I think that that event connects well to the need and I found the content also very interesting because you really could see that students tackeled the problem from 'I need to pitch myself as SPD student' and really started to explain their program. After their presentation I would ask them like 'look at what you can do. If you know that SPD is an unfamiliar term for companies, should you start with that? Or can you better start with skills, things that you can do, things that you want, and ideas you have and explain and pitch that?'"* (CC-1)
Solution Principles	
Easy accessibility stimulates participation 2x	Easy accessibility of activities stimulates participation in activities. *"But what we see what makes people come is easily accessible activities, that helps a lot, so fun things. You don't want you to have a problem, that it's difficult, and that you have to come here but that it's optional and that we have fun workshops and activities."* (CC-1)
Referral stimulates participation 1x	Referral by other people stimulates participation in activities. *"Referral works very well. At a certain moment I had a wave of industrial design students because one after the other emaild 'yeah, you helped my friend, my roommate and can I also come by?' so that works very well."* (CC-1)
Let students regard themselves as a project 1x	Having students regard themselves as a project that they need to place in the market for employers is an effective approach. *"So that vision really is: you learn people how they can deal with these processes themselves. And the funny thing always is I think is that Industrial Design Engineering students are pre-eminently the students who already know this. Because when I say 'look at yourself as a project', 'I need to place myself in the market' […] They do it all."* (CC-2)
Counselling should be need-driven 2x	Only counselling that deals with a relevant need of students is effective. *"Look, our success factor is that when it turns out that people can use what they learned for something that they needed."* (CC-2)
Counselling should build	Counselling should build competence so that students become capable to handle any similar situation without help.

competence 2x	*"[...] what we simply could do is being a matching service. [...] But what we do is help students to come up with 'but what is it that I want and what am I good at and how can I do that?' And that makes them capable to do it on their own. And they can do that with this application but also with the next […]"* (CC-1)
Involve companies in education 1x	Involving companies in educational projects helps students gain experience with practice. *"I think you find it […] in design education […] who then do a project with a company, there is a professionalization component there. Students then have the opportunity to sniff around in a company environment, look around, become familiar […]"* (IDP-1)
Solution Ideas	
Individual career counselling 2x	Provide individual career counselling for students and recent graduates. *"Every student at this university has de possibility to come to us at the moment that they have questions. That goes for current students, that goes for students until a year after their graduation."* (CC-1)
Give workshops 2x	Give interactive workshops to students at a moment when students need to consider their career. *"I think that that is very good because it very directly connects with what you need then at that moment and that you pull forward the whole process of thinking about your career with that […]"* (CC-2)
Use role models 1x	Use role models to explain to students what Industrial Design Engineering is about. *"We tried that [...] and sometimes it worked. You saw that then at the questions people asked […] That one worked for a more famous company. Philips or an automotive one. 'O yeah, we all think of that as an example.' So that had role model elements. [...] the younger ones, those were a sort of role models."* (IDP-1)
Ask external guest speakers 1x	Ask external guest speakers to inform students about practice. *"I think it partly worked. With partly I mean that we saw for example with 'bringing the outside world into the minds of the students' that you can paint a fair picture by asking guest speakers, by using external knowledge."* (IDP-1)
Faculty connects companies to students 1x	Have the faculty connect companies to the students to give them a balanced set of companies. *"[...] so you do not leave it to the student to think of 'god, which companies should we invite?' Because what you see then is that the DDB is very design-oriented while that only covers a small part of Industrial Design Engineering. [...] And I think 'you cannot do that, leaving the selling of your education and students for that matter to your students'."* (CC-2)
Make booklet about Industrial Design Engineering 1x	Make a booklet about what Industrial Design Engineering has to offer for society. *"And we made a booklet for that. You would also want that for Industrial Design Engineering specifically. Which graduation directions are there, let a student speak, let an alumnus speak 'I am here now and how do I fit in here as an industrial designer?' [...] And it must be dynamic! [...] It must very up-to-date. There is a piece of the solution."* (CC-2)
Alumni coaching students 2x	Alumni can help students with specific questions from their expertise. *"Well, it is hard. Because I also coached someone who was good with customer processes. [...] who had difficulties with the question 'how can I make clear in open applications what my added value can be?' And because you are not from the discipline, you don't have the language to explain what you're good at. And because I worked in that discipline a bit here at KPN I could help her to explain to companies what you can do."* (IDA-4)
Stimulate internships 1x	Stimulate internships to help students gain experience with practice they need. *"[...] the DUT services on the topic of internships I think makes a crucial contribution to your career development. Having or not having done an internship. That has been a thorny issue for years."* (CC-2)
Alumni Involvement	
Faculty searches little contact with alumni 1x	The faculty searches little for contact with alumni and seems indifferent about it. The faculty therefore misses out on what alumni have to offer. *"Yeah, I think that we do cool things from an academic world but we can only tell about practice from the experience we have up until graduation projects. Say 'this is what we experience in the industry'. When you lose the link with graduation projects those people go their own way and keep little contact with the faculty. We also don't do that from out the faculty. Incidentally, sometimes in a network, but that is where it ends."* (IDP-1)
Alumni can be role models 1x	Alumni can be good role models for students. *"And if we say something about the automotive sector then there is quite the chance that that also in other domains or industries, organizations, that we educated top talents say in the last twenty years, who all came to a wonderful place in practice, those could be role models, could inspire our new batch of students."* (IDP-1)
Alumni can become valuable teachers	Talented alumni can become valuable teachers for the faculty. *"[...] that still is a close club who between themselves know where to find each other but are also invited heatedly by the same education to participate in activities, to give input, and if there is talent that the education asks 'would you want to become professor at our own faculty, our own education because…'"*

1x	(IDP-1)
Alumni can bring in insight in the reality of practice 1x	Alumni can give insight in the reality of practice as they are part of that reality. *"[...] here within the faculty you see [..] that still people think 'no, we really train designers'. Sure, but five years later those people really are doing something else. Those people do not tell that back. So can we learn from alumni? Yes, I think a lot. [...] We don't use that enough I think."* (IDP-1)
Alumni can bring in reality's expectations 1x	Alumni can help clarify how IDE education is relevant to the industry and what the industry expects from IDE education. *"[...] I think there is a large pile of alumni who can offer us a lot for professionalization but also maybe relevance of research or how to train young talent and how the industry values that. Yes, that is maybe what we are looking for a bit."* (IDP-1)
Alumni can provide opportunities 1x	Alumni can provide opportunities for researchers and students. *"And in the end it is of course important for the DUT to stay in contact with the alumni because they could place studies […] or that they offer internships or graduation spots… that sort of things."* (IDA-3)
Alumni can provide funds 1x	Alumni can provide funds for the faculty. *"And in the end it is of course important for the DUT to stay in contact with the alumni because […] imagine that, you also have eighty years old alumni who think 'what shall I do with my inheritance?' That they may think one time about the DUT."* (IDA-3)
Problems for Alumni	
I can only explain what I myself do 8x	Alumni can only explain to other people what they themselves do. They make their own version of Industrial Design Engineering and adapt that to the situation. *"I often go to clients and then I have to explain what I do. And that is fairly easy: I say first that I am a user researcher and that I use the research results to improve our products."* (IDA-2)
I know Industrial Design Engineering as I studied it 4x	Alumni who studied at different time periods received different education and therefore have a different idea of what Industrial Design Engineering is about. *"Look, the discipline changes because if you asked that to someone twenty years ago then what I do now, interaction design, was simply not part of it. And now it is a larger part I think because products become more digital or have a service component. So yeah... Industrial Design Engineering, yeah how Industrial Design Engineering is Industrial Design Engineering still?"* (IDP-1)
Name is confusing 3x	The name 'Industrial Design Engineering' is confusing for people: the name leads to wrong expectations. *"But I can imagine that people who did not attend the study have difficulty to understand what it is about. I don't think it is very clear and that the name doesn't help. Industrial Design Engineering then... yeah. I think a lot of people then think like 'oh, design, products' while it is much wider than that.* (IDA-4)

Table 7: Code Table Interviews with Employees

5 Discussion

This chapter discusses the validity and reliability of the research results. Section 5.1 discusses the literature study results. Section 5.2 discusses the alumni interview results. Section 5.3 discusses the employee interview results. Section 6.5 discusses the scientific relevance of the study's findings. Section 6.6 gives suggestions for further research.

5.1 Literature Study

The literature took place in established literature sources, namely Scopus, Web of Science, and Science Direct. The wide number of searched topics and the finding that the results are consistent with each other gives confidence that a literature search by another researcher would produce similar results and that another researcher would come to similar interpretations based on the same results.

5.2 Interviews with Alumni

In the concept 'validity' I distinguish construct validity, internal validity, and generalizability as Verhoeven (2011) explains them. There are many aspects to the validity of this part of the research due to the application of the analogy and the limited time frame to research a wide and varied topic. These two factors mostly challenge the construct validity of the study: did the study measure what the study intended to measure? To start with the influence from the analogy, comparison with the interview results shows that the key insights and recommendations from the analogy fit one-on-one. In other words, this positively contributed to the validity of the analogy. The use of open questions and control questions to prevent the suggestion of answers further contributed to the validity. One thing that stands out, however, is that the interview results also included individual aspects (the choice drivers and psychology-related effectiveness aspects) – a topic that literature from the teacher analogy hardly covers at all. Possibly the aim for generalizability and the difficulty to capture individual differences was reason for that literature to leave the individual aspects out. In my opinion this difference does not weaken the consistency between the research results and thereby does not lower the construct validity of this study.

Another measure to improve construct validity was to only code what participants stated about themselves. The participants also made remarks about other industrial designers but this did not always align. For example: participants stated that other industrial designers would never read a book while no participant made such a remark about him- or herself even if the participant stated that reading books was not his or her preference. This could mean that statements about other industrial designers are less reliable.

Another point for the construct validity is that the research results are consistent with each other. As they do not contradict with each other and cover the whole range of topics from the analogy and even more, this gives confidence that the research measured what it intended to measure. The interviews with the two participants confirmed this statement. While their answers were fully in line with each other they did not hesitate to use different phrasing and to state where they personally differ from each other.

Another point for the construct validity is that the research design did not triangulate the data collection. The data collection now only includes observations from other researchers (second-hand information) and thoughts of industrial designers about how they professionalize. The study did not directly observe the professionalization of industrial designers, which lowers the validity of the industrial designers' thoughts and the researcher's understanding of the observations of other researchers. This leaves room for error in the study results and it may be for example that things that industrial designers think are important are not so important in actual practice.

Another point for the construct validity is the limited time budget for the interviews. The limited time frame allowed the researcher to superficially cover the whole professionalization topic but to only deepen a few aspects in detail with each participant. The consequence was that participants provided complementing data but also that some results only have a basis in the response of one or a few participants. The consistency between the answers gives confidence that these responses are generalizable but only a wider study can confirm this.

One should also consider the researcher's influence in the study to assess the internal validity; to what extent the researcher biased the interpretation of the data. Transparency was the most important measure to improve internal validity by showing the separate interpretive steps from raw data to conclusions so that other researchers can check whether the interpretations were correct. A difficulty in this measure is that I

had to translate the participant quotes from Dutch to English, which might result in loss of meaning. This makes checking the results more difficult for researchers who do not speak Dutch. Another measure was to discuss the coding with a peer student to see if he came to the same interpretations and to discuss the results with the project supervisors. Reflection on the research method with the similar Grounded Theory method improved the quality of the data analysis steps.

Given the issues mentioned above, the generalizability of the study findings becomes a point of discussion. Especially the lack of triangulation but also the small number of participants (eight) can give reason to doubt about to what extent one can apply the research findings to other cases. In terms of scientific understanding, I think the research findings of this study are not convincing enough to continue deepening scientific understanding. A next step first requires a wider study that confirms the findings from this study and that also directly observes industrial designer professionalization. However, especially the results' consistency and the completeness give confidence that the research findings are of sufficient quality to use for the cases that started this study. Evaluation of applied recommendations can help filter out the remaining errors which are not likely to have fundamentally structural impact.

Given the measures to ensure construct and internal validity I feel confident about the reliability of this study: that other researchers would come to similar findings. However, direct observation of industrial designer professionalization may lead to additional or adjusting insights.

5.3 Interviews with Employees

The construct validity of this part of the study may be a point of discussion. To research the students' problems I interviewed participants that annually see a wide range of IDE students but needed to go on their overall impressions of their experiences to answer my questions; they did not keep track of their experiences with the specific topic. Furthermore, I only interviewed a small number of participants and since the interview concerned individual views and experiences, other people may give different answers. The participants' responses did not contradict each other, though, what improves the construct validity. The next part of the study that discusses solutions to the observed problems also allows confirming the insights from this part of the study: if participants disagree with solutions they may also disagree with the interpreted problems. Yet the study does not triangulate the data from this, which lowers the construct validity. The interviews included possibly sensitive topics but confidentiality gave room to put forward honest opinions about things that are not going well.

My individual interpretation of the participants' responses may give room for discussion about the internal validity of this part of the study. Since the interviews were semi-structured I needed to steer follow-up questions into topics that I considered to be most relevant for the study. The analysis part required me to connect the dots what also requires personal interpretation. The presentation of the codes and quotes provides transparency in the conclusions.

Due to the small number of participants, no triangulation, and the individual interpretation the generalizability of the conclusions of this part of the study may be a point of discussion. The reliability of the study may be disputable since repetition of the study with different participants and with different researchers can lead to different results.

5.4 Scientific Relevance

The analogy between teacher and industrial designer professionalization can provide a relevant starting point for other research into industrial designer professionalization or related topics. The industrial designers professionalization model is in early development and needs further validating research but can provide starting points for research into related topics. The relevance of the study's conclusion is case specific and therefore limited. Similar cases may benefit from this study's insights.

5.6 Further Research

Future research can seek to confirm the findings that resulted in the industrial designer professionalization model by triangulating the data and by involving a larger group of respondents. Triangulation would require direct observation by the researcher, which was not the case in this study. A larger group of respondents will give more reliable data if the group includes industrial designers from different education institutes and working in different industrial design related fields. An international sample of respondents would make the research outcomes more reliable for situations outside the Netherlands.

One can use the following research set-up to achieve these goals. One can use the literature research results and the interview results from this study as a starting point. The first step then is to

confirm these data with a larger group of respondents: at least forty industrial designers from different education institutes with varying ages. Semi-structured interviews that cover all the topics that this study identified to be relevant in industrial designer professionalization can give this confirmation and would take between sixty and ninety minutes per interview. One can do a case study with some of the respondents – say three to five respondents – by following them for a period of time in their work and by recording observations of how they professionalize themselves in order to triangulate the data. One can then compare the observations with the interview data for discrepancies. An international sample requires a larger group of respondents – say at least sixty respondents with four different nationalities – and comparison between the respondents with different nationalities. Differences that come up can give reason to do a wider research into those differences with more nationalities.

6 Conclusion

This chapter answers the main research question: *How can the Delft University of Technology effectively support the professionalization of Industrial Design Engineering students and alumni?* This chapter provides reasoning from the research results towards that answer.

Section 6.1 describes the professionalization situation of the two cases, using research results. Section 6.2 argues why and to what extent the DUT should support student and alumni professionalization. Section 6.3 answers the sub-research questions. Section 6.4 answers the main research question.

6.1 IDE Professionalization Situation

Figure 3 shows the schematic model of factors that influence the IDE students' and alumni's professionalization situation. The sub-sections in this section each describe one of those factors.

6.1.1 The Academic Industrial Designer's Own Needs to Become a Better Professional

Effective professionalization starts when the academic industrial designer experiences a concrete need to improve himself or his situation. The designer can only then give priority to professionalization activities. The designer seeks activities that fulfill his specific needs. Personal preferences are less important. For effective professionalization:

- The designer should integrate professionalization activities with daily work.
- The designer should be aware of his needs and have a proactive attitude.
- The designer benefits from guidance by more experienced professionals.

IDE students lack work experience to know what practice expects from them and what they can expect from practice. The IDE proposition is unclear to students and they therefore cannot explain how their education gives them added value for employers, also due to their lack of work experience. IDE students need guidance by experienced professionals on how to present themselves to companies and clarity about the IDE proposition. IDE students first need to become aware of these needs by experiencing them concretely. This experience and supporting activities should be part of their daily education.

IDE alumni experience various needs in their work. The IDE faculty possesses of the expertise, network, and resources to support alumni with a part of those needs. The DUT should adjust professionalization activities to alumni's needs and daily work. Alumni will become aware of their needs in their work and need a proactive attitude towards the DUT's offers to participate effectively.

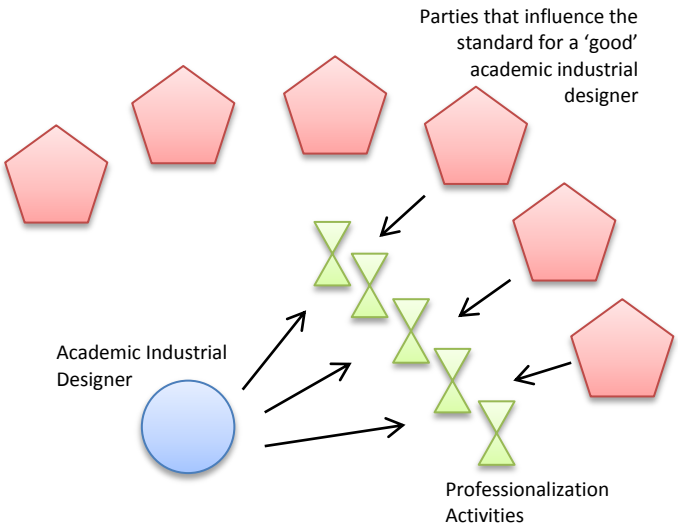

Figure 3: Factors of the Professionalization Situation

6.1.2 Parties that Influence the Social Standards of Being a 'Good Academic Industrial Designer'

Field developments, supervisor's directions, and client demands influence directly what academic industrial designers deem important for their professionalization. The designer's organization bears responsibility to provide vision for the designer's professionalization. The designer's organization should involve the designer in deciding what is important for his professionalization. Experienced professionals in the designer's social context also influence what the designer deems important for his professionalization.

IDE students rely on their teachers and other DUT professionals to know what is important for their professionalization and to be up-to-date with field developments. Their faculty bears responsibility to provide students with vision for how they should present themselves to employers.

The IDE faculty influences field developments and thereby indirectly what IDE alumni deem important for professionalization. Alumni's supervisors or clients and other field developments influence that directly.

6.1.3 Available Professionalization Activities that Suit the Academic Industrial Designer's Needs

Academic industrial designers might participate in any professionalization activity that suits their needs. Easy accessibility and opportunity steer the designer's pick from the available activities. Self-reflection is important for effective professionalization. Group professionalization stimulates dialogue and self-reflection and can stimulate individual participation.

The IDE faculty can adjust professionalization activities to education and IDE student's needs. DUT parties can offer IDE students easily accessible activities by adjusting them to education schedules and offering them for free. Group activities can stimulate dialogue, self-reflection, and individual participation.

DUT parties can adjust activities to IDE related topics and ask IDE alumni for their needs to offer suitable professionalization activities. DUT parties can offer IDE alumni easily accessible activities by giving a clear overview of their offers and by charging low prices or no price. Group activities can be more effective as they stimulate dialogue between alumni and self-reflection.

6.1.4 Parties that Offer Professionalization Activities for Academic Industrial Designers

Which professionalization activities a party offers to academic industrial designers depends on the party's capabilities, focus, and resources. The DUT IDE faculty, Career Centre, and Alumni Office together possess of the capabilities, focus, and resources to fully support IDE student professionalization and to partly support IDE alumni professionalization.

6.2 Why Professionalize

I found during the study that people have different opinions about whether the IDE faculty should support professionalization and to what extent the IDE faculty should do that. This section argues why the IDE faculty should support student and alumni professionalization.

Supporting professionalization contributes to the IDE faculty's mission statement. "Our mission is to contribute to the knowledge, skills, methods and professional attitudes in the field of integrated product development. We aim to achieve this through education and research at an internationally recognized scientific level…" (M&C, 2014). The IDE faculty wants to contribute to the field by means of education. This is only effective if students can present their capabilities to employers Otherwise employers cannot utilize those capabilities and thereby the IDE faculty would fail its mission in this part. Professionalizing alumni is a direct means to achieve this mission and is thereby worthwhile. So in short, the IDE faculty has a responsibility to professionalize its students and benefits from professionalizing alumni in achieving its mission.

The IDE faculty bears responsibility towards students and towards society to prepare students for professional practice. The research results imply that students rely on their teachers and other DUT professionals to know what is important for their professionalization and to be up-to-date with field developments. Society invests in education so that students become valuable professionals for society. So the IDE faculty bears responsibility to professionalize its students and to prepare them for participation in society.

In addition to the previous argument, students need professionalization *before* they graduate. Lacking professionalization will at least lead to delays in students starting their careers and students might end up with work that does not fit their potential. Students might thereby not live up to their potential which makes IDE education partly a waste of investment. Furthermore, students that graduate go out of sight for the DUT. The Alumni Office and the CC found that reaching them then is difficult. So the opportunity to professionalize students is during education, not after. Students need to get into the professionalization cycle at the DUT before they graduate.

Practice shows that the DUT recognizes the responsibility to support professionalization. The DUT already organizes professionalization activities for students and alumni. The DUT also funds the CC and the Alumni Office, for example. So the DUT's actions show that she recognizes the previous arguments.

Finally, involvement with alumni can be beneficial for the IDE faculty as well. Alumni can be good role models for students. Talented alumni can become valuable teachers at the faculty. Alumni can give insight in the reality of practice as they are part of that reality. Alumni can help clarify how IDE education is relevant to the industry and what the industry expects from IDE education. Alumni can provide researchers and students with opportunities. Alumni can provide the faculty with funds. So professionalizing alumni is not only a responsibility but can be mutually beneficial.

6.3 Answer to Sub-Research Questions

6.3.1 Sub-Research Question 1

This sub-section answers the question *'Which starting points does academic literature offer for industrial designer professionalization?'*

Table 2 in Sub-Section 4.1.2 gives a full overview of the starting points that literature provided. Especially insightful were the starting points that professionalization should be an integral part of daily work and the high influence of the industrial designer's social context.

6.3.2 Sub-Research Question 2

This sub-section answers the question *'What do Industrial Design Engineering alumni do to professionalize themselves?'*

The professionalization activities in the industrial designer professionalization model (see Figure 6) show the variety of activities that IDE alumni do to professionalize themselves. Especially insightful was that IDE alumni might attend any kind of activity that suits their professionalization need. The drivers in the model show which other factors influence the IDE alumni's choice for activity.

6.3.3 Sub-Research Question 3

This sub-section answers the question *'What makes Industrial Design Engineering alumni's professionalization efforts effective?'*

The effectiveness aspects in the industrial designer professionalization model (see Figure 6) show which factors are of influence in this matter. Especially influential aspects are that activities should be need-driven and that IDE alumni should have a proactive attitude. IDE alumni should also be aware of their needs for effective professionalization.

6.3.4 Sub-Research Question 4

This sub-section answers the question *'What do the Career Centre and the IDE faculty envision for the professionalization of Industrial Design Engineering students and alumni?'*

The tables in Sub-Section 4.3.1 and 4.3.2 show the problems that CC and IDE employees see with IDE students and alumni and the solutions that they think might improve that situation. The employees envision that IDE students need real experiences with the professional field and tailored guidance by professionals to improve their situation. The employees envision that IDE alumni should get easier access to DUT professionalization activities by means of a better overview and that a culture change is necessary for professionalization at the DUT to become 'normal' for alumni.

6.4 Answer to Main Research Question

This sub-section answers the main research question '*How can the Delft University of Technology effectively support the professionalization of Industrial Design Engineering students and alumni?'*

Although this question is wide, I can name three core measures that the DUT can take to effectively support the professionalization of IDE students and alumni. DUT parties should first of all ensure that professionalization activities address a relevant need of students or alumni. For supporting student professionalization this means that the IDE faculty should create a need for students by giving them real experiences with the field. For supporting alumni professionalization this means that the DUT parties should monitor the alumni's professionalization needs and adjust their activities to that.

Creating easy accessibility to activities is another core measure that the DUT can take to improve the current situation. The DUT should create an overview of the available activities that alumni can access easily. The DUT should continue facilitating professionalization activities for low or no prices to keep them accessible. The DUT can make an effort to make attending professionalization activities at the DUT more 'normal' for alumni as they currently do not always see the DUT as an obvious organization to look for such activities.

The IDE faculty should provide vision for IDE student and alumni professionalization by providing clarity about the IDE proposition: which competences IDE education should teach. That will provide especially students with better focus for how they can develop themselves and how that development brings value to their employers.

7 Looking for Solutions

This chapter gives an overview of how I continued to look for practical solutions for the IDE case and the CC case. Section 7.1 presents the main problems that the DUT should overcome to improve the situation. Section 7.2 presents the kind of solutions that are necessary to overcome the main problems. Section 7.3 explains the method that I applied to find concrete solutions. Section 7.4 presents the results of this effort. Section 7.5 discusses the validity and reliability of the results. Section 7.6 draws conclusions on the results for the two cases.

7.1 Main Problems to Overcome

The main problems to overcome of IDE students are the following:

- Students lack the work experience to know what employers expect from them and need guidance on that matter.
- Students need to become aware of their inability to present themselves to work on that effectively. Now they learn that *after* graduation but they need to deal with this matter *before* graduation.
- Students need clarity about the IDE proposition before they can explain their added value.

The main problems to overcome of IDE alumni are the following:

- The DUT needs to create a professionalization culture change as attending professionalization activities at the DUT is not common practice for alumni. Alumni are often not aware of the DUT's professionalization offers as they do not expect that from the DUT.
- DUT professionalization activities need to be easily accessible overview wise, budget wise, and time wise.
- The DUT needs to adapt its offers to the alumni's professionalization needs.
- Alumni cannot promote IDE as they cannot give a clear account of the IDE proposition. This is not so much a problem for the alumni but rather a problem for the IDE faculty and future alumni who have to find work.

7.2 Overcoming those Problems

The main problems of IDE students to overcome require the following solutions:

- Students need a real experience with the professional field so that they experience a real need. This is necessary for effective professionalization as they then become aware of their needs and can give it priority.
- Students need guidance by DUT professionals and/or professionals from the field to learn what employers expect from them.
- The IDE faculty and CC can guide students in this matter and the Alumni Coaches program can also help with that.
- Companies who are interested in IDE students may want to help guide students during education for mutual benefit.

The main problems of IDE alumni to overcome require the following solutions:

- The DUT should involve students in the professionalization program before they graduate so that attending professionalization activities at the DUT becomes 'normal'.
- The DUT should make promoting activities easy for alumni that participated in those activities and want to share them with their network.
- The DUT should provide a clear overview of the DUT's offers and provide easy access to its activities for alumni.
- The DUT should continue monitoring the alumni's professionalization needs. Already attending alumni are an easy target group for that.

The main problems of both IDE students and alumni to overcome require that the IDE faculty clarifies the IDE proposition. I worked on clarifying the IDE proposition; see 'Part II: Thoughts on Academic Industrial Design Education: A New Breed of Design Competency'. My effort shows that there is a fundamental problem in explaining academic industrial design education. A single explanation namely becomes too general and abstract to be useful in practice due to the wide variety in where academic industrial designers end up working. One can only clarify this matter clearly on a design philosophical level. The alternative is to show for each professional field how academic industrial designers can add value. This explanation is concrete and useful in practice. The IDE faculty

probably benefits most from pursuing both alternatives.

7.3 Method

I needed a solution space to continue my research. I therefore applied abductive reasoning to define a solution space:

Premise 1: The DUT's offerings need to become easily accessible and easy to explore.

Premise 2: A website is easily accessible and allows much flexibility in functionality.

Conclusion: An online digital interface may be an effective solution to support the professionalization of IDE students and alumni.

This is only one solution idea though. There may be more and better solution ideas as this is abductive reasoning. This reasoning is on an abstract level and therefore does not take into account the full complexity of practice so it is a starting point to look for solutions. Research that is based on this reasoning can lead to useful insights for solutions as such research interprets findings in a coherent manner.

I interviewed the same IDE alumni and CC and IDE employees that I interviewed earlier. I conducted semi-structured interviews to verify the quality of and to improve the solution idea. The interviews took about fifteen minutes out of time budget constraints. I conducted the interviews with the IDE employee directly after each other out of practical reasons. The interview guides are available in Appendix 3. Appendix 8 provides the interview transcripts from the interviews with IDE alumni and Appendix 6 provides the interview transcripts from the interviews with the other participants

The analysis of the interview transcripts included grouping data according to the interview topics and coding the data groups. These codes represent the answers to the interview questions and function as argumentation to make choices in formulating recommendations. Appendix 9 provides the codes with their respective quotes.

7.4 Results

The participants provided me with practical feedback on the solutions. Sub-Section 1 gives an overview of the interview results and Sub-Section 2 provides the interview code tables.

7.4.1 Overview Results

The participants agreed that offering all activities in on central place like a digital interface makes professionalization activities easier to find and stimulates participation. Participants mentioned that giving alumni access to DUT facilities like printing, workshops, and meeting rooms – possibly against payment – can stimulate participation in the interface. Participants mentioned that the interface has potential for students as well. The interface can include a pin board between students and alumni to exchange opportunities and questions, for example.

Participants mentioned multiple attention points to make the digital interface effective:

- Keeping the interface up-to-date.
- Promoting the offers regularly.
- Including an easy to use search function.
- Making the activities easily accessible.

Participants mentioned multiple functions for a digital interface, including:

- A function to come into contact with other alumni.
- A function to give suggestions for professionalization activities.
- A review function to rate activities.
- A function to share activities via social media.
- A pin board with research groups to share opportunities and to place requests.

I asked the participants for their top-3 choice of interface functions. These are the mostly mentioned functions:

- Attending courses.
- Networking with other alumni.
- Attending career counselling.
- Getting into touch with students.
- Access to DUT knowledge databases.

7.4.2 Code Tables

Table 8 presents the strong points that participants mentioned about the proposed solution.

Code	Explanation/Quote
One central place 9x	Offering all activities in one place makes it easier to find them and stimulates to participate in them. *"Yeah, I like it. I find it good to join it at one point and to make one overview. Then it is easier to find."* (IDA-4)
Customized offerings 1x	Offering separate activities that alumni can compile into a customized program makes it possible to address the individual's specific needs. *"That it [offered activities] is separate, that appeals to me I think. And that you can compile your own program that way, that works well I think."* (IDA-1)
Career counselling 1x	Offering career counselling addresses the alumni's needs well. *"You also mentioned career counselling. I find that a strong one."* (IDA-5)
Obvious search path 1x	An overview interface is the obvious first choice to search for online and therefore addresses the alumni's expectations well. *"I think 'yes', because this online is the way in which you will first search and where you want some info and what can be easily accessible."* (IDA-6)
Meeting DUT people 1x	An overview interface makes it practically attainable to get into contact with students and researchers at the university. *"The thing is that it all is too fragmented right now and that also is precisely what this idea tackles […] why I would more to do with Industrial Design Engineering is purely to talk with people about their research and to meet students, so to speak. And to meet possible graduation students and interns. 'What are they doing and how can I get into contact with them?'"* (IDA-6)
Easily accessible 1x	The interface set-up makes participation in the activities easily accessible. *"You can step in at a level that you like yourself. So it is easily accessible. So you can be very active or just come and watch and take in content and not contribute anything further. So that is strong I think."* (IDA-6)
Wide offerings 1x	The wide range of offerings makes the interface appealing to alumni. *"The strong point is that it is very wide. Yes, it is quite comprehensive. You go into a lot of directions. It really is a reservoir of all kinds of things. I think that that is the strongest point"* (IDA-7)
Cross-selling 1x	The interface's set-up stimulates cross-selling of activities. *"But what this has is that by presenting that as a combination of activities you improve the chances of cross-selling […] by inspiring people with ideas. I mean, just a conversation like this or that of the last time makes me wonder 'Yeah, what could I do at the DUT? What can I get there, what can they offer me?"* (IDA-8)
Realistically attainable 1x	Building the interface is realistically attainable. *"Yes, I do think that the interface is easier to realize than bringing more practice in education if I can simply translate it like that […] because this, the interface, is something that will make a lot of people very happy. Especially if you are willing to build it. [LAUGHING]"* (CC-1)
Students experience professionalism 1x	The interface offers students the chance to experience professionalism. *"What I find a very charming idea is to also give students access to the discussion, to the fora, or to the information that so to speak belongs to the other side of the spectrum where you finished your studies […] Because with that it offers the new, younger generation the chance to get a picture of professionalism. That would definitely be worth the effort."* (IDP-1)
Possibility to keep track of outside world 1x	The interface gives effective possibilities to keep track of what happens in the outside world. *"But I would also find it very important to maybe abuse a bit such a platform, such an initiative to get in the dynamics of the outside world as fast as possible so that we as organization, as faculty become somewhat more innovative again."* (IDP-1)

Table 8: Strong Points Solution

Table 9 presents additions and improvements that participants mentioned for the solution idea.

Code	Explanation/Quote
Networking function 5x	Create the function to come into contact with other alumni: alumni one met during an activity, alumni who can help one with a certain question, or alumni who one got out of contact with.
Suggestions function 2x	Create the function for the alumni to give suggestions about what more activities they want from the DUT.
Access to DUT	Provide access to DUT facilities like printing, workshops, meeting rooms, and so on to attract

facilities 2x	alumni to the interface and to participate in the activities. Facilities may be provided against payment.
Link to social media 1x	Create the function to share and recommend activities via social media like LinkedIn, Twitter, and Facebook.
Review function 1x	Create the function to place a review about activities that the alumnus participated in.
Pin board with research groups 1x	Create a pinboard function between alumni and DUT research groups to stimulate interaction so that the alumni and research groups can offer opportunities to each other for their work.
Alumni counsellors 1x	Involve experienced alumni to provide career counselling or coaching to other alumni. Reward the experienced alumni with counselling training or with free access to activities for example.
Link to LinkedIn groups 1x	Provide links to the already existing relevant discussions and groups on LinkedIn.
Involve student-assistents 1x	Student assistents can be a financially attractive option and very capable to keep the interface up-to-date and to monitor the contents.
Provide course materials 1x	Provide course materials on the interface after one participated in an activity.
After graduation tips 1x	Provide practical tips on everything the fresh alumni should do and consider right after graduation, such as procedures, finding living space, and so on.
Profile DUT's strengths 1x	Provide information on the DUT's strong points, expertise, research areas, and so on.
Financial support function 1x	Provide the option to (regularly) donate money to the DUT.
Tips for non-DUT activities 1x	Display tips for other interesting activities that happen outside the DUT to make regularly visiting the interface more attractive.
Give access to non-DUT professionals 1x	Allow access to professionals who did not study at the DUT to involve them with the DUT as well.
Cooperate on offerings with other universities 1x	Cooperate on offerings with other universities to give a full range of offerings to alumni.
Career choice perspectives 1x	Provide information about career perspectives in different fields: how it influences one's career path and what the possibilities are.
Moderate contents 1x	Create a moderator function to start or fuel activities and discussions that are relevant to the DUT and to make sure that the DUT uses relevant outcomes.
Search function repository 1x	Create an easier to use search function to search theme-based in the DUT repository.

Table 9: Improvements and Additions Solution

Table 10 presents attention points that participants mentioned for the solution idea.

Code	Explanation/Quote
Keep up-to-date 3x	Keep the interface continuously up-to-date and promote that to make it worth the effort for alumni to regularly check it.
Promote regularly 2x	Promote the interface regularly and to a wide audience in order to get enough participation to make it worth the investment.
Easy search function 2x	Make sure that alumni can quickly and easily find what they are looking for in the large amount of offerings and avoid that they encounter irrelevant information.
Easily accessible 2x	Ensure that activities are easily accessible.
Meeting other professionals theme-based 2x	Make activities that are about meeting other professionals, like alumni drinks, theme-based so that alumni know what to expect and which kind of professionals they may meet so they know what they can gain from attending in the activity.
Allow flexible growth 1x	Be sure to allow flexible growth of the interface so that it can follow technical and societal developments.
Integrate alumni associations 1x	Be sure to integrate the alumni associations into the interface.
Reconsider the offerings 1x	Do not only improve the interface between the alumni and the DUT but also use the interface to reconsider whether there should be different or more offerings.
Physical meetings are important 1x	Physical meetings with and between the alumni are important to keep the activities interesting and relevant; to ensure that they do not drown between the vast amount of online offerings.
Do not repeat curriculum 1x	Do not repeat education from the IDE curriculum but offer widening or deepening activities.

Table 10: Attention Points Solution

Table 11 presents the suggestions and attention points that participants mentioned for including activities for IDE students in the interface.

Code	Explanation/Quote
Pin board with companies 2x	Create a pin board function between companies (professionals) and students where companies can offer projects and look for students and the other way around.
Alumni coaches 1x	Create a function to bring students in contact with experienced alumni to receive individual coaching from them on their specific questions.
Role models 1x	Use alumni role models to illustrate what industrial designers in practice do and why they are capable of that.
Offerings at introduction 1x	Be sure that there are relevant offerings available to students when introducing the interface to them so that they remember it and actually use it.
Educate generic professional skills 1x	Offer education on generic professional skills the IDE curriculum does not include.
Include practice in education 1x	Include practice in the education itself like the IDE faculty already does with practical cases.

Table 11: Student Inclusion

Table 12 presents the top choices of alumni for activities that they would want to be available in the interface.

Code	Explanation/Quote
Courses 7x	Attending courses or workshops.
Networking 4x	Meeting other alumni to help each other with questions and to get to know each other.
Career counselling 3x	Career counselling for alumni.
Contact with students 3x	Getting contact with students to find graduation students, interns, project groups, and such.
Access to knowledge databases 3x	Access to the knowledge databases that hold research by graduation students and researchers.
Readings 2x	Attending readings and meeting other alumni there.
Suggestions 2x	Suggestions for other activities that the alumnus can attend.
Up-to-date overview 1x	An up-to-date overview of all activities.
Contact with researchers 1x	Getting into contact with researchers to help each other with projects.
Alumni coaches 1x	Inclusion of the offerings by alumni coaches for students.

Table 12: Top Choices Alumni

7.5 Discussion

The construct validity of this part of the study may be disputable since I provided the participants with a textual description and verbal explanation but not with a visual overview, which left the ideas at an abstract level of understanding. This may be difficult for participants to picture. Resulting from that, the participants could only answer on an abstract level whereas a visual overview may evoke different, more detailed responses. Yet the participants were familiar with the concept of online offerings on an interface so that made it easier for them to comprehend the presented solutions. Another point of discussion may be that participants may have given me socially desirable answers since they responded face-to-face to my personal ideas. All of them responded to agree with the central idea to offer all activities in one place for example. Nevertheless, the participants did not fail to give critical points. Specific questions for improvements and additions contributed to that. Also, the participants did not contradict each other what improves the construct validity of this part of the study.

The internal validity may be influenced by my interpretation of the importance of how many participants mentioned certain points. The result that all participants agreed that it is effective to offer all activities in one place is relevant to the sub-research question as well as it is relevant that most participants would desire the interface to offer courses and workshops, for example. Yet if only one participant mentions a certain strong point; addition; change; or attention point, that does not mean it is less relevant. So while for some points it is relevant that multiple participants mentioned it, one cannot rule out points that only one person mentioned. But there are points that are less relevant to the research question since they fall outside the scope of the study such as the suggestion to cooperate with other universities on offerings. The presentation of the full code tables makes my choices on this matter more transparent, which increases the internal validity of this part of the study.

The participants gave similar and complementing responses to the proposed solution, which improves the generalizability of this part of the study. The diversity in participants – alumni, CC professionals, and an IDE employee – strengthens this statement. Still, having ten participants may be a relatively small number to go on. The confirmation from the participants that they want things that they did not mention in their first interview improves the generalizability from the conclusions of the first interview round (the previous sub-research questions).

The short time frame for the second interview round (fifteen minutes) may influence the reliability of this part of the study. Participants needed some time during the interview to get into the topic before they could give on-topic

responses. More interview time may allow for more extensive response from the participants. Yet the current complementing diversity in response may suggest that more response would be complementing rather than conflicting. Different stimulus materials with more visuals, however, may lead to different, more detailed responses.

7.6 Conclusions

The participants confirmed that an online digital interface may yield potential to improve the effectiveness of the DUT's offers. An interface especially has potential for easy accessibility, promotion, and networking. An online digital interface can only solve a part of the problems for IDE students and alumni though. The main problems to overcome require more feral measures. An interface can become an integral part of that solution. So, the results are useful as practical ideas to fill in recommendations for the two cases.

8 Recommendations

This chapter presents my recommendations for the CC and IDE case. I based these recommendations on the insights from Chapter 6 and 7. Section 8.1 presents my recommendations that apply to both cases. Section 8.2 presents my recommendations for the CC case. Section 8.3 presents my recommendations for the IDE case.

8.1 Recommendations for both Cases

Both cases require concrete and practical insights into the IDE proposition: what can academic industrial designers offer to employers? I recommend a pragmatic, customer-centered approach to this matter. Employers need to know what academic industrial designers can offer to their specific professional field. Academic industrial designers need to know what they can offer for a specific vacancy. So the IDE faculty should tailor information about the IDE proposition to professional fields rather than providing one general explanation that applies to all and clarifies little.

8.1.1 Informative Booklet

I recommend the IDE faculty to develop an informative booklet that explains the IDE proposition for each professional field where academic industrial designers regularly end up.

- Use the professional field categorization from practice: product design, graphic design, service design, project management, business strategy, ergonomics, research, marketing, and so on. Explain for each master how the education enables the student to add value to that field. Possibly include only masters that are relevant to that professional field.
- Give examples of multiple alumni that work in those professional fields. Tell their story and show how their education enables them to do their work.
- Do not only show 'superstar' alumni. Only showing superstars would give unrealistic expectations and skepticism with employers and would set undoable social standards for students. Sshow a variety of alumni that is similar to reality: big and small companies, ambitious and less ambitious alumni, and so on.
- Also make an online version on the Alumni Office website in the format of 'career prospects of IDE students'. This makes the information more interesting to students.

8.1.2 Responsibility

Developing this booklet should be the responsibility of the IDE faculty since they bear the first responsibility for professionalizing IDE students. The faculty should provide a budget and appoint a development team. The faculty can for example involve people from GPS team and master classes team and professionally experienced teachers in this team.

Such a booklet helps to solve indistinctiveness about the IDE proposition on a practical level for students and employers. Solving the indistinctiveness on an academic level still needs to be done. That requires a design philosophical, abstract approach and also is the responsibility of the IDE faculty.

8.2 Recommendations for the Career Centre Case

Students need a real experience with the professional field so that they experience a real need. This is necessary for effective professionalization as they then become aware of their needs and can give it priority. I recommend that all IDE students need to present themselves to professionals for real. There should be something at stake that the students need in that practice. Theoretical exercises do not stick.

Generic Professional Skills (GPS) 3 is an ideal course to let IDE students practice for real. The course's focus is on student professionalization and involves all IDE master students. GPS 3 is therefore the proper place for such an assignment. Many students at the time of the GPS 3 course still need to find a graduation assignment or already explore their options to start their careers. This provides the 'real need' that is necessary for effective professionalization. So I recommend that IDE students practice presenting themselves to companies for real in the GPS 3 course.

8.2.1 Practice for Real in GPS 3

I recommend the following set-up to let IDE students practice presenting themselves to companies for real in the GPS 3 course:

- Invite companies that look for graduation students and let students who are still looking for a graduation assignment

present themselves to these companies. Make it a job application process where students apply up front with a CV and motivation letter and companies select applicants for an interview.
- Give students one day to prepare for this application and involve the CC to facilitate this day in a workshop format. Tell students up front for which companies they can apply. Give the companies one or two days to make the selection and then invite them for a day for interviews with the selected students.
- Let students who already have a graduation assignment or were not selected by the companies meet with the coaches from the Alumni Coaches program. Give the students the choice in what they want to use that meeting for as long as it is a relevant problem to them. They can discuss strategies to look for a graduation assignment or practice a job interview for example. The meetings with alumni coaches can lead to further contact between the student and alumni coach.
- Ask the alumni coaches and companies to make it a confronting experience: a 'real' experience. This practice should make the students aware of their needs and their ability to present themselves clearly and convincingly to companies.
- Make supporting information, about writing a motivation letter for example, only available on the Alumni Office website. Students then become familiar with that website and how to use it. Overview visuals on the website can help students remember which services are available to them during and after education.

8.2.2 Responsibility

Realizing this recommendation would be the responsibility of the IDE faculty and the GPS 3 team in particular. Help from the CC, the Alumni Coaches program, and companies in the IDE faculty's network would also be necessary. The informative booklet that I recommended in the Section 8.1 can be useful to attract companies.

8.3 Recommendations for the IDE Case

As Section 6.4 argues, the main problems of IDE alumni to overcome require the following solutions:

- The DUT should involve students in the professionalization program before they graduate so that attending professionalization activities at the DUT becomes 'normal'.
- The DUT should make promoting activities easy for alumni that participated in those activities and want to share them with their network.
- The DUT should provide a clear overview of the DUT's offers and provide easy access to its activities for alumni.
- The DUT should continue monitoring the alumni's professionalization needs. Already attending alumni are an easy target group for that.

8.3.1 Online Digital Interface

I recommend making current activities more accessible by channeling all DUT professionalization activities through the Alumni Office website. That website namely already seeks to fulfill this function. Yet every DUT party currently uses their own website. Presenting one overview with all activities can make the DUT offers more accessible for alumni. This would require a well-designed interface as there are many activities. Placing and maintaining activities on the website should be easy for DUT parties. The DUT ICT departments can possibly assist with this matter. Such a website can contain the functionality for alumni to promote activities via social media to their network. It can also contain functions for alumni to give feedback on and suggestions for activities. Chapter 7 presents other functions that IDE alumni would desire from such a website.

As a culture change is necessary to draw alumni back to the DUT, the first place to start is with students as they are not used to the current professionalization culture. Students can get used to the idea of professionalizing themselves at the DUT by using the Alumni Office website already in the GPS 3 course. They become familiar with the activities that they can attend at the DUT that way. Promotion to alumni might best start with the alumni that already participate in activities: to stimulate them to share the activities with their network by giving easy options for that. Promotion by email to other alumni may work if the promotion emphasizes activities that solve relevant needs of alumni. One way to identify such needs is by asking already participating alumni about which needs they encounter and to see which needs reoccur.

8.3.2 Responsibility

The Alumni Office would have the main responsibility to build and maintain their website and to monitor offers within the DUT. They would need support from Marketing & Communication and the ICT departments to do their part. DUT parties also carry responsibility to place their activities on the Alumni Office website. Alumni associations should channel their activities through the Alumni Portal as well instead of using their own portal. DUT parties might benefit from their own 'spot' on the Alumni Office website.

9 Personal Reflections

In this chapter I wrote down reflections on my learnings in my graduation project. In Section 1 I discuss reflections and some ideas about what competences academic industrial design education builds; an issue that popped up during the study as difficult to answer. In Section 2 I discuss my other reflections.

9.1 Academic Industrial Design

One essential and difficult question popped up during the study: what is academic industrial design about? Both DUT employees and alumni explained that the answer to this question is unclear. Looking at the IDE faculty's curriculum, students learn design like a professional discipline and yet there is an academic part to it as well while it remains unclear how academic industrial design education is different from HBO industrial design education. IDE students are not even necessarily aware of this difference since many of them think they train to become designers; an unrealistic picture since they are not aware that most of the alumni end up in all kinds of problem-solver jobs besides industrial design.

Furthermore, the confusion increases because IDE students do much more than product design; service design, business strategy design, interaction design, and architecture for example become more important. Actually, the education name 'Industrial Design Engineering' itself is therefore confusing to people.

9.1.1 Proposition: Academic Design

Since the CC case requires an answer to this question and since the case clients mentioned it specifically, I did not only formulate recommendations on how to work on this question but I gave it extensive thought myself as well. In this part of the reflection I want to share these thoughts on what I think academic industrial design is about and how it is different from HBO industrial design and from other related disciplines.

My position is that to understand what academic industrial design is about one must understand two different ´layers´ of design competence: applied design competence and academic design competence. Applied design competence refers to the 'classical' view on design of deciding the look and functioning of an object by making a detailed drawing of it. In the case of industrial design this is what HBO industrial design is about and what the context of academic industrial design is. Academic design competence, however, is what professionals build up by attending academic design education and takes place on a higher abstraction level than applied design competence. It focuses on research, integration, synthesis, and concretization where applied design competence focuses on integration, synthesis and concretization. Figure 7 shows how I think academic design relates to applied design fields and other related fields.

Figure 7 holds a schematic overview including two axes. The horizontal axis shows three consecutive categories from research to solution concretization. Research includes fundamental research that aims to understand phenomena and applied research searches answers for specific cases. Solution Development includes integration of research insights and synthesis of insights and ideas. Solution Concretization includes the concrete elaboration of synthesized solutions into a physical or digital format. The vertical axis holds the division of sciences into Alpha, Beta, and Gamma sciences. As the Universiteit Utrecht (2014) explains "Alpha sciences study the products

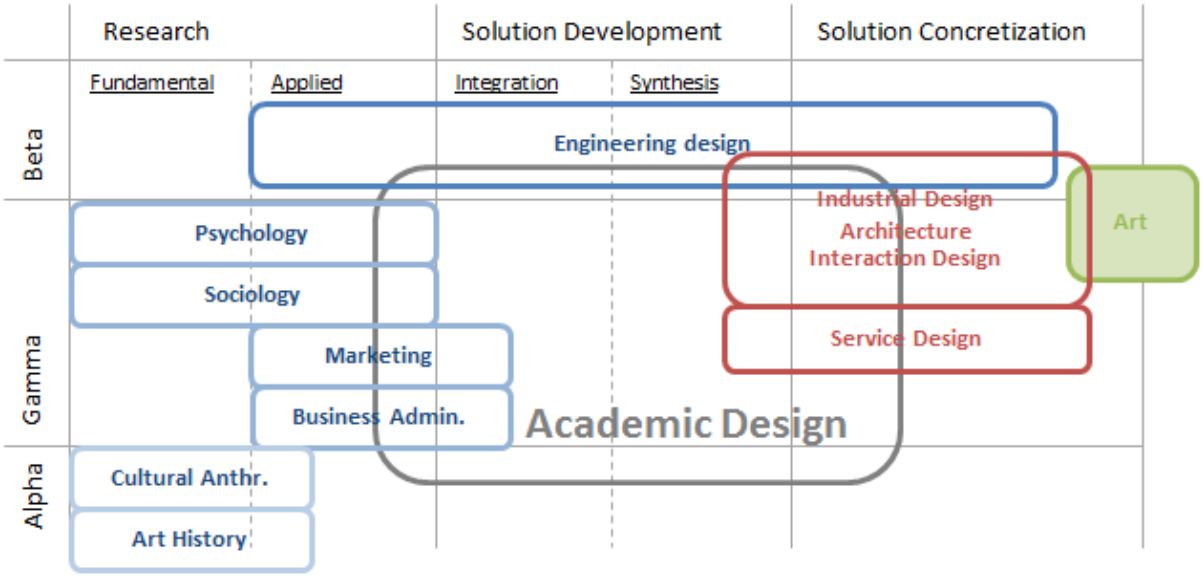

Figure 7: Academic Design and Related Fields

of human acts, Beta sciences study the non-human nature, and Gamma sciences study human acts". I use this division to bring order into design-related sciences. The sizes of the disciplines' surfaces areas give an ordinal indication of the scope of the discipline.

Academic design encompasses Alpha, Beta, and Gamma sciences and makes the transgression from scientific research to concretized solutions. Academic design starts with design research that focuses on understanding the so called 'problem situation': understanding the context of the case the academic designer is working on and the needs and wishes of the people within it (the 'user') as well as the needs and wishes of other involved parties (such as the case client). Design research borrows research methods from Alpha, Beta, and Gamma disciplines and adjusts them to its needs. Academic design then continues with integration of insights from the design research and from research in other disciplines, such as psychology and physics theories. Integration then transgresses into synthesizing solutions using design methods. Finally, academic design concretizes solutions at least up to a concept level in the case's respective field (for example a product in the field of industrial design) and includes a plan to realize the solution in its context. Typical academic design competences include reflection, empathy, analytical thinking, creativity, visualizing, solution-oriented thinking, envisioning, facilitating, and team work.

I regard engineering design (encompassing the technical sciences) as a different design discipline in itself. It only focuses on Beta studies – it neglects the user – and more specifically on technology development. It builds on insights from natural sciences like physics and chemistry and starts with research and development to come up with new applicable technologies, integrating insights from the different Beta disciplines. Engineering design then synthesizes and concretizes technical solutions for specific cases. Academic design integrates insights and technologies from engineering design and includes a part of engineering design competence as well.

Gamma sciences like psychology and sociology focus on fundamental and applied research and develop theories and recommendations for specific cases. Gamma sciences like marketing and business administration focus on applied research and develop insights and action plans. Academic design integrates these theories, insights, recommendations, and action plans and applies those sciences' methods in its design research.

Alpha sciences like cultural anthropology and art history focus on fundamental and applied research and develop theories and insights. Academic design integrates these theories and insights and applies those sciences' methods in its design research.

Applied design fields like industrial design and architecture focus on integration of Beta and Gamma sciences, synthesis of insights and ideas, and concretization into physical or digital products. These fields also overlap with art in the concretization part. Applied design fields like service design are similar but do not include insights from Beta sciences and art.

Design studies includes both fundamental and applied research and covers both Alpha and Gamma science as it studies the acts and products of academic design, engineering design, and the applied design fields. Academic designers need insights from design studies to understand their own work – to understand what they do.

9.1.2 Competence Paradox

The academic design construct can never exist or come to be apart from an applied design field; there always is overlap. Looking at the design activity, the cases always take place in an applied design field and therefore one must master that field to a certain level to be able to synthesize and concretize ideas that fit their context. The contents of academic design always take place in an applied design field and therefore it can only exist in combination with each other.

Academic design methodology also cannot not arise or develop by itself. Designers first learn design methodologies in an applied design field and then transform the patterns of that methodology to a more abstract level after which they can apply them in different applied design fields as well. So there also is no one set of academic design methodology: it depends on the academic designer's personal background and development which academic design methodologies he develops. Academic design cannot come to be unless it grows from applied design fields.

So while I mention a separate construct of academic design there seems to be a paradox between the different design competences: while the academic design construct clearly indicates a different set of design competence from applied design competence, the academic design competence can only come to be from applied design competence and can only exist in combination with applied design competence. One

should therefore rather understand academic design as an extension of applied design competence: something built on top of it.

9.1.3 Differentiator

So actually I only use the construct of academic design to indicate the differences between academic and HBO designers. These differences include the competence to understand design methodology on a transcending abstraction level, the competence to reflect on one's work and methods, and the competence to integrate methodologies and insights from other sciences.

So what is it that academic designers do? Academic designers solve questions – which they understand as wicked problems – with concretized solutions. These questions can take place in a traditional applied design field like industrial design or architecture but can also take place in 'new' applied design fields like business strategy. Design consultancies are on the rise there to develop business strategies using a design approach (design thinking). The designer's differentiator in 'new' applied design fields includes the competence to develop integrated solutions (including the involved people, technology, and case situation), strong innovative synthesis competences, and competence to translate research insights into concretized solutions.

This understanding of academic design explains why academically educated designers end up in so many different places and can take up so many different tasks. It explains why knowing a bit about so many different things in combination with design competence makes sense compared to specializing in one field.

9.1.4 Implications for Education

For academic design education this understand implies first that the IDE faculty is right in teaching applied design methodology, design research methods, generic professional skills, and related sciences such as marketing and psychology.

Personally I also see a step-wise growth in education from applied design competence to academic design competence to design studies. I think that bachelor education mainly focuses on teaching applied industrial design competence and introducting academic design competence. I think that master education focuses mainly on academic design competence with a strong contextual influence from applied industrial design and introducing design studies. I think that design studies is fully academic and the domain of PhD's and researchers. Or maybe this step-wise growth is not really the case but I do think it would make sense to set up education this way.

9.2 Learnings from Project

During my graduation project I learned many things, mostly about doing research and working on a practical case. I also found that what truly gives me a drive for work is that I can make a positive impact for people: that my work helps them with something that is a frustration for them, whether it is something small or something big. I experienced this mostly when I noticed in people's reactions that the topic of my project really was relevant to them and that they were happy that I aimed to make an improvement. Technology, research, and commercial interests are all of course interesting and very much relevant but they do not give me the satisfaction that I need to do my work. But as I said, they are definitely interesting and I learned a lot on those matters. In the following sub-sections I discuss my learnings on various themes.

9.2.1 Dealing with Two Cases

Perhaps the most challenging part was to include two cases in the project that did overlap in the main topic but had a different nature and a different aim. The choice for including both cases rested in the opportunity that arised to do them and by that make the project relevant to more people, which I needed for the project to get started. I think that in the end I managed to give satisfactory results for both cases, although keeping them both in sight was not always easy. In a presentation that I gave earlier to the case clients and other interested people, for example, I had spent too little effort on giving clear solution ideas for the CC case. Fortunately, the presentation ended well with a fruitful discussion and the presentation was a well-timed warning for me to better elaborate solution ideas for the CC case.

Overall, I think that dealing with both cases went allright although I could not give the full attention to each case that is necessary to give more conclusive outcomes. Yet, since the cases are related to each other, I also could integrate solutions between the cases; something that proved worthwile since an integrated solution offers valuable advantages. In a future situation where I would have to deal with a similar situation, I think structuring the research even more and to keep a closer eye on the division can help to better deal with the difficulties.

9.2.2 Learning Writing

Steven Flipse made a lot time available to help me to improve my academic writing skills and I learned an incredible lot from him. I especially learned about the 'culture' around academic writing – norms and expectations – and about how to

phrase my sentences. This is challenging and even more difficult to learn without a good teacher. I am much more aware now of what I can and cannot do, what the quality state of my writing is, what I can further improve, and how I should understand academic writing. Two other highlights in my learnings are that I better understand how descriptive academic writing needs to be very precise and as neutrally phrased as possible. Also, I better understand how to give the reader a quick overview and understanding by using figures and tables.

A difficulty that I did not expect, though, was that the writing process went much slower due to the new lot of considerations that I needed to take into account. At a certain point, each word and sentence seemed to take forever. I also asked for too much feedback in a period of time and therefore I got stranded in the overwhelming amount of improvements that I still needed to make (while writing itself was going slow). I should better dose the amount of feedback that I ask for and give myself time to deal with what I already have first.

9.2.3 Research Methodology

A positive experience was that research methodology is more flexible than I thought. I learned this when I included the analogy in my research method, which required me to find a way to analyze and include the results and to point out how this influenced the study. Where some people might experience structure to be limiting, I experienced that structure helps me to make great leaps forward and puts me on tracks that are otherwise difficult to find. This was a relieving experience and gave me confidence that my method made sense. I also better understand now into what detail I need to explain my methods.

I should make more time for iteration in my research projects, though. My estimation for the workload of my project was realistic (except for the writing part; I had not foreseen the influence of the learning process on my writing speed) but I had included little time for iteration. In my project I found that another thorough iteration would be valuable to the study since the results become clearer and more comprehensible.

I underestimated confidentiality of interviewees' responses a bit since I had not made clear decisions about the availability of the interview transcripts early in the project. Next time, I should do this earlier and directly communicate to the interviewees to prevent confusion with them about this matter.

Transcription is one thing that I will not do again on such a large scale (over twenty interviews). It is far too time consuming for me to be economic (transcription services can do it faster, cheaper, and better) and it gave me physical complaints that did not fully went away. If outsourcing the transcription is not possible, I will choose a different research method altogether before the research project starts.

9.2.4 Research vs. Design

In this graduation project I strongly encountered the differences between research and design. Even in doing research, I experience a considerable influence from my education in industrial design. On one hand this was a positive thing: I made early leaps towards practical solutions, which gave me directions for my research. I also thought more creative about my research methods, which helped to find more effective methods. On the other hand, the design way of thinking also distorted my research process. I had difficulties to keep the design leaps separate from the research steps, which I had to correct in the end of writing the report. Also, switching to research thinking was not always easy for me although that is very important for good research: looking at how things are instead of thinking how you want them to be. In my research this was a reoccurring 'nasty' habit of me that I fortunately could keep within boundaries. In a next research project I will be more aware of this and better check with myself that I am looking at the research with the right mindset.

Applied research has one limitation that I keep finding frustrating, though. Since everything needs to be based on solid research, the best you can do is to formulate a good answer on an abstract, generalizable level as well as some recommendations. When thinking further about practically realizing the recommendations, though, I found that many practical issues come up that applied research cannot take into account. Applied research understands some delimited aspects of the case very well, better than design would, but is not capable to provide an integrated, full solution like design can: an additional step will always be necessary before one has an attainable solution. Of course there are cases where applied research is necessary but in the field of Science Communication I think there is much more room for design approaches.

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Part II: Thoughts on Academic Industrial Design Education: A New Breed of Design Competency

A Design Philosophical Essay about the Distinctive Competencies of Academically Educated Industrial Designers

Introduction

Academic industrial design education nowadays teaches or should teach a mix of science and design competencies to its students. It is unclear, though, into what distinctive competency that education results compared to science education and professionally focused industrial design education. This essay explores industrial design education in the Dutch university higher education sector and existing literature to present a framework for design that clarifies the distinctive competency of academically educated industrial designers. The essay achieves that by proposing a notion of academic design competency that applies to all academic design education and discusses its distinctive elements and implications for industrial design education.

The field of industrial design is establishing itself as an academic field, which started when the university higher education sector incorporated it and "engaged with research in the academic sense" as Melles and Kuys (2010, p. 5228) argue. They point out the still present need for industrial design to legitimize itself as an academic field and note that "an increasing body of doctoral projects has begun to emerge centering on industrial design and these projects point to the increasing academic credibility of the field" (p. 5229).

Yet the establishment of an academic industrial design field raises questions about which activity this field constitutes and which activity academic industrial design education should teach. As Willem (1990, p.43) argues, science and design are "distinctly different activities". He argues that science (simply understood) is about creating knowledge of the natural world and that design is about producing "change in a man's environment". On this matter Willem also cites Simon (1981) "The natural sciences are concerned with how things are… Design, on the other hand, is concerned with how things ought to be" and March (1984) "Science investigates extant forms. Design initiates novel forms".

An academic industrial design field should somehow include both. Willem argues that science and design do interact with each other: "design is a process in which creativity and knowledge (science) interact to produce novelty in the man-made world" and "it is through design that science exceeds being pure knowledge and participates in creating an effect" (p. 47). Yet this described interaction does not clarify how an academic industrial design field integrates these activities.

These questions are not only relevant to academia, but also to students that attend academic industrial design education. A career counsellor from the Delft University of Technology Career Centre gave an account of their question: "Wat kan ik nou eigenlijk?", translated to English: "What is it that I can do?" These students ask what competency their education taught them and how that is useful in work practice. They experience difficulties in explaining this to employers and clients.

This essay looks at industrial design university higher education in the Dutch education system and builds on academic literature to develop a notion of 'academic design activity' that helps to clarify a notion of 'academic design competency'. This essay uses the latter notion to clarify which competency academic industrial design education teaches to its students or should teach to its students; the questions that I raise in this essay are rather normative since academic industrial design education is still in the making.

1 Dutch Education Setting

The Dutch education setting gives insight into the differences that emerge in the establishment of an academic industrial design field as there are two levels of university higher education in the Netherlands: HBO (higher professional education) and WO (academic education). Traditionally, industrial design education is HBO education, but the Delft University of Technology, the Eindhoven University of Technology, and the University of Twente offer industrial design curricula at WO level. The shift to education on WO level also led to a shift in the focus of education.

Universities at HBO level focus on preparing industrial design students for industrial design work practice. The six universities that offer the HBO education Industrial Product Design, for example, developed the 'nationwide career and training profile' (Maas et al., 2013) that describes the career profile of HBO Industrial Product Designers with several years of work experience and the competencies that recent graduates should have. Alignment of education to this profile should ensure that the education connects well with work practice. The 'design academies' also offer education on HBO level.

The WO industrial design curricula aim to prepare their students not so much for a certain career, but rather for dealing with a certain complexity of problems, as their mission statements express (see Table 1). This complexity is mostly in the environment around the design cases, which requires an integrated solution and therefore a multidisciplinary approach. Next to design competency, the students should acquire scientific research competency in order to deal with this complexity in their design cases or to move to academic, design related research positions. These mission statements are still general, though, and do not necessarily align with the reality of education.

Delft University of Technology "The field of industrial design engineering consists of all activities concerning methodical and creative innovation and the development of consumer goods, or parts thereof. The objectives of the Faculty of IDE are described in the mission statement: *Creating successful products people love to use.* Our mission is to contribute to the knowledge, skills, methods and professional attitudes in the field of integrated product development. We aim to achieve this through education and research at an internationally recognised scientific level, as befits our status as part of Delft University of Technology. The Faculty of Industrial Design Engineering's concern is to study, innovate and improve the development of durable products and their related services for people, on the basis of the balanced interests of users, industry, society and the environment." (TU Delft, 2011, p. 5)
Eindhoven University of Technology "The mission of the Industrial Design Department at Eindhoven University of Technology is to perform research on and to provide education in: ***'Creating intelligent systems, products and related services in a societal context.'*** In the Department of Industrial Design at Eindhoven University of Technology TU/e we aim for a new type of engineering discipline: design and creation of intelligent systems, products, and related services in a societal context. An intelligent system and product is characterized by adaptive behavior based on the situation, context of use and users' needs and desires. In particular, we focus on problems and opportunities that are of benefit to individuals, societies and different cultures worldwide." (TU/e, 2014)
University of Twente "Industrial Design Engineering related research within the University of Twente aims to develop qualitative and quantitative knowledge on all phases in the life cycle of products, i.e. initiative, design, production, use, maintenance and recycling, all with a strong emphasis on the user, in a societal and environmental context, with special focus on interdisciplinary cooperation, leading to answers on design questions from 'the real world'." (University of Twente, 2010, p.12) "The faculty aims to educate IDE academics at the Bachelor, Master and PhD levels for those typical sectors of the labour market within the field of engineering technology. The graduates will be prepared for the positions of tomorrow, and therefore will have a profound orientation on the newest knowledge and methods within this field and also will have the attitude and learning competency for functioning in adjacent fields at short notice. The graduates should have a level of competency equivalent to that of well-reputed universities in western countries." (Quality Assurance Netherlands Universities, 2007, p. 26)

Table 1: Mission Statements of WO Industrial Design Education in the Netherlands

To further clarify the matter of academic education, the three universities that offer WO industrial design curricula formulated university wide criteria for academic bachelor's and master's curricula (Meijers et al., 2005). They formulated seven areas of competency for their students (see Table 2). These too mention both the scientific research and design competencies and dealing with the complexity of the environment. Yet this description still does not show the distinctive elements of academically educated (industrial) design students.

A university graduate…
1. is competent in one or more scientific disciplines A university graduate is familiar with existing scientific knowledge, and has the competence to increase and develop this through study.
2. is competent in doing research A university graduate has the competence to acquire new scientific knowledge through research. For this purpose, research means: the development of new knowledge and new insights in a purposeful and methodical way.
3. is competent in designing As well as carrying out research, many university graduates will also design. Designing is a synthetic activity aimed at the realisation of new or modified artefacts or systems with the intention of creating value in accordance with predefined requirements and desires (e.g. mobility, health).
4. has a scientific approach A university graduate has a systematic approach characterised by the development and use of theories, models and coherent interpretations, has a critical attitude, and has insight into the nature of science and technology.
5. possesses basic intellectual skills A university graduate is competent in reasoning, reflecting, and forming a judgment. These are skills which are learned or sharpened in the context of a discipline, and which are generically applicable from then on.
6. is competent in co-operating and communicating A university graduate has the competence of being able to work with and for others. This requires not only adequate interaction, a sense of responsibility, and leadership, but also good communication with colleagues and non-colleagues. He or she is also able to participate in a scientific or public debate.
7. takes account of the temporal and the social context Science and technology are not isolated, and always have a temporal and social context. Beliefs and methods have their origins; decisions have social consequences in time. A university graduate is aware of this, and has the competence to integrate these insights into his or her scientific work.

Table 2: Criteria for Academic Bachelor's and Master's Curricula (Meijers et al., 2005)

2 A Framework for Design

In order to better understand which activities an academic industrial design field should comprise and which competencies academic industrial design education should teach, this chapter presents a framework for design that centers on these two issues. I propose to make a distinction between the 'academic design activity' and the 'professional design activity' in order to present a framework for design that clarifies the competency of academically educated industrial designers. The term 'academic design activity' encompasses the activities that academically focused design education teaches to its students. The term 'professional design activity' encompasses the activities that professionally focused design education teaches to its students. I deliberately leave the word 'industrial' out of the terms as they apply to other design disciplines as well, which I discuss in the third section of this chapter.

In this essay I understand design competency from the viewpoint of design activity: the competency to perform design activity. I need this simplification to make the competency topic comprehensible for the propositions that I make in this essay. Describing which processes go on in the designer's mind is a very complex topic; too complex for me to handle at this point. I do think, though, that the propositions of this essay can give further starting points for understanding what goes in the designer's mind: this approach provides a frame to better understand design competency.

A framework for design also requires a definition for 'design'. On this matter I want to align with the definitions that Love (2002) proposes:

- "'Design' – a noun referring to a *specification* or *plan* for making a particular artefact or for undertaking a particular activity. A distinction is drawn here between a *design* and an *artefact* – a design is the basis for, and precursor to, the making of an artefact.
- 'Designing' – human activity leading to the production of a design."

I want to stress in accordance with this definition that a design can be both about an artefact and an activity, in line with the debate about science vs. design that the introduction section discusses. In a more recent debate about that topic, Galle and Kroes (2014) limit the definition of design only to the aim of making an artefact. A well-designed artefact, however, also requires a well-designed plan to implement the artefact successfully in society, for example. The development of such a plan design and an artefact design need to be integrated as they are interrelated. A marketing plan and a production plan, for example, can have considerable influence on an artefact's design to make the plans feasible. While we can theoretically understand artefact design and activity design as two different things, they are interrelated in design practice and therefore a design should also consider activity.

I also want to emphasize in accordance with Love's definitions that a design has its own 'history of thought' next to the drawings, documents, and such that make up the physical parts of the design. This history of thought emerges during 'designing' and is the proof of a design's quality; it consists of the considerations that the designer made in making design choices, based on the information that the designer had available (resulting from research, for example). Knowing the history of thought is indispensable to fully understand a design. A definition of design is incomplete without such a concept that I labelled 'history of thought'.

The first section in this chapter further clarifies the term academic design activity. The second section clarifies the relation between academic design activity and sciences. The third section discusses differences between design disciplines.

2.1 Academic Design Activity

In order to clarify the concepts of academic design activity and professional design activity and how they are different, I grouped the design activities that they encompass into four categories:

- Research: conducting (design) research to create understanding of a specific aspect of the problem situation.
- Integration: integrating insights from design research and other scientific research to create an overall understanding of the problem situation.
- Synthesis: synthesizing (novel) solutions for the identified problem situation.
- Concretization: concretizing the synthesized solution(s) into a design.

Note that evaluation, decision-making, and communication can occur in different categories and that implementation occurs in the concretization activity.

These categories purposefully do not represent a process structure: a designer may

move through the different categories as he thinks is best. As a result of this choice, the different design process structures that literature provides (see for example the comparison by Howard (2008, p. 165)) all fit into the category framework as they show how a designer moves through the different categories. Bamford (2002) shows how unpredictable this process can be. I chose to define this categorization since it is more neutral towards different theories about design processes, making it wider applicable, and since it clarifies the concepts of academic and professional design activity more clearly than existing design process models.

One can also understand this category framework from different paradigms, for example the problem solving paradigm and the reflection-in-action paradigm that Dorst and Dijkhuis (1995) discuss. Section 3.2 will show that the reflection-in-action paradigm that Schön (1983) proposed (as cited in Dorst and Dijkhuis (1995)) fits the description of academic design competency better, though.

The academic design activity puts more emphasis on the research activity in comparison with the professional design activity that puts more emphasis on the concretization activity (see Figure 1). This is the result of including research activity in academic design education whereas professional education focuses on preparing its students for the practical needs of companies. More research activity also leads to more integration activity. Note that HBO educations (that prepare for professional design activity) may also include research activity, but not to the extent of WO education; Figure 1 only shows the main focus of the academic and professional design activities to emphasize the differences.

2.2 Relation with Sciences

The definitions of the research category and the integration category already point out that there is a relation with sciences in the academic design activity. Academically educated designers integrate insights from a wide range of scientific research to improve their understanding of the problem situation and they conduct design research themselves to further clarify aspects of the problem situation. Figure 2 illustrates this overlap.

Sciences investigate a delimited aspect of reality to obtain a detailed understanding of that aspect whereas the design activity aims to obtain an integrated understanding for one or more problem situations at a given point in time. The kind of understanding that sciences aim to obtain is therefore a different kind of understanding than the kind of understanding that the design activity aims to obtain. Scientific understanding is abstract and often aims to be 'universal', whereas design understanding is concrete, temporal, and bound to a specific frame: the 'problem definition'. Yet they interact with each other and complement each other through the design activity.

What I labelled 'design studies' in Figure 2 is the science that applies scientific methods to study the design activity itself and to investigate more 'universal' principles in the design activity, for example how users respond to the use of lighting in combination with television screens or how expert designers act differently compared to novice designers. A characteristic difference between design studies and design activity is that design studies primarily aims to create knowledge

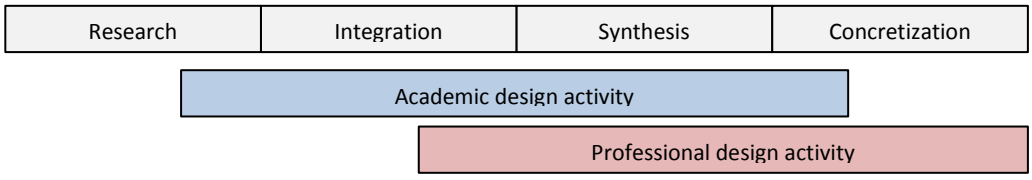

Figure 1: Focus of academic vs. professional design activity

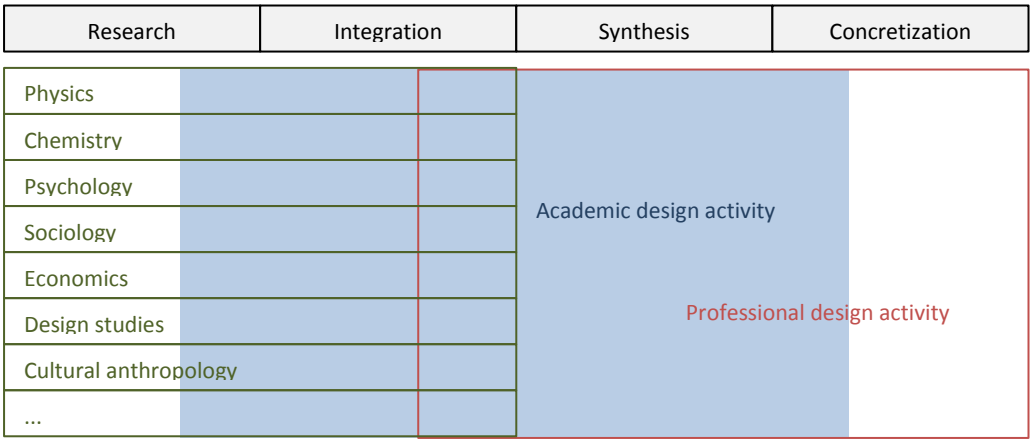

Figure 2: Overlap with Sciences

(abstract and more universal) whereas design activity primarily aims to create a design (concrete and more temporal). A possibly confusing overlapping characteristic is that design studies also can have a normative character (developing design methodology, for example), as design activity does.

2.3 Differences between Design Disciplines

There are considerable differences between design disciplines although I only defined a 'generic' design activity as I noted in the introduction of this chapter. The reason for that decision is that existing definitions of the design activity also do not note the differences between design disciplines and that literature into the matter seeks to understand the design activity as one whole concept, even though that proves to be challenging. With this essay I want to propose a constructive addition to the available body of literature and therefore I align with that literature, but for the matter of design competency I need to point out how different design disciplines require and therefore educate different design competencies.

Different design disciplines represent different application fields of design, like architecture represents design of buildings and their environment and like engineering design represents the design of mechanical artefacts (in a simplified manner of speaking). This division connects well with the aim of education that focuses on the professional design activity to meet companies' needs on the matter of design competency. As different needs require different measures, one can expect designers from architecture to use a different approach than designers from engineering design and also to need different scientific insights. Sociology may be more relevant to architecture whereas engineering design may require a deeper understanding of electronics, and so on. As designers from different disciplines need to do different activities they also need to acquire different competencies. In this essay I do not exclude any design field from the concepts of academic and professional design activity, even if a design field shows little effort to establish itself as an academic field. I assume that all design fields can have at least the potential to develop into an academic design field.

So, designers from different disciplines acquire different sets of design competencies. Of course, on a more abstract level, different design disciplines have a similar nature: they share their aim to make a design to improve a situation, which requires the same main steps. In that sense I agree with the existing body of literature to study the design activity as one phenomenon. Yet the diversity is also what makes the design activity so valuable: design is as diverse as the diversity of human needs. A sound description of the design activity phenomenon should pay tribute to that diversity.

The implication for the academic design activity is that different designers can give a different interpretation to it. A notion of academic design competency, which I discuss in the next chapter, needs to transcend the differences in sets of competencies and point out on a more abstract level how it is different from professional design competency.

3 Notion of Academic Design Competency

As I explained in the introduction of Chapter 2, I approach the matter of design competency from the view point of design activity: the competency to be able to perform design activity. Then I made the distinction between academic and professional design activity, which results from the different aims of academically and professionally focused educations, and proposed a framework that illustrates that distinction and the overlap of the design activity with sciences.

In this chapter I extend the notion of academic design activity with the notion of academic design competency. In the first section I describe how academic design competency relates to professional design competency. In the second section I describe the distinctive elements of academic design competency. In the third section I discuss how differences between design disciplines influence academic design competency.

3.1 Academic Design Competency vs. Professional Design Competency

As I argue in this essay, students from academically focused design education should acquire both scientific research and design competency and develop that into a distinct competency. This I call academic design competency.

The key observation for understanding academic design competency is that academically focused education trains designers to solve highly complex cases, also outside their original application field (see Table 1 and 2). So what academically trained designers do is that they apply the design strategies they learned to cases that transcend or even fall outside their original application field (outside the industrial design field in the case of industrial design education). They bring their design strategies, the rationale behind the design activities they undertake – the 'thinking steps', to a more abstract level so that they can apply those design strategies to cases that are multidisciplinary in nature; cases that a professional from a single application field on his own cannot resolve.

So the distinction between academic design competency and professional design competency is that academic design competency enables the designer to bring the professional design competency to a more abstract level and apply it to cases that transcend or fall outside the designer's original application field (see Figure 3). Academic design competency allows the designer to take a step back from his design competency and reflect on the rationale behind it, the thinking steps that he makes. Academic design competency also requires the designer to be able to quickly adjust to a different application field; to develop knowledge and competency in that field and to integrate that with his design competency. Academic design competency goes further than being a so called 'T-shaped designer' since it is not only about integrating perspectives from and collaborating with professionals from other disciplines, but actually moving to other disciplines to do work there. Academic design competency allows designers to become 'M-shaped professionals' for that matter.

This understanding that a designer can apply his design strategies wider than only his original application field also is closer to the more abstract understanding of design that Willem (1990, p.43) expressed: "designing is the expression of an innate human ability, an ability to change the environment presumably for the better". This understanding does not limit the design activity to the aim of making artefacts but more to creation of something novel to improve a situation – whether by means of an artefact or by means of a course of action. As the complexity of

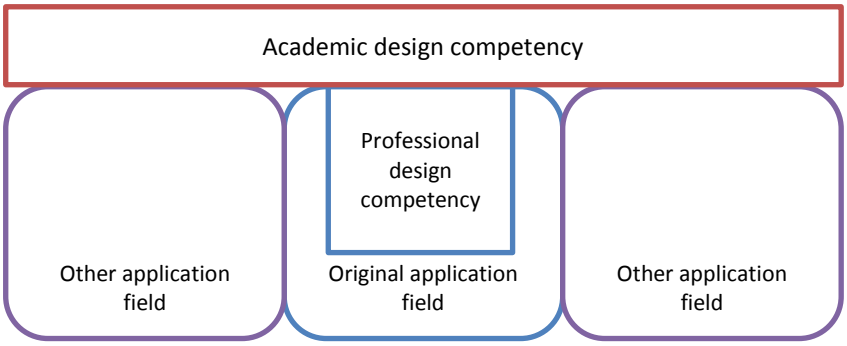

Figure 3: Academic Design Competency vs. Professional Design Competency

cases for academically educated designers requires more than the design of artefacts, this is an important notion to take into account for academic design education.

3.2 Distinctive Elements

Using the presented framework for design, it is possible to identify the distinctive elements of the design strategies that designers apply in academic design activity. Figure 4 illustrates the distinctive steps that those designers take.

Academically educated designers move through different (categories of) steps in their academic design activity in an order that suits them (iteratively, for example). They might start with any step, not necessarily problem analysis. Problem analysis represents the research and the integration categories from Figure 2 and synthesis represents the synthesis category. Figure 4 does not include the concretization category as that is not a distinctive element here. The problem definition is the scope through which the designer frames the problem situation and the designer's integrated understanding is his actual (concrete) understanding of the problem situation.

The distinctive competency that academically educated designers can contribute to complex cases is the competency to quickly switch between problem analysis, building an integrated understanding of the problem situation through research and integration, and synthesis of solutions. Scientifically educated professionals do not learn to make this switch and professionally educated designers do not learn to make such thorough problem analyses to tackle highly complex problems. So, academically educated designers do have a distinctive competency as they have a distinctive set of activities that they can contribute that allows them to solve multidisciplinary cases.

Existing literature confirms these distinctive elements for designers. Cross (2004) describes expert design behavior to be based on "adequate 'problem scoping' and on a focused or directed approach to gathering problem information and prioritising criteria" and that "Expert designers are solution-focused, not problem-focused […] experience in a specific problem domain enables designers to move quickly to identifying a problem frame and proposing a solution conjecture." Ho (2001) describes similar expert design behavior: using backward strategies. Dorst and Cross (2001) describe the co-evolution of problem space and solution space. Lawson (2004) explains how designers develop schemata and gambits to approach the design activity with experience – what I labeled 'design strategies' before in this essay. Lawson's concept of schemata and gambits also directly brings into question to what extent a designer can be aware or 'conscious' of his 'design strategies', the rationale behind his approach, and therefore if that rationale is actually rational. Perhaps 'intuition' is a better term to understand designer's behavior in applying 'design strategies'.

Looking back at the discussion of science versus design, I think one can characterize the differences in behavior between a scientist and a designer as follows:

- A scientist researcher aims to phrase the right question and then seeks to answer that question.
- A designer seeks to design a solution and seeks an answer that allows him to design and support that solution; a different attitude and working sequence (working backwards). A designer predetermines where he wants to end up (although a designer may end up with a completely different solution than he expected at the start of the design process).
- A designer puts more effort in realizing solutions; a scientist puts more effort into building scientific knowledge. The complexity and multidisciplinary nature of problems that academically educated designers deal with makes this difference even more important.

This understanding of academic

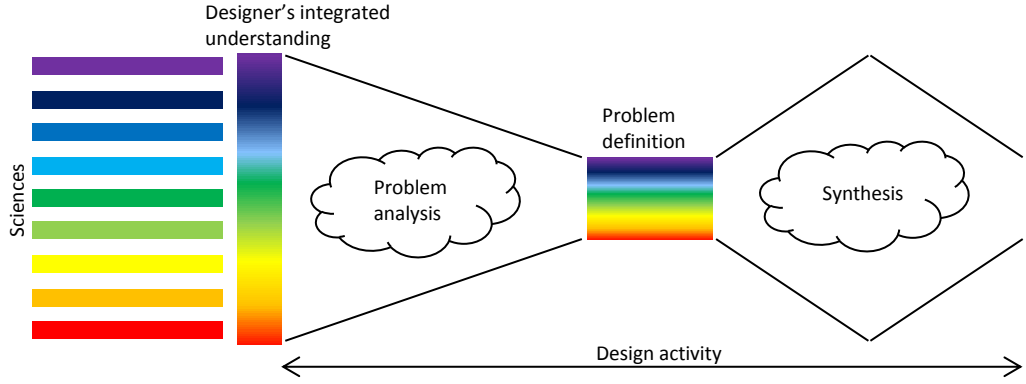

Figure 4: Distinctive Steps of the Academic Design Activity

design competency – with its non-linear nature and highly complex cases – also clarifies why the reflection-in-action fits the proposed framework in Chapter 2 better than the more linear rational problem solving paradigm:

> "Describing design as a process of reflection-in-action works particularly well in the conceptual stage of the design process, where the designer has no standard strategies to follow and is proposing and trying out problem/solution structures" (Dorst & Dijkhuis, 1995, p. 274).

3.3 Differences in Interpretation

The differences between design disciplines that I discussed in Section 2.3 and the schemata and gambits that Lawson (2004) proposes clarify how different designers give different interpretations to the design activity, which then also is the case for academic design activity. Designers use their own design strategies based on their previous experience and education. The multidisciplinary nature of the cases that academically educated designers face may even enlarge these differences: there is more unclearness about which strategies to follow which can lead to more diversity in strategies. This can be an issue for understanding the academic design activity and for cooperating with academically trained designers as one can get different experiences with different designers.

4 Implications for Industrial Design Education

Moving back to the original focus of this essay, the proposed notion of academic design competency has multiple implications for academic industrial design education – that may apply to other academic design education as well. While the notion of academic design competency may logically require a different education, its relation with professional design competency (bringing those design strategies to a more abstract level) explains the necessity to first educate design students in professional design activity before it becomes possible to teach them academic design competency. I name this problem a 'competency paradox' as it can seem confusing why academic education should first teach professional design competency. The current division between WO industrial design Bachelor and Master programs in the Netherlands seems to fit this set-up: the Bachelor programs focus more on professional design competency and the Master programs extend that by focusing more on academic design competency.

Assuming such a set-up for education, I think that WO industrial design Master education should explicitly deal with this matter of academic design competency to clarify to its students what their distinctive competency is so that they can better explain and utilize that. I could imagine a Master course wherein students need to work on a case that falls completely out of the industrial design field so that they need to apply academic design competency and that the students regularly need to reflect on the design strategies they apply and how their industrial design education enables them to do that. WO Bachelor education should then not only teach professional design competency but also prepare students for (introduce them into) academic design activity so that they can make the switch to Master education well.

Working experience and design philosophy seem to be important to learn academic design competency. The term academic design competency itself may be useful to express the focus of industrial design education (academic or professional). Educating from the reflection-in-action paradigm seems to fit better for academic design education, but I do not think that that implies that education should exclude other paradigms: on the contrary, I think that academic competency of any kind should enable an individual to understand and work from different paradigms and perhaps even develop (new) paradigms. This again explains the importance of design philosophy and also of philosophy of design.

5 Conclusions

5.1 Conclusions

The concept of academic design activity that I propose in this essay shows that what makes the activities of academically educated designers 'academic' or 'scientific' – which is about creating knowledge – is not the act of the designing itself, but rather the use of 'academic thinking' and reflection to construct both an abstract and a concrete understanding of complex, multidisciplinary problem situations and to bring previously learned design strategies to an abstract level to then apply them to those problem situations. What makes the activities 'scientific' is that these designers develop new understanding and new ways of dealing with complex, multidisciplinary problems that were not available to the world before: new knowledge. The designers can share this new understanding and these new problem-solving ways with other people, who can build on or challenge this new knowledge like they can with knowledge that results from scientific research activity.

Important, though, is that the knowledge that academic designers develop is a different kind of knowledge than the kind of knowledge that scientific researchers develop (see Section 2.2). Due to this epistemological difference, one should not put 'academic design knowledge' in the same basket as 'scientific knowledge': both require different criteria for what makes 'good knowledge', both require different methods to develop such knowledge, and both should be received and used in a different way. Scientific knowledge often provides principles that one can apply with deductive reasoning while academic design knowledge should be interpreted with analogical reasoning; learning something about a new, concrete problem situation by looking back at one or more previously tackled, concrete problem situations.

As I noted before, academic design competency then becomes the competency to do academic design activity. Unfortunately, I cannot give much more insight here than the use of design strategies; something that researchers before me, like Lawson (2004), already identified. Defining what makes up this competency would be a next step in developing the line of reasoning that I propose in this essay.

5.2 Other Remarks

The similarity between problem solving and the design activity and the discussion on that matter briefly came forward in this essay as it is relevant to the topic. In addition, I want to make a case that they are not the same thing: design is not all problem solving (e.g. art and design for children's play) and not all problem solving is design (e.g. a physician who prescribes a standard treatment for a patient). Problem solving is rather a collection of design strategies as there are multiple ways to doing that. The novelty aspect of design also seems to be a distinctive factor. On a side note, the distinctive competency of academically trained designers that I propose is in complex problem solving, though.

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Part III: Professionalizing Academic Industrial Designers in Written Communication Competence

A Design for a Writing Education Method for Academic Industrial Design Education

1 Introduction

1.1 Background

Written communication is a generic professional skill for academic industrial designers. Academic industrial designers need to communicate about their work with teachers, clients, supervisors, colleagues, users, and other people. They communicate about the contents and process of their work for multiple reasons: to inform people, to convince people of certain propositions, to cooperate with people, and so on. And writing has more use to academic industrial designers. They can use writing to document their progress and to reflect on the contents of their work. So obtaining writing competence is important for academic industrial designers' professionalization.

I found during my studies that written communication in academic industrial design is not so easy. Academic industrial design is an integrated field and written communication thereby requires integration of norms and practices from the involved fields such as engineering, industrial design, and social sciences. These norms and practices can conflict. There is literature on written communication available for those separate fields but there is no literature available that explains how one can integrate norms and practices in the academic industrial design field. Academic industrial design also has its own norms and practices for written communication that are now largely unwritten. I experienced this myself during my studies when I wanted to improve my writing. I largely depended on instructions from teachers and desired tailored written instructions for academic industrial design. Not all teachers are skilled writers themselves. Other students and alumni that I spoke to confirmed that they needed written instructions to improve their writing independently.

The Delft University of Technology (DUT) Industrial Design Engineering (IDE) faculty recognized these difficulties with education in written communication. Willemsen (2012) for example made an assessment of the writing quality of graduate reports by IDE students from the Strategic Product Design master program and found that their writing competence is inadequate. The IDE faculty hired Willemsen to develop a learning line for writing education throughout the curriculum. Multiple teachers make efforts to structurally improve writing education in their courses. Yet these teachers all need to largely 'reinvent the wheel' as opportunity to share experiences on this matter is limited and writing education materials do not give teachers all the support that they need.

In response to this situation I wanted to develop writing education materials for academic industrial design myself. I started working on this idea two years ago when I conducted a study into which topics that writing education should include and how one can set up writing education effectively with workshops. I ended with an overview of relevant topics, various insights into effective writing education, and insight into the situation of IDE students.

I continued the development of writing education materials as part of my graduation project. I wanted to achieve concrete results in this project. I wanted to design and evaluate at least a part of the writing education materials in detail. This report part presents my design process, additional analysis results into the situation of writing education, and the design and evaluation of the writing education materials that I developed.

1.2 Problem Definition

Academic industrial design students do not have appropriate education materials to independently develop their written communication competences. They need such materials as teachers have little time to coach students on that matter and are not available when the students work outside class. Available education materials are fragmented, scattered, not always of sufficient quality, and do not give integrated instructions for written communication in the academic industrial design field – only for related fields separately.

Writing education also does not reach its full potential since teachers need to largely 'reinvent the wheel' for writing education as opportunity to share experiences on this matter is limited and writing education materials do not give teachers all the support that they need.

Academic industrial designers cannot reach their full potential with inadequate written communication competences. Writing education is an important part of their professionalization. Tailored writing education materials are necessary to support them in this matter.

1.3 Project Goal

The project goal was to at least partly develop a Writing Education Method (WEM) for academic industrial design education that addresses the needs of students and teachers. The design should have sufficient support from prior analysis and

evaluation with users to show that the WEM fulfills its function effectively. The design should give concrete and complete guidelines for further development of the WEM.

One point of clarification: the focus of the WEM is on teaching written communication competence but I refer to that in this report with the term 'writing education' to make the text better readable.

1.4 Preconditions

Together with my supervisors I formulated preconditions for the WEM development:

- Concrete and detailed results were of primary concern. I could better develop a detailed part than a conceptual whole.
- I had to only conduct further analysis into the most essential aspects where I could not make an 'educated guess' as time was limited.
- I assumed that my personal experiences as an IDE student provided credible input to understand student needs for the WEM. I did need to include other students' views though to see how needs can be different.
- Finishing the project without delays had a high priority. I therefore had to plan the workload carefully.
- The DUT IDE education served as role model education for this project. I needed a clear example of academic industrial design education and access to teachers and students. The DUT IDE faculty was suitable for this since it is leading in its field and since I had direct access to teachers and students there.

1.5 Report Set-Up

Chapter 2 explains which methods I applied in this project. Chapter 3 gives an overview of my analysis results about the needs of students and teachers in writing education. Chapter 4 presents available norms and assessment tools for writing education. Chapter 5 explains the main issues in academic industrial design writing education that the WEM should overcome. Chapter 6 presents the WEM design. Chapter 7 presents the evaluation of the WEM design with users. Chapter 8 presents my conclusions on the current state of the WEM design and how to continue development.

2 Method

This chapter explains which methods I applied in this project. Figure 1 gives an overview of the steps that I took.

Figure 1: Project Steps Overview

3 Students and Teachers

This chapter gives an overview of my analysis results about the needs of students and teachers in writing education. These results came from my previous research into writing education at the DUT IDE faculty and from the interviews with teachers from this project. Appendix 1 provides a summary overview of the results from my previous research. Appendix 2 reports about the set-up and outcomes of the interviews with teachers.

Section 3.1 gives an overview of the student's situation. Section 3.2 gives an overview of the teacher's situation.

3.1 Students' Situation

3.1.1 Role of Writing

Writing is a generic professional skill for academic industrial design students. Students need writing to communicate their work results or to obtain assignments, also after their studies. Not all students experience much need to learn to write since industrial designers in practice can often compensate lacking writing skills with oral skills in presentations. Research orientated students often do see the need to learn to write as they need to write scientific articles. Students who advance in writing can use it to reflect on and improve their work.

3.1.2 Writing Assignments

Students have to write reports and such for most courses. Teachers give instructions for and feedback on the writing itself on some courses. Students often carry out their writing often in groups and also individually. The instructions and expectations that students receive from different teachers can seem conflicting or can be conflicting as assignments have different requirements and teachers have different ideas about 'good' writing.

3.1.3 Typical Difficulties

Teachers currently see that students experience difficulties with all aspects of writing. Good writers are an exception. Teachers also see that plenty of students think that they write well while they actually do not. The students do not see their weaknesses and that frustrates the learning process.

The most difficulties that students experience are actually not so much about writing skill itself. They are rather about 'proper thinking'. Dealing with information critically, providing clear argumentation, working methodically, reasoning from a question to method to analysis to conclusions, and so on. Teachers found that the problems are usually in thinking about the contents of students' when they have difficulties with writing. Expressing their thinking is not so difficulty for students when they got their reasoning and such straight.

Writing shows how difficult 'proper thinking' can be. Writing requires students to transform their thoughts as writing requires a conversational, linear way of thinking whereas designing requires an iterative, 'all over the place' way of thinking. Making this switch can be difficult for students. Writing in academic industrial design furthermore requires students to integrate writing norms and practices from different fields. Students need to learn how to cope with that.

Students often need to write in groups and that complicates the writing process and the learning process more. Students need to learn to produce a combined writing product that requires them to agree on the contents and to create consistent documentation. Working on their writing competences then is difficult as students need their time and energy for handling the assignment and group process.

3.1.4 Sources for Instructions

Students rely strongly on teachers for writing instructions. Teachers are often not available when students are doing the actual writing and run into difficulties. They can then only look up instructions that teachers put in digital or paper format and those are limited. Students otherwise have to go to an appointment with teachers or seek contact via phone or email if teachers can make time for that.

Literature sources are available from fields that are adjacent to academic industrial design. There are papers, books, webpages, YouTube movies and such but these sources are not tailored to academic industrial design and thereby cannot fulfill the students' needs for instructions. Students also cannot always find available sources or simply do not use available sources since they do not feel motivated, over-estimate themselves, or cannot make the time for example.

3.1.5 International Students

The writing level of international students varies greatly. Students have typical difficulties with English grammar depending on their native tongue. Culture differences also lead to differences in

openness to feedback. Students cannot and should not be stereotyped though. They are all different and their country of origin is not necessarily an indicator of their writing competences.

International students need to adapt their writing to the DUT IDE faculty's norms and expectations when they come here to study. They need instructions and practice for that.

3.1.6 Motivation

Many students do not feel motivated to learn to write since they started their education to learn to design, not to write. Teachers see that ambitious students and students who are interested in research usually do feel motivated to learn to write.

There are positive approaches to stimulate student motivation on this matter. Feeling of competence can stimulate student motivation. Students can obtain a feeling a competence by achieving good results on their writing and can lose that feeling if they achieve bad results. A topic for writing that has the student's interest can also stimulate student motivation in a positive way.

There are negative approaches to stimulate student motivation as well if positive approaches do not lead to satisfying results. Teachers see that harsh confrontation with bad writing results effectively creates a feeling of need with students to learn to write better. This approach causes frustration with the students though.

3.2 Teachers' Situation

3.2.1 Place of Writing Education in the Curriculum

Writing is a generic professional skill for academic industrial design students. Writing education is therefore spread throughout the curriculum. Some courses focus on teaching one or a few aspects of writing. Most courses require the students to communicate their work results in writing

The teachers that I interviewed gave an indication for which aspects of writing students should learn in which part of the curriculum. Concerning genres, students should start in their bachelor with design report, research report, and advisory report. Design brief comes later in the bachelor. Business plan and research article become relevant in the master. Curriculum Vitae, motivation letter, and portfolio become relevant at the end of the students' education. Research proposal, in its full form, is rather something for PhD students although a simplified form can be relevant for bachelor or master education. The participants mentioned that other genres, like web blog, may be relevant to some of the students as well but not to all of them.

Concerning writing aspects, the participants mentioned that bachelor students should start with message, structure, and referencing. They should have a basic level in spelling and grammar before they start their bachelor education. First year education should also include visuals and lay-out. Reasoning and argumentation should follow in the second year of the bachelor. Quality of sources can briefly begin in the bachelor but is mostly something for the master. Writing style is a topic for the master.

Concerning more general writing topics, writing methodology and writing process are things to start with in the bachelor. Understanding writing as a conversation on paper is an insight that slowly needs to grow throughout the curriculum. Writing as reflection can come near the end of the bachelor and subjectivity in writing is mostly a topic for the master.

The participants also mentioned that the indicated times are only starting points: each aspect of writing needs to begin at a basic level and then develop throughout the education. Follow-up courses can teach aspects at a higher level and increase in complexity.

3.2.2 Current Approach

The participants gave a clear opinion about how one should set up writing education. The teacher should first define clear learning goals for his course. In the end, the teacher needs to assess the students' progress on those learning goals. So the teacher should define an assignment and provide the information that students need to perform the assignment.

Clear learning goals for writing education should be divided into sub-goals and spread throughout the curriculum. This should be the curriculum coordinator's responsibility. The writing competence of students needs to grow stepwise throughout the curriculum. Students do not need to become outstanding writers. They should become aware of their strengths and limitations so that they will seek proper help in case that they encounter difficulties with writing. Students should learn to write by learning to ask 'proper questions' such as 'who is my audience', 'what is my message to them', 'so how should I structure my report', and so on. The participants agreed that a prescribed writing format can be useful in a course for practical reasons. A format can ensure that students do all assignment parts or it can make the amount of assessment comprehensible for the teacher, for example.

The interviews showed that reality can be different. Teachers focus on a part of writing education in their course and devise an assignment for the students. Writing education starts with one or multiple lectures to give instructions about the writing topic and students then have to perform the assignment individually or in groups. Teachers sometimes provide a prescribed format for the assignment to steer the students in a certain direction. Students can ask for help during the assignment, for example in a special lesson hour for questions. The students receive feedback on their writing from either teachers or other students by peer review. The feedback moment is when most of the learning takes place. Teachers find that their possibilities to instruct students and give them feedback are limited in reality. Writing education thereby becomes less effective since the instructions and feedback are crucial to the students' learning process.

3.2.3 Typical Difficulties

Teachers experience various difficulties in teaching to write. Writing competence needs to grow over the years with students and some writing aspects such as 'subjectivity in writing' are difficult to teach in one course. Writing education in different courses should build forward on each other and that is difficult if teachers have different opinions about 'good writing' or if assignments require a different approach to writing. That can be confusing to students.

Teachers have little time budget to teach writing since writing education never is a course's first priority. Students do often need to report about their work in written form but teachers have little time to give feedback on the writing itself. Teachers can use writing to assess the student's quality of thinking though and help students to write better by requiring them to explain their work clearly on paper. Putting high demands on the writing product helps students to improve on the aspects of writing that give them most difficulties (see Sub-Section 3.1.3). The large student amounts also limit the teachers' possibilities to coach students. Peer review by other students can help in that matter but is only effective in teaching formal writing aspects. Students need teacher feedback to improve the contents of their writing.

Teachers ideally want to teach students to write by teaching them to ask themselves 'proper questions'. That would be the 'academic' approach. Such questions are abstract though and students need a basic amount of writing experience in academic industrial design before they can understand such questions and abstract models at a pragmatic level. Students need hands-on instructions to gain a basic amount of writing experience.

Giving feedback to individual students is difficult if students write in groups. Teachers can then only give feedback to the group as a whole even though they might see large differences between the document's different parts.

3.2.4 Differences between Teachers

Not all teachers are equally competent in writing. Some teachers do not write much in their profession and thereby did not develop their writing competences much, for example. That limits them in what they can teach to students. Teachers can also have difficulties with writing themselves for other reasons.

Other teachers are so far in their development that they have difficulties with adapting their instructions to the students' level. A typical reoccurring example is that teachers start their writing instructions with a very abstract explanation that is widely applicable and makes perfect sense to the teacher but gives little hands-on information for the students. The students then cannot get the basic experience that they need to advance in their writing competences and the writing education misses its goal.

Teachers from other fields can have difficulties to adapt their writing instructions to academic industrial design as norms and expectations for writing are different in other fields. On participant told for example that such a teacher instructed students should provide references for all the graphic elements that they used in their collages. Teachers from academic industrial design have a different opinion about this. They see a collage as a new artwork and providing references then becomes unnecessary.

3.2.5 Role of Education Materials

The feedback moment is currently the main learning moment for students as available writing education materials support students insufficiently. The possibilities to teach writing thereby are limited and both students and teachers desire writing education materials to support writing education.

The teachers that I interviewed stated that they do not desire a WEM that they should include in their lessons. Those lessons are already stuffed and such a WEM would increase the teacher's workload instead of reducing it. The teachers want a WEM that they can refer students to for self-study. On one hand that saves teachers the effort of explaining the same thing to different students over and over again and on the other

hand that allows students to learn things that teachers do not have the time for to teach to them. A WEM that focuses on self-study also allows the students to learn at the moment when they do the actual writing and need it the most.

A WEM should cover all writing related topics that are relevant to academic industrial design so that teachers can refer to any topic that the student needs to learn. International students need such a complete overview to get up to speed with writing norms and expectations at the DUT IDE faculty.

4 Norms and Assessment

This chapter presents available norms and assessment tools for writing education that are useful to academic industrial design education. Norms are necessary to make the required level of writing competence for students explicit. Assessment tools are necessary to make the students' level of writing competence better measurable and less prone to different expectations by teachers.

Section 4.1 presents available norms for writing education that relevant for academic industrial design education. Section 4.2 presents available suitable writing assessment tools.

4.1 Available Norms

4.1.1 The Meijer's Criteria

The DUT is part of the 3TU federation together with the University of Twente and the Eindhoven University of Technology. The 3TU federation formulated general norms for education at their universities: the Meijer's criteria (Meijers et al. 2003). Laurent Willemsen pointed me to this. These norms apply to the DUT IDE faculty as well and also give norms for writing education. Table 1 gives an overview of the relevant Meijer's criteria categories. The grey-marked norms are relevant to writing education.

Competent in co-operating and communicating		Basic intellectual skills	
Bachelor	Master	Bachelor	Master
Is able to communicate in writing about the results of learning, thinking and decision making with colleagues and non-colleagues.	Is able to communicate in writing about research and solutions to problems with colleagues, non-colleagues and other involved parties.	Is able (with supervision) to critically reflect on his or her own thinking, decision making, and acting and to adjust these on the basis of this reflection.	Idem, independently.
Is able to communicate verbally about the results of learning, thinking and decision making with colleagues and non-colleagues.	Is able to communicate verbally about research and solutions to problems with colleagues, non-colleagues and other involved parties.	Is able to reason logically within the field and beyond; both 'why' and 'what-if' reasoning.	Is able to recognise fallacies.
Idem to above (verbally and in writing), but in a second language.	Idem to above (verbally and in writing), but in a second language.	Is able to recognise modes of reasoning (induction, deduction, analogy etc.) within the field.	Is able to apply these modes of reasoning.
Is able to follow debates about both the field and the place of the field in society.	Is able to debate about both the field and the place of the field in society.	Is able to ask adequate questions, and has a critical yet constructive attitude towards analysing and solving simple problems in the field.	Idem, for more complex (real-life) problems.
Is characterised by professional behaviour. This includes: drive, reliability, commitment, accuracy, perseverance and independence.	Idem.	Is able to form a well-reasoned opinion in the case of incomplete or irrelevant data.	Idem, taking account of the way in which that data came into being.
Is able to perform project-based work: is pragmatic and has a sense of responsibility; is able to deal with limited sources; is able to deal with risks; is able to compromise.	Idem, for more complex projects.	Is able to take a standpoint with regard to a scientific argument in the field.	Idem, and is able to assess this critically as to its value.
Is able to work within an	Idem, for a team with great	Possesses basic numerical	Idem.

interdisciplinary team.	disciplinary diversity.	skills, and has an understanding of orders of magnitude.	
Has insight into, and is able to deal with, team roles and social dynamics.	Is able to assume the role of team leader.		

Table 1: The Meijer's Criteria (Meijers et al., 2003)

4.1.2 IDE Bachelor Criteria

The DUT IDE faculty formulated criteria for the bachelor program (Competenties Bachelor IO, n.d.). Table 2 provides the criteria that are relevant to writing education.

Relevant Criteria DUT IDE Bachelor
6.1 Design Drawing You can visualize and effectively communicate ideas, concept designs, details, and the relation to the user using design drawings and/or renderings.
6.2 Technical Documentation You can technically document and effectively communicate a concept design and an elaborated design using a 3D-CAD program, in particular SolidWorks.
7.1 (Re)formulate a Research Problem You can (re)formulate a research problem and support your interpretation.
8.1 (Re)formulate a Design Problem You can (re)formulate a design problem and support your interpretation.
9.2 Recognize and Filling Knowledge Gaps You are able to gather and analyze relevant information and knowledge in order to realize a design goal.
10.1 Critical and Constructive Attitude and Reflecting You can ask adequate questions and you have a critical and constructive attitude towards analyzing and solving design problems; by means of critical reflection you have insight into your own behavior (thinking, deciding, acting), in design methods, and in your own working methods and you can adjust your behavior and working methods.
10.2 Logical Reasoning You can reason logically, think of 'why' and 'what if' questions; you can reason on various abstraction levels, including systems level.
10.4 Develop and Defend Position/Vision You can develop a founded own position with regard to a discipline-related topic, you can effectively communicate and defend your position.
11.1 Report in Words and Image You can communicate in writing your vision, ideas, concepts, and design in an informative and convincing manner (in PO3, Minor, and BEP: in English).

Table 2: IDE Bachelor Criteria (Competenties Bachelor IO, n.d.)

4.2 Available Writing Assessment Tools

Laurent Willemsen pointed out the tools by Rogers and Rymer (2001) to assess the writing level of students. They developed four tools to assess four aspects of writing:

- "The Task Tool evaluates how well the writing meets reader expectations and situational demands." (p. 151)
- "The Coherence Tool focuses on how well the piece of writing forms a meaningful whole for the assumed reader." (p. 127)
- "The Reasoning Units Tool examines how logically convincing the reader finds the claims and support presented in writing." (p. 129)
- "The Error Interference Tool assesses whether errors interfere with the writer's communication and/or damages his/her credibility." (p.130)

Table 3 provides the charts that the tools use to score the writing level (p.127-151):

Task Tool	
6	Fulfills the task completely by addressing reader expectations and meeting situational requirements for the writing. Content addresses reader requirements, issues, concerns, or questions; form is fully appropriate for the context and situation.
5	Fulfills the task to a great degree, addressing most reader expectations and meeting situational requirements for

	the writing. Content is largely relevant and form is sufficiently appropriate for the context and situation.
4	Fulfills the task to some degree, addressing some reader expectations and, for the most part, complies with situational requirements for the writing. Content may meet reader expectations to some extent, but not completely. Form may depart from the contextual and situational norms in some respects.
3	Begins to fulfill the task. Includes some content that the reader finds relevant. Content leaves the reader expectations largely unfulfilled, however.
2	Questionable as to whether the writing fulfills the task. Content may seem somewhat relevant to the task, but may address it in a roundabout fashion. The reader may need to hunt hard to determine the writer's reason for writing or what the writing is actually for.
1	Does not fulfill the task. Content evidences writer misunderstanding regarding what the writer needs to accomplish. It may be irrelevant to the task. It may surprise or disappoint the reader. Can be characterized as 'off-task'.
Coherence Tool	
6	Text forms a meaningful whole with a controlling idea that is logically developed, with each passage clearly related to the next. Rereading is unnecessary, even if content is complex.
5	Text largely forms a meaningful whole with a controlling idea that is logically developed, with each passage clearly related to the next. Rereading is rarely necessary, and there are no unclear passages.
4	Text forms some overall sense of meaning around a central idea and a generically logical movement from one passage to the next. Occasional rereading may be necessary, but unclear passages are few and minor.
3	Some passages hold together, but the parts do not form a meaningful whole; context may be missing; parts may be unclear, inconsistent, or unrelated. Cohesive devices may be used appropriately, but some may be inappropriate, and cohesive devices may not compensate for the lack of overall meaning. Frequent rereading of passages may be required; some passages may remain unclear.
2	Many passages do not hold together; there is no overall sense of a meaningful whole. Cohesive devices may be needed or inappropriately used. Passages may require rereading; many may remain unclear.
1	Passages are disjointed and there is no overall sense of meaning. Text requires rereading; many passages remain unclear.
Reasoning Units Tool	
6	Reasoning units consist of claims and support and are logical, credible, and complete. Claims are explicitly stated, explained, and substantiated with supporting evidence and support is relevant to claims, varied, concrete, and engaging.
5	Reasoning units consist of claims and support and are logical and credible. Claims are explicitly stated and sufficiently explained and support is varied and relevant to claims.
4	Reasoning units consists of claims and support and are adequate. Claims are relatively apparent and support is reasonably relevant to claims.
3	Reasoning units are incomplete or inadequate. Claims may be underdeveloped with little or no support. When support is used, it may be insufficient, seem simplistic (the "everyone knows" type), or may be inappropriate to the claim.
2	Claims may be very vague, difficult to find, insignificant, or irrelevant. Little or no support for claims is evident or support may be presented without claims.
1	No claims and no support.
Error Interference Tool	
6	No errors interfere with communication or damage credibility. No disruptive errors, but may have a few credibility and/or etiquette errors, and/or accent errors.
5	Errors do not interfere with communication or damage credibility. No disruptive errors, but may have occasional credibility and/or etiquette errors; may have some accent errors.
4	Errors do not seriously interfere with communication or damage credibility. Occasional disruptive errors and/or some credibility errors and etiquette errors; may have frequent accent errors.
3	Errors interfere with communication and/or damage credibility. Some disruptive errors and/or frequent credibility and etiquette errors; may have numerous accent errors.
2	Errors interfere seriously with communication and damage credibility. Frequent disruptive errors and numerous credibility and etiquette errors; may have numerous accent errors.
1	Numerous errors of many types severely interfere with communication and damage credibility.

Table 3: Writing Assessment Tools (Rogers and Rymer, 2001)

I would say that bachelor students should score a 4 and all master students a 5 on all these tools when I look at the available criteria. Scoring a 6 may be possible for ambitious students that continuously work on their writing competences.

5 Main Issues in Writing Education

This chapter explains the main issues in academic industrial design writing education that the WEM should overcome. This overview enabled me to make the switch from problem analysis to design as the conclusions from this chapter provided design principles.

Section 5.1 discusses the purpose of writing education in academic industrial design. Section 5.2 discusses how the WEM should deal with conflicting norms and practices. Section 5.3 discusses the WEM should support the teaching situation. Section 5.4 discusses how I should adapt the WEM to student development.

5.1 Purpose of Writing Education

5.1.1 Purposes

Academic industrial design students need to learn written communication as many academic industrial designers need that in their work later on. Students also need to communicate their work in written form. Written communication is not at the core of academic industrial design but a generic professional skill. Academic industrial designers therefore need to develop their written communication competence to a basic professional proficiency. A higher degree of competence can be beneficial for their work but should not be required in my opinion.

Students and professionals can use writing to reflect on their own thinking and by that improve their own work. They need a basic amount of writing competence to become able to do that; reflecting is difficult if one struggles with every sentence. Using writing to reflect is valuable to academic industrial designers as reflecting is – in my opinion – a core academic competence, indispensable to function professionally.

Available norms for academic industrial design education clearly state that students should become able to communicate effectively in written form. These norms also have a pragmatic character. Students should use writing to achieve a certain purpose; they do not need to learn to write for the sake of becoming a good writer. Writing here is generic professional skill; a side thing that academic industrial designers need to get their work across. Available norms do not name writing to reflect as such but do abundantly state the need for students to think 'properly' – asking the right questions, reasoning well, and so on. Writing to reflect would directly contribute to that and may be indispensable to reach the students' full potential.

I wrote an essay in Part II of this report about the distinctive elements of academic industrial design competence. I argued in that essay that academic industrial designers need to transcend disciplines and are (or should be) especially capable in solving multidisciplinary problems. An academic understanding of sciences and design and how to integrate both and an academic ability to reflect on their work and field should enable academic industrial designers to do that. Written communication is indispensable to deal with such complexity as academic industrial designers need to communicate complex analyses, relations, and solutions to a variety of readers. A thirty-minute presentation cannot possibly cover such complex projects in full detail. Writing to reflect is indispensable to deal with the full complexity on a detailed level as the amount of information is far too large for the human mind to deal with in one chunk. Academic industrial designers need to break the problem down into parts and deal with them in steps. Documentation is necessary to keep track of one's steps and to create overview for oneself.

5.1.2 Conclusions

Academic industrial designers have a pragmatic need for written communication competence. Academic standards for written communication are too idealistic for academic industrial design education as they require a far deeper understanding of language from students than pragmatic standards and as students have little time in their education to spend on writing education. 'Rules of thumb' are more appropriate for academic industrial design writing education. Students obtain a basic professional proficiency in terms of writing skill from which they can develop themselves further if they desire.

Writing education should progress to academic standards in terms of 'proper thinking' though. Proper thinking is at the core of academic industrial designers' competences and their pragmatic need therefore includes a deep understanding of logic, message, and such. Writing education should teach students what proper thinking is and how to go about it in writing. Pursuing academic ideals in this matter goes as long as academic industrial designers need the competences for their work. Writing to reflect can be highly valuable and possibly indispensable to

learn proper thinking and education should therefore stimulate that abundantly.

5.2 Conflicting Norms and Practices

5.2.1 Conflicts

Academic industrial design integrates norms and practices from different fields and written communication therefore also needs to integrate norms and practices from different fields. This can cause conflicts in norms for how one should use information, which information one should present, and so on. Teachers can have different opinions about 'good writing'. Their norms can differ too as assessment is subjective. These factors can cause confusion with students as they receive different instructions for their writing assignments.

5.2.2 Conclusions

The WEM should address conflicting norms and practices in multiple ways. The WEM should make students aware of the complexity of the situation and show them how they can deal with that. The WEM should be consistent and coherent in writing instructions, which requires choices by me on which norms and practices to provide to students. The WEM should at the same time explain how assignments and teachers have different requirements for writing and that those come first so that students check that with their teachers. The WEM can reduce subjectivity in writing assessment by providing writing assessment tools like the tools by Rogers and Rymer (2001).

5.3 Teaching Situation

5.3.1 Situation

Teachers have little time for writing education and want good sources that they can refer students to for explanation. That should save them much of the work. Teachers differ in competence to teach writing. Some teachers have difficulties with writing themselves. Other teachers progressed so far in their writing competence that they have difficulties to adjust their instructions to the students' level. Teachers from other fields can have difficulties to adjust writing education to academic industrial design.

Teachers and students both need to deal with student group assignments. Writing in groups makes giving feedback difficult for teachers as they can only give feedback to the group as a whole. Students who write in groups need to deal with the group process to get to a consistent result and often do not know how to handle that.

Students have varying ambition to learn to write. Students who are ambitious and/or have an interest in research or writing in general are more often motivated. Other students only write to finish their assignments and are more difficult to motivate with a positive approach. A negative approach like harsh confrontation with bad results can motivate them as well.

5.3.2 Conclusions

Teachers need a good reason to give priority to writing education as their courses are already stuffed. One good reason is that the writing quality is an indicator for the student's thinking quality and thereby for his work quality. Demanding that students deliver a well written document helps students to improve the contents of their work as well. The WEM should make teachers aware of this. The WEM should also focus on supporting self-study for students and be easy to refer to specific topics so that students can use the WEM independently.

The WEM's instructions for students can possibly support teachers who have difficulties with writing as well. The WEM's instructions should be a good example for teachers with highly developed writing competences who have difficulties to adjust writing instructions to the students' level. The WEM should also explain to those teachers how to build up writing education. The WEM should provide consistent and coherent norms and practices for writing in academic industrial design and at the same time give room for teachers to disagree with that and give different instructions to students.

The WEM should give instructions to teachers and students for how to deal with group work. Teachers might best avoid group work in writing education that is about writing skill itself. Giving feedback to groups is easier when writing education is mostly about the work contents; about reasoning and such. Group discussions namely center on such aspects whereas writing style is an individual matter for example. Students need a practical approach to go through the writing process with a group and to achieve consistent results.

The WEM should instruct teachers on how they can motivate students. The WEM should provide available approaches and leave it to the teachers to choose which approach they want to apply.

5.4 Student Development

5.4.1 Development Issues

Students first need a basic amount of practical writing experience in academic industrial design before they can understand more abstract instructions like theoretical models. Inexperienced students can understand more abstract instructions on a syntax level but they cannot link that to concrete experiences and thereby they cannot understand abstract instructions on a pragmatic level. In other words, inexperienced students understand what the instructions mean grammatically but they get stuck when they need to apply those instructions in a writing assignment. Students first need hands-on instructions to get through their first writing assignments. It then becomes possible to look back at those assignments (experiences) and point out more abstract patterns and such. Teachers nowadays often start with abstract instructions like argumentation models or generalizations (like "writing can have two purposes: to communicate a message to other people and to reflect on your own work). Students can do little with such abstract models at the start of their education. They first need to go through the motions a few times and encounter the issues for real.

Students cannot obtain writing competence in one or a few courses. Writing competence needs to grow throughout the curriculum as students need practice to try things over and develop routines. This puts a challenge for teachers as they share responsibility for the students' development. They need to coordinate when students learn what and how courses build on each other. A learning line, like Laurent Willemsen is developing for DUT IDE, can assist teachers in that matter.

Laurent Willemsen also pointed out the matter of student epistemology to me. Students can have a fundamentally different understanding of what 'knowledge' is. This understanding develops over time and has implications for how students perceive education. Students need to learn that there is no 'one truth' about writing education; that different teachers provide information that can seem conflicting and that students need to learn to deal with that in a responsible way. Wever and Willemsen (2013) use the Seven Stages of Reflective Judgment by King (2000, p. 20) to assess student epistemology (see Table 4). They note that "most students show little development beyond stage IV. Writing assignments are still primarily written for their instructor and the student's role is to figure out what the instructor wants to hear/read" and thereby show that student epistemology is an important issue that becomes explicit in student's writing. This matter is directly related to the matter of 'proper thinking'; that students need to learn the right thinking steps to approach writing and the contents of their assignments properly.

5.4.2 Conclusions

The WEM should initially focus on providing hands-on instructions for students to get through their first assignments. Rules of thumb for writing are most useful in this matter. Academic ideals for writing are less important in that stage. The WEM should progress to an academic way of looking at written communication by teaching 'proper thinking' to students. I note here that proper thinking is not so much about practical writing skill (grammar, writing style, and so on). Academic industrial design students have no need to develop that to an academic level as they only have a pragmatic need for that (see Section 5.1). That means that rules of thumb suffice for practical writing skill and that more advanced writing instructions are only desirable for students who want to develop their language skills further. The WEM should clearly address that it provides rules of thumb and what the limitations of those are. The WEM should also provide more advanced instructions for practical writing skill with references to where students can learn that.

The WEM should explain to teachers why and how they should coordinate writing education throughout the curriculum. The WEM set-up should follow a logical learning line itself so that teachers can use the WEM as a practical tool to set out writing education.

The matter of student epistemology is a general matter for education and transcends writing education for that matter. Student epistemology becomes explicit in the students' writing though and writing education thereby is an opportunity to deal with student epistemology. The WEM should make teachers aware of this matter, give instructions for how to assess the student's epistemological development using the student's writing, and give instructions for how they can adjust their instructions to help the student to develop to the next stage of development.

The Seven Stages of Reflective Judgment	
Stage I	*View of knowledge:* Knowledge is assumed to exist absolutely and concretely; it is not understood as an abstraction. It can be obtained with certainty by direct observation. *Concept of justification:* Beliefs need no justification since there is assumed to be an absolute correspondence between what is believed to be true and what is true. Alternate beliefs are not perceived.
Stage II	*View of knowledge:* Knowledge is assumed to be absolutely certain or certain but not immediately available. Knowledge can be obtained directly through the senses (as in direct observation) or via authority figures. *Concept of justification:* Beliefs are unexamined and unjustified or justified by their correspondence with the beliefs of an authority figure (such as a teacher or parent). Most issues are assumed to have a right answer, so there is little or no conflict in making decisions about disputed issues.
Stage III	*View of knowledge:* Knowledge is assumed to be absolutely certain or temporarily uncertain. In areas of temporary uncertainty, only personal beliefs can be known until absolute knowledge is obtained. In areas of absolute certainty, knowledge is obtained from authorities. *Concept of justification:* In areas in which certain answers exist, beliefs are justified by reference to authorities' views. In areas in which answers do not exist, beliefs are defended as personal opinion since the link between evidence and beliefs is unclear.
Stage IV	*View of knowledge:* Knowledge is uncertain and knowledge claims are idiosyncratic to the individual since situational variables (such as incorrect reporting of data, data lost over time, or disparities in access to information) dictate that knowing always involves an element of ambiguity. *Concept of justification:* Beliefs are justified by giving reasons and using evidence, but the arguments and choice of evidence are idiosyncratic (for example, choosing evidence that fits an established belief).
Stage V	*View of knowledge:* Knowledge is contextual and subjective since it is filtered through a person's perceptions and criteria for judgment. Only interpretations of evidence, events, or issues may be known. *Concept of justification:* Beliefs are justified within a particular context by means of the rules of inquiry for that context and by context-specific interpretations of evidence. Specific beliefs are assumed to be context specific or are balanced against other interpretations, which complicates (and sometimes delays) conclusions.
Stage VI	*View of knowledge:* Knowledge is constructed into individual conclusions about ill-structured problems on the basis of information from a variety of sources. Interpretations that are based on evaluations of evidence across contexts and on the evaluated opinions of reputable others can be known. *Concept of justification:* Beliefs are justified by comparing evidence and opinion from different perspectives on an issue or across different contexts and by constructing solutions that are evaluated by criteria such as the weight of the evidence, the utility of the solution, or the pragmatic need for action.
Stage VII	*View of knowledge*: Knowledge is the outcome of a process of reasonable inquiry in which solutions to ill-structured problems are constructed. The adequacy of those solutions is evaluated in terms of what is most reasonable or probable according to the current evidence, and it is reevaluated when relevant new evidence, perspectives, or tools of inquiry become available. *Concept of justification:* Beliefs are justified probabilistically on the basis of a variety of interpretive considerations, such as the weight of the evidence, the explanatory value of the interpretations, the risk of erroneous conclusions, consequences of alternative judgments, and the interrelationships of these factors. Conclusions are defended as representing the most complete, plausible or compelling understanding of an issue on the basis of the available evidence.

Table 4: The Seven Stages of Reflective Judgment (King, 2000, p. 20)

6 Writing Education Method Design

This chapter presents the WEM design. Section 6.1 explains the choice for a magazine format for the WEM. Section 6.2 presents the didactic set-up for the WEM. Section 6.3 presents the graphic design for the WEM. Section 6.4 discusses the WEM's impact on education.

6.1 Magazine Format

6.1.1 Explored Options

I was searching for a suitable format for the WEM from the start of this project. I explored various options such as a book, a playful tool, a workshop, a lesson plan, instructional movies, and a web platform. These options did not suffice though. Academic industrial design students do not have time to read books. A playful tool quickly becomes cumbersome as it requires much effort by the user. A workshop is undesirable as teachers cannot make time for that. Instructional movies have some potential but require more work to make than I can spend. A web platform on which teachers can add writing instructions may sound promising but is expensive and difficult to moderate as teachers have different ideas about 'good writing'. Who decides which content gets placed? Who moderates the content to make it coherent and complete? Who manages quality? A web platform would – I think – result in a messy compilation of what is already there. A web platform would not improve the situation.

6.1.2 Magazine Format

I decided to make the WEM in the format of a magazine. This magazine should include articles between two and four pages about the various topics of writing education. These articles give a brief but full explanation of the topic at hand, provide visuals and tables to provide overview, and give further reading tips for students who want to learn more. A magazine can be large enough to cover all writing education topics.

A magazine format addresses the needs of teachers and students well. A magazine for one is attractive to read. Magazine articles are brief and to the point and yet complete. A magazine is graphically attractive. The size of a magazine feels 'light' but complete. Quality material can give the magazine a pleasant 'feel' when holding it or looking at it.

A magazine is suitable for self-study. The division of topics over separate articles makes it easy for teachers to refer to specific topics and easy for students to look up a specific topic. A magazine is easy to explore. Students need a minimum amount of time to study a topic as instructions are brief and yet complete. Overview figures can give students quick reminders when they want to look up something that they learned before. Magazine articles allow for easy referral to further readings.

The character of a magazine does not have such an authoritative status that it is quickly perceived as 'truth'. A magazine leaves room for teachers to disagree and give different instructions if they desire. A magazine should include many references for further reading and by that show its modest place in available literature. A magazine can function well as a framework and benchmark and that is what it should do.

Moderating a magazine is doable since the moderation can be confined to a few moments with a small group of writers. That small group has the discussions once and then can make a decision. Publishing a new version of the magazine every so many years is possible and allows making improvements or changes to keep the magazine up-to-date for example.

A magazine is cheap to produce. The production price starts from below 1 euro at a scale of 1,500 pieces (Drukzo, n.d.). A commercial store price can then start from around 5 euros. A not-for-profit price can start at around 1.50 euros. Such prices are a low threshold for teachers and students to purchase the WEM. A pdf version can be spread for no costs.

6.2 Didactic Set-Up

6.2.1 TSCL method

A WEM needs a didactic set-up to ensure that the instructions address the students' learning well. I used the Ten Steps to Complex Learning (TSCL) method (Kirschner & Van Merriënboer, 2008) to better understand the didactics of writing education and to structure the WEM.

The TSCL method is a prescriptive method to design education programs that aim to educate complex cognitive skills (complex learning) such as written communication. The starting point for the method is a holistic design approach, which means that the learning tasks in the education program

need to be 'authentic whole-task experiences' that integrate the different aspects of writing. Kirschner and Van Merriënboer argue that this approach is more effective for learning than educating the different aspects of complex learning separately (atomistic learning) since these aspects are interrelated and the student needs to learn to integrate them.

The TSCL method includes ten steps (see Figure 5) to design four parts of the education program: learning tasks, supportive information, procedural information, and part-task practice.

> *"The term learning task is used here generically to include case studies, projects, problems, and so forth. They are authentic whole-task experiences based on real life tasks that aim at the integration of skills, knowledge, and attitudes. The whole set of learning tasks exhibits a high variability, is organized in easy-to-difficult task classes, and has diminishing learner support throughout each task class.*
>
> *Supportive information helps students learn to perform non-routine aspects of learning tasks, which often involve problem solving and reasoning. It explains how a domain is organized and how problems in that domain are (or should be) approached. It is specified per task class and is always available to learners. It provides a bridge between what learners already know and what they need to know to work on the learning tasks.*
>
> *Procedural information allows students to learn to perform routine aspects of learning tasks that are always performed in the same way. It specifies exactly how to perform the routine aspects of the task and is best presented just in time—precisely when learners need it. It quickly fades as learners gain more expertise.*
>
> *Finally, part-task practice pertains to additional practice of routine aspects so that learners can develop a very high level of automaticity. Part-task practice typically provides huge amounts of repetition and only starts after the routine aspect has been introduced in the context of a whole, meaningful learning task." (Kirschner & Van Merriënboer, 2008, p.246)*

Below is additional explanation of the design steps:

> *"The analyses of cognitive strategies and mental models are necessary for learners to achieve the nonrecurrent aspects of carrying out the task. The analysis of cognitive strategies answers the question, How do proficient task performers systematically approach problems in the task domain? The analysis of mental models answers the question, How is the domain organized?"*
>
> *"The analyses of cognitive rules and prerequisite knowledge are necessary for learners to achieve the recurrent aspects of carrying out the task. The analysis of cognitive rules identifies the condition-action pairs that enable experts to perform routine aspects of tasks without effort (IF condition, THEN action). The analysis of prerequisite knowledge identifies what learners need to know to correctly apply those condition-action pairs." (Kirschner & Van Merriënboer, 2008, p.250)*

Blueprint Components of 4C-ID	Ten Steps to Complex Learning
Learning Tasks	1. Design Learning Tasks
	2. Sequence Task Classes
	3. Set Performance Objectives
Supportive Information	4. Design Supportive Information
	5. Analyze Cognitive Strategies
	6. Analyze Mental Models
Procedural Information	7. Design Procedural Information
	8. Analyze Cognitive Rules
	9. Analyze Prerequisite Knowledge
Part-Task Practice	10. Design Part-Task Practice

Figure 5: Ten Design Steps (Van Merrienboer & Kirschner, 2007)

I iteratively applied Steps 2 – 9 throughout my design process to create a didactic set-up in WEM design. The method's aim and the intuitive approach make the TSCL method suitable for this design project. There are many aspects to writing and that makes designing an effective and coherent education program difficult. The holistic approach with a set-up of multiple, varying learning tasks allows dealing with this difficulty. The way of thinking that the method prescribes also feels intuitive to me personally. That made integrating the method into my design approach easier and therefore more attainable.

Insights from the TSCL method have multiple implications for the WEM design. The TSCL method points out well the complexity of learning written communication and argues that education should consist of whole-task experiences so that students learning to integrate the different writing aspects and understand their relations to each other. This implies that the WEM focuses on writing full documents such as reports and articles

before it dives into specific aspects. Articles on specific aspects should relate back to the whole-task assignments to help students to obtain an integrated understanding.

Students need 'cognitive strategies' and 'mental models' as the TSCL method labels them to deal with the non-recurrent aspects of written communication. The non-recurrent aspects cover most aspects of written communication except for spelling and grammar. In Section 5.1 and 5.4 I argued that students are better off with rules of thumb for practical writing skill as the need for that is pragmatic and as achieving academic standards on this matter require far more effort than academic industrial design students can spend. I also argued there that academic industrial design students do need to achieve academic standards for 'proper thinking' as that is at the core of their competences. The combination of these insights implies that the WEM purposefully should include cognitive strategies and mental models in the form of rules of thumb for practical writing skill and cognitive strategies and mental models that progress from rules of thumb to academic standards for proper thinking. These choices need to be explicit in the WEM so that teachers and students are aware of the level of education.

The TSCL method shows how writing education should progress with groupings of instructions that focus on one theme, increase in difficulty, and decrease in support. The WEM set-up should reflect this progression. The WEM needs a division in themes with groups of articles. The first article groups should give most support to students and following groups of articles should step-by-step require more independence by students so that they learn to develop themselves independently.

6.2.2 Magazine Set-up

I made an overview of writing topics using my research from this and my previous project and put them in a progressing order using the responses from the teachers that I interviewed. I then transformed that overview into a table of contents for the magazine. Figure 2 shows that table of contents.

The WEM contains three types of themes for students. The first theme 'Starting your writing' includes articles about writing genres, in this case reports. The other theme that includes writing genres is 'Expanding your repertoire'. The themes 'Feeling the writing rhythm' and 'Getting the hang of writing' include articles about the writing process. The themes 'Going a bit deeper' and 'Going considerably deeper' include articles that cover more general writing aspects. 'Wait a second… are these instructions about writing or about thinking?' is an intermezzo article that should make students aware of the relation between thinking and writing. 'Recommended further readings' provides an overview list with references for further reading. The theme 'Teacher instructions' includes articles that discuss the need for writing education and how to go about writing education.

The WEM progresses from hands-on instructions towards an academic way of looking at written communication. The first two article groups fully focus on giving hands-on instructions to get students through their first assignments so that they gain a basic amount of writing experience that they need for more abstract instructions. The first and the fourth group of articles focus on whole-task experiences by focusing on writing genres. Articles from other groups refer back to these articles to explain the relations between writing aspects. The third and fourth article groups start to establish an academic way of looking at written communication while still giving hands-on instructions to go about writing. The fifth and sixth article groups fully focus on establishing an academic way of looking at written communication and give a minimum amount of hands-on instructions to get started. The first article groups work mostly with rules of thumb. Following articles groups increasingly use more abstract academic instructions.

Pages 87 and 88 provide a preliminary draft of the 'My first design report' article to give a concrete example. The draft shows hands-on instructions to get students through their first assignments. The instructions continuously provide rules of thumb to get a hold of the situation. The article also ends with a note that emphasizes that these are only rules of thumb and are limited in their application. The article also uses a table to give an overview that students can quickly look up when they need it and a visual to help students remember that written communication is like speaking on paper.

Written communication in academic industrial design
A writing education method for students and practitioners

Starting your writing
- Introduction
- My first design report
- My first research report
- My first advisory report

Feeling the writing rhythm
- Introduction
- Making a writing plan
- The writing process

Going a bit deeper
- Introduction
- Audience and message
- Structure
- Reasoning and argumentation – easy level
- Visuals and lay-out
- Referencing
- Spelling and grammar

Theme with articles

Wait a second… are these instructions about writing or about thinking?

Expanding your repertoire — Theme name
- Introduction
- Design report
- Design brief
- Research report
- Research article
- Research proposal
- Advisory report
- Business plan
- Curriculum Vitae
- Motivation letter
- Portfolio

Going considerably deeper
- Introduction — Short theme introduction
- Quality of sources
- Reasoning and argumentation – advanced level
- Writing style

Getting the hang of writing
- Introduction
- Writing like talking — Article about writing
- Subjectivity in writing
- Using writing to improve your own work

Teacher instructions
- Introduction
- Why writing education and how to use this magazine
- Our courses are already stuffed, how can we include writing education?
- Getting students to learn writing
- Adjusting writing education to student development
- Assessing writing quality

Recommended further readings — Overview list

Figure 2: WEM Table of Contents

My first design report

You are making your design and your supervisor asks you for a report. What do you need to include in your report? And what should the report look like? This article provides hands-on instructions to get basics of a design report right.

What is a design report?

A design report is a document in which you present the design that you made to the people who are interested in that design. You explain the need to make a design, for which users you made the design, and which steps you took to make the design. You show the design itself and give an explanation of its properties. You explain why your design is a good design: how it addresses the users' needs and how you evaluated the design's quality. You finish your report with conclusions about the steps that are necessary to continue the product's development.

Your audience

The first question you need to ask when writing is: who am I writing for and what do they need to know? This may seem obvious but is not always easy. Your audience may foresee difficulties that you did not for example. Or they might not know as much of the topic as you expected them to know.

You can imagine a conversation with your audience about your design and wonder which questions they would ask you. You can ask someone to read an early version of your report. You can ask people from your audience up front what they expect from your report. You will get better at empathizing with your audience as you gain writing experience.

Your teachers are probably the main audience of your report in case you are attending your first year of education. They need your report to assess the quality of your design process and your final results. So be sure to give a clear overview of both. You cannot expect your teachers to give you points for something that you did not include in your report.

Your report requires a different balance in case you write for a client. You do need to explain the steps of your design process but mainly to convince your client that you took the necessary steps to get to a good result. So keep it brief. Your client furthermore needs to see that you understand the situation of him and the product's users well to feel confident that your design is of good quality. And you most importantly should show the design and support how the design meets the project's requirements. The client finally wants to know which next steps are necessary to continue the design's development.

Structure

Your audience needs to find their way through your report. So you need to give your report a clear structure. Table 1 provides a basic structure that you can use to get started. There is no prefixed structure that applies to all design reports though. You need to find a sensible way yourself to logically sequence the different parts of the report. You can structure the report like an oral presentation for starters.

Be aware that a report should not be a chronological overview of your project. The structure may look chronological but you only show final results that are relevant to your audience. You can structure the sections in a chapter by theme rather than by chronology to get this right.

Use chapters, sections, and sub-sections to make a clear division of the different report parts. Use descriptive headers to inform the reader about each part's contents. Place a topic sentence at the start of each paragraph: a sentence that brings forward the main point of that paragraph. Use the remainder of the paragraph to explain and support that main point.

Explaining your choices

You regularly need to make choices during your design process, e.g. which design methods you use, which materials you apply, or which requirements get priority over others. You should consider for your report which choices are relevant to your audience: which choices should they agree with in order to be convinced that your design is of good quality?

You should explain those choices in your report and give reasons for making those choices. There are many different reasons to make a choice: an expert's opinion, costs-effectiveness ratio, feedback by users, your 'gut feeling', a creative idea, and so on. Not all reasons may be as obvious to your audience as they are to you though. Consider them carefully.

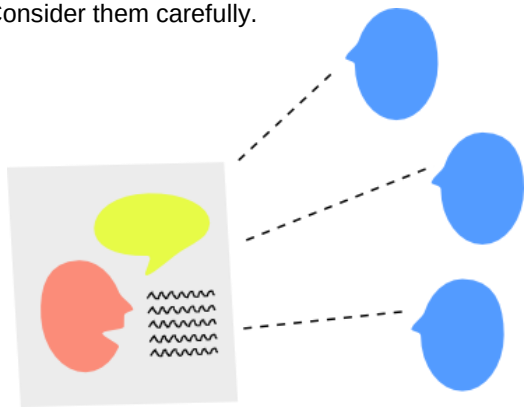

Figure 1: Writing is like speaking on paper. Use formal, professional language to grab a suitable writing style. Also use bulleted lists, tables, diagrams, and such to get the most out of written language.

Visuals

Visuals are a powerful tool to communicate information to your audience. Here you can put your design skills to work. Be sure to use visuals in a functional way to support your text effectively. You can use visuals for multiple purposes:

- To show your product: its looks, working principles, use, and details.
- To explain complex relationships.
- To structure information (with tables).
- And many more purposes. Be creative.

Lay-out

A decent lay-out makes the report easier and more attractive to read. These are some basic tips for a decent lay-out:

- Make a clear difference between different levels of headers.
- Use no more than three levels of headings (chapters, sections, and sub-sections) to keep the document readable.
- Leave enough whitespace on the page to keep the report attractive to read.
- Use a font that is easy to read on paper and on screen.
- Use graphic elements to guide the reader through the pages.
- Use your graphic skills to make the document look attractive. This is a last priority though.

Writing style

Writing style is about how you phrase your sentences. The easiest way to grab a suitable writing style is to write text like you would speak in an official oral presentation (see Figure 1). You can try reading the text out loud to find out if the style 'feels right'. Use professional language like you use in an official meeting with clients for your product. Do not make your sentences too long to keep them readable.

And be consistent in your language. Inconsistent use of terms and names confuses the reader. Inconsistent writing style has a similar effect. Writing consistently can especially be difficult when you write with a group. A writing plan (see the article about that) can help you to consistently use terms and names. You will need to read each other's parts to find out if you use a similar 'tone' of voice.

Important note

This article mainly contains 'rules of thumb' to help you through your first assignments. You will find though that writing is complex and that rules of thumb do not suffice to help you with all your questions. In the magazine part 'Going a bit deeper' we will start progressing to an academic understanding of written communication.

Front page The front page should at least include the report title, possibly a sub-title, the authors' names and prefixes, the place and year of writing, and the name of the organization behind the design project. You can also include other relevant information and visuals.
Summary The summary gives a brief but complete overview of the contents of your report. Some readers will only read the summary! Include the main points from each chapter, especially conclusions and recommendations.
Table of contents The table of contents should include an overview of the chapters, sections, and sub-sections with page numbers at the right side of the page. Increase the indent of the sections and sub-sections to create a clear hierarchy.
1 Introduction The introduction introduces the contents of the report and should at least include the background of the problem situation, the problem definition, the design goal, preconditions for the project, and an explanation of the report's structure (what each chapter is about).
2 Method The method chapter gives an overview of the steps that you took in your design process and supports how those steps contributed to the project.
3 Problem analysis The problem analysis chapter presents the results of research into the problem situation that you conducted. Give a clear overview of the problem situation and explain your problem definition.
4 Program of requirements The program of requirements chapter gives an overview of the requirements for the design. Categorize the requirements and use lists to keep them readable.
5 Concept Design The concept design chapter should present the alternative solutions that you developed and your choice for which solution to continue with.
6 Detailed Design The detailed design chapter shows the final design in detail. Use visuals. Explain how the design works, what its properties are, and how it addresses the user's needs. Support your choices.
7 Evaluation The evaluation chapter explains how you evaluated the design's quality, what the outcomes of the evaluation were, and how you improved the design after that.
8 Conclusion The conclusion chapter gives conclusions about the quality of the final design and which steps are necessary to continue development of the design.
References The references chapter provides a list of all references that you made in the text. Use, consistently, one referencing style, like APA style.
Appendices The appendices include information that 'clutters' the main text but is relevant to at least some readers, like big chunks of data from your analysis work.

Table 1: A basic structure for a design report

Further reading:

Source 1
Source 2

6.3 Graphic Design

A magazine needs an attractive lay-out and visuals to make it appealing for students and teachers to purchase and read. In the example article you can see the graphic design that I made. I do not possess of sufficient skill though to make a professional graphic design. The purpose of the design that I made is to communicate my ideas for the graphic design.

I wanted the graphic design to be 'industrial design like' and to reflect the conflicts that arise in integrate norms and practices from different disciplines. I found inspiration in a TU Delta magazine for shapes that represent 'engineering' to me: straight, thick shapes with sharp corners that are ordered in a clear, straightforward structure (see Figure 3). I wanted to combine these 'engineering-like' shapes with typical industrial design colors that I recognize from my own education. This should create the contrast that I was looking for. I picked colors using Adobe Kuler (Adobe, 2014) (see Figure 4).

Figure 3: Inspiration from a TU Delta Magazine (TU Delft, 2014)

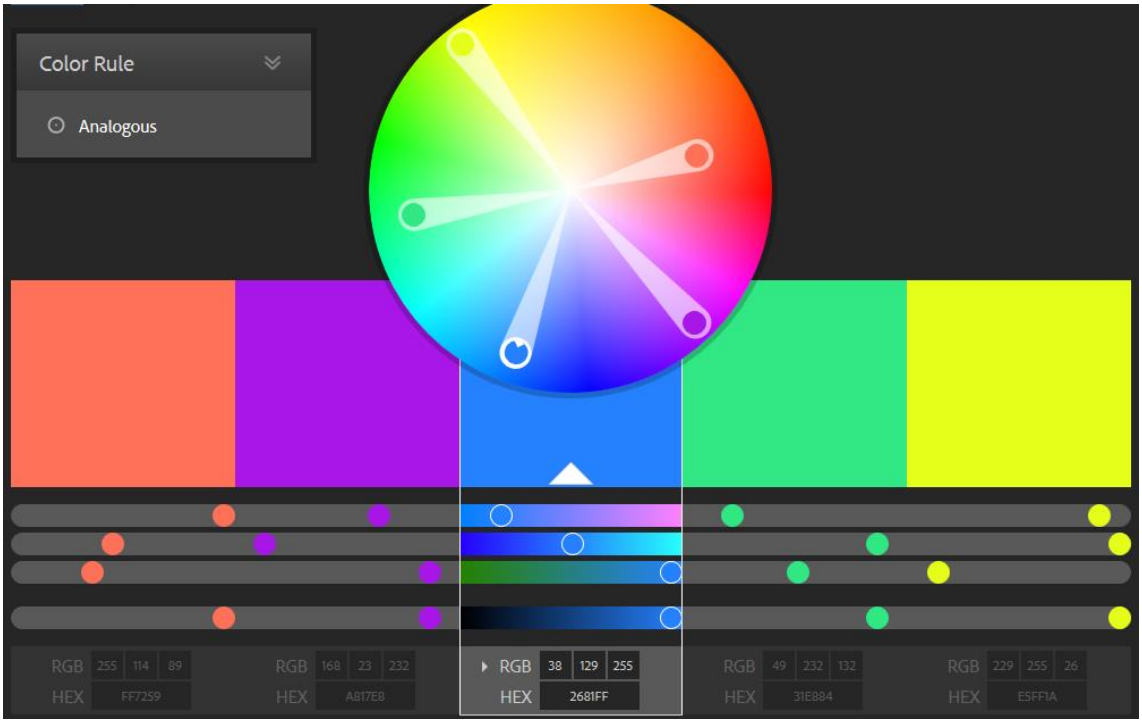

Figure 4: Color Scheme (Adobe, 2014)

6.4 Impact on Education

Use of the WEM will make an impact on education. This impact came forward in the conversations that I had with teachers and students. I foresee multiple consequences for teachers and students.

6.4.1 Consequences for Teachers

Faculty wide use of the WEM means that the WEM becomes available to students from the start of their education and that the WEM becomes part of a collection of literature that students expect to be leading. Students will expect that they can use the WEM in their courses. That means that teachers need to deal with that expectation. That will not be a problem for teachers who desire to use the WEM but it will cause friction when teachers disagree with instructions from the WEM or when a course has different requirements. Teachers will then have to communicate to their which things they see different and what they expect from the students.

The WEM can help teachers to improve their own writing and to set up writing education. Teachers who do not write much can use the writing instructions to get to the level they need to instruct students. The WEM provides instructions for teachers to set up and give writing education in a course. The WEM itself is an example for teachers for how to spread writing education throughout a curriculum and for addressing students at their level. The WEM will therefore confront teachers with their own ideas about writing and writing education.

The WEM cannot take all the work from teachers in writing education but can take the part that teachers want to get rid of: giving the same basic instructions over and over again. Teachers can use the WEM to set up their lessons quicker and can refer students to the WEM for most instructions. Teachers can use the time that they have to give course specific instructions and to answer questions that go beyond the WEM.

6.4.2 Consequences for Students

Students should preferably receive the WEM when they start their education so that they can make optimal use of it. They will probably perceive the WEM as an authoritative source that they can follow blindly but they probably find out soon that teachers have different opinions about how students should write. These different opinions from teachers are probably confusing to students as that probably does not fit their 'world view' (see Section 5.4 about student epistemology). The WEM will require teachers to explain why they disagree though and that will hopefully stimulate the students' epistemological development.

Students can easily carry the WEM around as magazines are lightweight. They will probably use the WEM at home when they write. They might bring the WEM to the faculty if they expect that they will need the WEM. Teachers who want students to use the WEM should probably explicitly state that their students should bring the WEM. A pdf version of the WEM can be a solution for students who do not want to continuously carry the WEM around or do not need it that often.

The WEM can be helpful for group writing as students then have an authoritative source to refer to when they make an effort to improve the group writing process. Yet the group dynamics and culture will probably be decisive for whether the group uses the WEM or not. Teachers can influence that process. Whether students use the WEM when they work alone depends on the students' motivation and whether the student gets sufficient results.

7 Evaluation

This chapter 7 presents the evaluation of the WEM design with users. I mainly needed to find out in the evaluation phase whether the magazine format that I designed is as effective as I expected it to be and if teachers and students would recognize it as such. My main priority for my graduation project was to get the concept design right. Further elaboration of articles could happen after I finished graduation.

Section 7.1 explains the evaluation method that I applied. Section 7.2 presents the evaluation results. Section 7.3 discusses the validity and reliability of the results. Section 7.4 draws conclusions on the WEM design's quality.

7.1 Method

7.1.1 Proofreading

I applied proofreading as evaluation method. I wrote a first draft for seven articles and the theme introductions for participants to proofread and give feedback on. This evaluation method gives particularly valid responses for this development stage as the method confronts participants with a concrete product. They see 'the real thing' and thereby can give concrete and detailed feedback about what they think of drafts. Proofreading is close the actual usage situation wherein users independently use the WEM for self-study. Proofreading has the flexibility that I needed with the short time span that I had for the evaluations. Participants can proofread whenever they can make the time and I could make individual appointments for the evaluation at a time that suited the participants. Trained readers can do the proofreading quickly so that it does not take too much effort from them. Proofreading allowed me to try out writing style and approaches to set up articles. I needed to try these things out for real to find out what I could do concretely and whether that works.

I took eight days to write the first draft for the articles and theme introductions. The seven articles that I wrote drafts of were spread over the magazine. Seven articles was the maximum that I could do in the time that I had and the minimum to give a decent impression of what the WEM would become. I included two articles from the first theme to show how they differ and relate to each other: 'My first design report' and 'My first research report'. I included the article 'Design report' to show its relation with 'My first design report'. I included the article 'Reasoning and argumentation – easy level' to give an example of an article about a specific writing topic. I included the article 'Wait a second… are these instructions about writing or about thinking?' as that article discussed key insights for writing education. I included two articles in the theme 'Teacher instructions' to give an impression of that theme. I wrote a draft for all theme introductions to show the magazine's theme progression. This was also necessary to clarify which topics each theme would include. The time frame to write the drafts was very short so the drafts were quick and dirty. I did not check any draft before sending it to the participants. I knew that there would be language mistakes and writing parts that do not work well. Yet I figured that was okay since the main purpose of the evaluation was to find out whether the magazine concept works. Details were not important at this stage. The quick and dirty approach also left in spontaneous ideas for the article that I otherwise might leave out after the first check. This way I could find out whether those ideas work. Leaving language mistakes would give me insight in frequent mistakes that I make. That allows me to improve my own writing.

7.1.2 Participants

I included two teachers, one recent IDE alumnus, one IDE student, and two education professionals in a coordinating role as participants for proofreading. The two teachers (coded PR-1 and PR-2) have daily first-hand experience for multiple years with teaching students to write. They can be labeled as highly experienced and knowledgeable on the daily practice of writing education in academic industrial design. The IDE student was doing his/her graduation project at the time and the IDE alumnus graduated recently (coded PR-3 and PR-4). These participants can be considered knowledgeable on the students' situation and needs as they recently attended IDE education and could look back on the full experience. The IDE student is native Dutch speaker and has dyslexia. The recent alumnus lived in the USA for multiple years as a child and attended an international school where writing education has a high priority. These different situations gave these participants a considerably different perspective on the need for writing education. One education professional in a coordinating role is highly experienced as industrial design teacher, yet not a frequent writer. The other education professional specializes in scientific writing and coordinates education for that but has little experience with teaching writing to students (coded PR-5 and PR-6). These

participants could give a good account of the perspective from coordinating professionals.

7.1.3 Procedure

I prepared the participants for proofreading with a document with instructions (see Appendix 6). These instructions explained the background of the evaluation, what I expected the participants to do, and provided them with six criteria to keep in mind while proofreading the drafts: The education method…

1. Teaches the right skills and subjects.
2. Fits existing abilities of students.
3. Progresses to an academic way of looking at written communication.
4. Motivates the student with its writing style.
5. Has a comprehensible size and a sufficient level of detail.
6. Supports inexperienced teachers sufficiently.

I sent those instructions along with a document with the WEM's table of contents and the drafts that I wrote. The participants had up to two weeks to read the document. They needed considerably less time to do so.

I planned a face-to-face meeting or a Skype conversation with the participants to evaluate the WEM design with them. One participant had to cancel the Skype meeting and sent feedback by email. The other evaluations took between thirty and sixty minutes. In the evaluation I first explained the current situation of my graduation project and my aim for the evaluations again and gave room for questions about that. Then I explained how I wanted to go about the evaluation. I first wanted to discuss the magazine format for the WEM with the participants: whether that format is suitable for the intended use. Then I wanted the participants to give an evaluation of the WEM with the criteria that I provided to them. I finally wanted them to give other feedback that they had; feedback on the articles themselves for example. The participants largely followed this evaluation set-up but I let the evaluation go in the sequence that the participants preferred. I recorded the evaluations for analysis afterwards.

I did not transcribe the evaluations due to the limited time budget. I made notes of the participants' responses instead by using the recordings. I categorized the notes along the criteria that I provided to the participants. Appendix 7 provides these notes. I made an overview of the results in Section 7.2. I needed to put a different weight on the responses from different participants as they differed on some points. I gave the highest weight to the teacher responses as those participants were most knowledgeable on the full range of aspects of writing communication. They can oversee writing education on an individual level, on a course level, and on a curriculum level from first-hand experience. I then gave the highest weight to the student and alumnus' responses as their have the best view on the students' situation and experiences with writing education. They know what they need since they encountered those needs for over five years of education. I put the least weight on the responses from the education professionals in a coordinating role. They had a good overview of writing education on a curriculum level and one of them has much experience with industrial design education on an individual and course level. Yet I found during the evaluations that the responses from the other participants were more precise, more pragmatic (and thereby more effective), and based on more first-hand experience with writing education specifically. I used the results overview to draw conclusions on the WEM design's quality.

7.2 Results

7.2.1 Feedback on the Magazine Format

The participants responded positive to the magazine format. They stated that the magazine format with articles of about two pages is very suitable since it is hands-on (not a 'dry' book) and that that works best for students. The magazine format is attractive to read. One responded stated that the magazine format can use some tool-like features like overview sheets to support students who quickly want to look up something that they learned before.

7.2.2 Feedback on the Criteria

The participants replied that the WEM set-up meets Criterion 1 'The education method teaches the right skills and subjects'. The WEM has a good systematic set-up and a good selection of topics for academic writing education. Small improvements can be made still. Participants replied that they would like to see a separate chapter about group work, an article about the genre graduation report, more advanced topics specifically to industrial design such as the use of analogies, and a link with oral and visual communication. Two participants replied that they would like to see an explanation in the first theme of the differences between a design report and a research report as instructions now overlap. PR-6 stated doubts about using rules

of thumb for writing as those do not lead to an advanced level of grammar. PR-6 also argued that rules of thumb were not yet presented as such and that that might cause confusion with students. Rules of thumb should explicitly be presented as such.

The participants replied that the WEM design largely meets Criterion 2 'The education method fits existing abilities of students'. All participants agreed that the WEM starts at point zero in giving instructions. PR 1-4 thought this to be a good starting point for first year students who have difficulties with writing. PR-3 stated that instruction preferably should be even more hands-on to help students get started with writing. PR-5 and 6 remarkably had a different opinion. They thought that starting at point zero underestimates the level of students who just came out of high school. Their argument for this thought was that high school students *should* receive decent writing education and the DUT IDE faculty can expect a certain level of writing. I give a higher weight in this matter to the responses of PR 1-4 as they have much first-hand experience with this matter and by that can form a better judgment. Participants also replied that case studies and examples can help to clarify the instructions further; for writing style and visuals for examples. Participants replied that links to further reading should best be placed in the articles where they are relevant.

The participants replied that the WEM design meets Criterion 3 'The education method progresses to an academic way of looking at written communication' as the WEM leads the user in an academic way through the different steps of learning to write and includes theoretical models and instructions to improve the students' thinking. One participant mentioned that the WEM can show the progression more explicitly. Two participants noted that the articles did not include references yet (I had skipped that as I only wanted to write quick first drafts) and that those should be included if I continue development of the WEM.

The participants replied that the WEM design does not perform well yet on Criterion 4 '

The education method motivates the student with its writing style'. Participants replied that the hands-on, informal writing style is fine but that the text includes many 'empty' motivational phrases like "Try it out yourself!' that do not help students. Participants replied that the text motivates most when it gives students precisely the instructions that they need when they need it. Participants replied that exclamation marks do not add anything and should be removed. Participants mentioned that the articles can make better use of graphic elements (show and tell) as some articles were mostly plain text.

The participants replied that the WEM design meets Criterion 5 'The education method has a comprehensible size and a sufficient level of detail'. The articles had a comprehensible size. Links to further reading are desirable to reach a sufficient level of detail. Boxes and visuals and such can make the articles more attractive to read. PR-3 replied that the set-up with theme introductions on a separate page and articles in two columns are attractive to read as they give 'air to breathe' which is important for people who have dyslexia like PR-3.

The participants replied that the WEM meets Criterion 6 'Supports inexperienced teachers sufficiently' quite well but that improvement is necessary. Participants replied that inexperienced teachers can improve their own writing competence with the instructions for students. PR-1 stated that inexperienced teachers have a responsibility themselves to put effort in studying the WEM. Participants stated that the articles in the theme 'Teacher instructions' need considerable improvement still. They need an improved structure that splits up topics clearer and they should make better use of bulleted lists, graphics, and such as the articles were mainly plain text. The articles should also include examples, case studies, best practices, and such to support teachers.

7.2.3 Feedback on the Article Drafts

The participants had many small improvements for the article drafts. These improvements concerned the article structure, textual details, and use of graphic elements. This feedback from the participants is useful for writing new drafts for the articles later in the WEM developments.

7.3 Discussion

7.3.1 Validity

The proofreading set-up was beneficial for the construct validity of this evaluation as it was close to the actual usage situation. Four participants could relate the drafts directly to day-to-day first-hand experiences with writing education. That contributed to the construct validity as well. Actual use might confront users with difficulties that the proofreaders could not foresee now but those difficulties are likely concern instruction details. A beta test with the finished WEM can point out the last points for improvement. The participants showed no hesitation to give critique during the

evaluations. That gives confidence that they did not hold back relevant points.

The proofreaders represented the different groups of users but were few in number. So the generalizability of this evaluation's results may be disputable as other users might react differently to the article drafts. Such different reactions will probably concern different ideas about 'good writing' and the level of support that the WEM should give though; these will always remain points of discussion as teachers disagree about these matters. I do not think that evaluation with other users will lead to different results about the suitability of the WEM format and selection of the topics; I think that those evaluations will only differ on article contents just like differences between respondents' replies in this evaluation.

7.3.2 Reliability

My presence as researcher influenced the evaluations as I steered the conversation and interpreted the results. I feel confident that other researchers would come to similar results due to the use of criteria and recordings to listen back. Participants did not hesitate to give critique and therefore I think that they would give similar responses to other researchers.

7.4 Conclusions

The magazine format is a very suitable for the intended use as it is hands-on and attractive to read. Tool-like features can make the magazine even more hands-on. The WEM design included the right skills and subjects. A few topics can be added and the relation between some parts can be made clearer. The WEM design fits the existing abilities as it starts at point zero. That is necessary for students who have difficulties with writing. The instructions can be even more hands-on to help students on their way and the WEM can go deeper into advanced industrial design topics for excelling students. The WEM design progresses to an academic way of looking at written communication. The WEM design has a comprehensible size and a sufficient level of detail. References to further readings can still improve the WEM on this point and more boxes and visuals can make the WEM more comprehensible.

The WEM design needs structural improvement on two criteria. The hands-on, informal writing style is fine but empty motivational phrases should be left out. Instructions should give users precisely what they need when they need it to motivate users to learn writing. The articles for teachers need structural improvements to make a clearer division of topics, better use of visuals and such to make the articles more readable, and case studies and such to give teachers what they need.

8 Conclusion

This chapter presents my conclusions on the current state of the WEM design and how to continue development.

9.1 Current State of Development

The project goal was to at least partly develop a Writing Education Method (WEM) for academic industrial design education that addresses the needs of students and teachers. The design should have sufficient support from prior analysis and evaluation with users to show that the WEM fulfills its function effectively. The design should give concrete and complete guidelines for further development of the WEM. I succeeded in meeting this project goal in my opinion. The prior analysis filled the gaps in understanding that I needed to fill to become able to make the WEM design. The evaluations confirmed the analysis insights and my expectations for the WEM design's quality. The evaluations also showed which improvements I need to make to get the WEM's quality to the required level. At this point I have a partly finished WEM design that I know how to improve and that I can elaborate further into a product that is ready for testing in education.

9.2 How to Continue Development

The next step is to improve the current WEM design with the evaluation results. The following step is to write the other articles to complete the WEM design. Proofreading is necessary to get these articles to the required quality. The step after that is to try out the full WEM design in education with teachers and different groups of students and to evaluate the design's quality and to make the final improvements. Publishing the WEM then becomes possible after a professional graphic designer and linguist edit the WEM. Bookstores can sell the WEM or education institutes can purchase the WEM for teachers and students as a not-for-profit price can be below 1.50 euros.

Cooperation with a small group of teachers (two or three) who are experienced in writing and writing education is desirable for further improvement and elaboration of the WEM. Their input is necessary to achieve the required quality. Writing in a group can improve the quality and speed of the writing process. Multiple opinions and perspectives are preferable to create a WEM that addresses the multidisciplinary situation of academic industrial design education. Teacher involvement will ensure a better link with the education institute's norms and practices. Teacher involvement can give other teachers confidence in the WEM's quality and by that make acceptance of the WEM's use easier for other teachers.

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Part IV: Branding Starting Points for Developing Academic Industrial Design Education Methods

A Case Study into the Starting Points of a Writing Education Method Design that are Distinctive for Academic Industrial Design Education

1 Introduction

This article presents a brand concept that drives education method development for academic industrial design education. I found in my graduation project that education method development for academic industrial design education requires one to overcome fundamental issues about the academic nature of industrial design and about making academic industrial design education effective. What makes industrial design 'academic' namely is unclear at this point. This makes learning goals for education disputable. In Part II of this graduation report I argue that academic industrial design has certain distinctive elements. Making academic industrial design education effective proves challenging. Academic industrial design namely is an integrated field which requires students to integrate competences from fields with different norms and practices. Students partly need to learn practical design skills and partly need to obtain academic thinking competences and these require different education approaches.

I found ways to overcome these development issues when I designed a writing education method for academic industrial design. I wanted to make the identified issues and their respective solutions explicit and operational for other professionals who develop academic industrial design education methods. An innovation-driving brand can provide the guidelines that other education designers need and can stimulate a coherent approach to education development over multiple projects. I used the writing education method design part of my graduation project as a case study to formulate the brand concept.

Chapter 2 gives an overview of the case and its results. Chapter 3 explains the working principle of an innovation driving brand and formulates the brand concept for driving education method development in academic industrial design education. Chapter 4 draws conclusions on the brand concept's quality and the brand concept's perspective for actual use.

2 Case: Designing a Writing Education Method

2.1 Background

My initiative to develop a writing education method (WEM) for academic industrial design education started when I experienced the need for better education materials myself. Existing writing education materials were not adjusted to academic industrial design and I relied strongly on my teachers for instructions. So I used an elective to conduct a study into which topics writing education should include and how one can set up writing education effectively. I continued the development of a WEM in my graduation project.

2.2 Project Goal

The project goal was to at least partly develop a WEM for academic industrial design education that addresses the needs of students and teachers. The design should have sufficient support from prior analysis and evaluation with users to show that the WEM fulfills its function effectively. The design should give concrete and complete guidelines for further development of the WEM.

2.3 Results

I explored multiple solutions, conducted additional user research, and finally designed a magazine set-up for the WEM as that format suited the needs of teachers and students best. There namely is little room for writing education in courses and a WEM should therefore support self-study by students. Teachers want to refer students to a good source of information for most questions and a WEM can fulfill that function well. The WEM should cover all topics with brief and hands-on instructions that are attractive to read. A magazine format is very suitable for that purpose. A magazine format also allows teachers to disagree with the WEM which is necessary since teachers with different backgrounds have different ideas about 'good writing'. The WEM magazine covers the writing basics for the full academic industrial design curriculum and points to sources for further reading.

I concluded that I found a very suitable format for the WEM and that I had sufficient support from prior analysis and evaluation with users to support that. I conducted user research with teachers and students using draft articles for the WEM. At the end of the project I knew how I needed to improve the draft articles and how I could continue elaborating the WEM.

2.4 Main Issues

I needed to overcome multiple main issues to create the WEM design. Chapter 5 of Part III of this report presents an overview of these difficulties and my conclusions about how to deal with them. The following sub-sections give a short overview of the issues for developing education methods and their solutions.

2.4.1 Purpose of Education

The purpose of academic design education and its consequences for the approach to education should be clear in order to give coherent academic design education. The first question at hand is what makes industrial design education academic? I argue in my essay in Part II of this report that academic designers should particularly capable of solving multidisciplinary problem as academic designers should have a feral understanding of sciences and design and an academic capability to reflect and act on that. This point shows that academic industrial design education should teach academic thinking and philosophy of science and design but that the education approach should be pragmatic. Students should most of all become able to act the obtained knowledge in order to become competent academic industrial designers.

The 'competence paradox' from my essay shows how pragmatic approach to academic education can be difficult to comprehend. Students first learn and should learn practical design skills before they can start to develop their academic competences. Such practical education may seem strange in academic education. Yet the practice of design is the only way for students to obtain a full understanding of the design activity. The students learn later in their development to understand those practical design approaches on a more abstract level and to apply them to different cases. That understanding combined with their understanding of sciences and design allows academic industrial designers to solve multidisciplinary cases. So academic industrial design education should always pragmatically look for a balanced mix of practical and academic education and how practical education prepares students for academic education.

This mix of practical and academic education becomes explicit in instructions for students.

Practical education will mainly provide hands-on instructions (including many rules of thumb) to help students on their way so that they obtain practical experience. Advancing education will progress to an academic way of looking at the topic at hand and focus more on 'proper thinking' and abstract models.

Academic industrial design education should explicitly state which competences students should learn up to a practical level and which they should learn up to an academic level. Students should also become aware of this situation throughout their education. Education professionals need to make choices on how far students should develop certain competences as students have time to only learn so much.

2.4.2 Integrating Norms and Practices

Academic industrial design integrates norms and practices from different fields and written communication therefore also needs to integrate norms and practices from different fields. This can cause conflicts in norms for how one should use information, which information one should present, and so on. Teachers can have different opinions about 'good writing'. Their norms can differ too as assessment is subjective. These factors can cause confusion with students as they receive different instructions for their writing assignments.

Education methods should create overview of these different norms and practices and provide a consistent and coherent approach to deal with the topic at hand. Otherwise students remain in the dark about how to go about it. This can cause friction with teachers who disagree with the proposed approach. Education methods therefore also should make students aware of the different norms and practices and show that people can have different opinions about that. So there should be a contrast in education methods: on one hand education methods should provide consistent and coherent approaches and on the other hand education methods should explain the situation's complexity.

2.4.3 Teaching Situation

Teachers differ in the competence to teach certain topics. Teachers usually specialize in certain areas and might experience that they cannot help students with questions outside their specialization. Other teachers might have developed their competences so far that they have difficulties to empathize with the students' level of development. Teachers from other disciplines may have difficulties to adapt their education to academic industrial design norms and practices. Education methods can support teachers in this matter. Their instructions for students can help inexperienced teachers. The education method's approach can show highly experienced teachers how they should address students and show teachers from other fields the norms and practices from academic industrial design. Education methods can provide guidelines for teachers to set up education so that they do not have to 'reinvent the wheel'.

The amount of available time for teachers to spend on a certain topic varies per topic and depends on the amount of students per teacher as well. Education methods can support teachers in this matter by finding a proper balance between supporting self-study and supporting education by the teacher.

Student ambition varies per student and per topic. Education methods can motivate students with giving precisely what they need when they need it. Education methods can support teachers with tips and tricks to stimulate student motivation.

2.4.4 Student Development

Students first need practical experience before they can understand abstract instructions at a pragmatic level. Teachers nowadays sometimes start with explaining abstract models for example before students can practice with the topic at hand. Students can understand such instructions at a syntax level but not at a pragmatic level as they cannot link it to experience. Students first need hands-on instructions to gain a basic amount of experience before they can understand more abstract instructions at a pragmatic level. This clarifies the 'competence paradox' that I mentioned in Sub-Section 2.4.1. Education methods should support such progress.

Many competences need to grow over time and practice and therefore over multiple courses. Supporting students' development by that becomes a shared responsibility that requires adaptation from different courses. Education methods can support teachers in this matter by providing guidelines for that on the specific topic (like the learning line that Wever and Willemsen (2013) develop for industrial design writing education at the Delft University of Technology).

Students' interpretation of instructions depends on their epistemological development (Wever and Willemsen, 2013; King, 2000); their understanding of what knowledge is and how knowledge is constructed. This matter does not address a single competence or course but is a general matter for the whole curriculum. Education methods should adjust instructions to

the expected development stages of students, actively support epistemological development, and make teachers aware of this issue and how to deal with that.

3 A Brand for Education Materials

3.1 Brand-Driven Innovation

The main issues that I found and the solutions that I found for those issues provide valuable lessons for the development of other education methods. I need to make those lessons operational for application in other development projects to achieve that though. A brand can help with that as a brand can drive future innovation in a coherent and a consistent manner by means of a brand promise. Abbing (2010) explains how this works.

Abbing (2010, p. 19) argues how one should understand 'the brand' in this matter: "The brand can best be defined as the relationship an organization has with the outside world. It is the platform for the shared understanding between marketing and innovation, and between organization and user […] From the process point (where the brand sets processes in motion and inspires people to innovate) the brand must bridge the gap between the marketing department (where the responsibility for the brand lies in most organizations) and the departments where innovation takes place (maybe R&D, or the design department, or maybe even manufacturing)." In other words: the brand expresses the value that the to-be-developed products should bring to the product's users. Product developers use this expression of value to guide the product's development.

Abbing argues that the 'brand promise' is the concrete part that connects branding and innovation. He defines the brand promise with a quote: "I understand what you find valuable, I understand my role in delivering that value to you, and I will do my best to fulfill that role." (p. 32). An elaboration of the brand promise in written text can help product developers to turn the brand promise into action. The next section provides a brand promise that can guide education method development for academic industrial design.

3.2 Academic Industrial Design Brand

I used the lessons from the case study to formulate the brand promise below that can guide education method development for academic industrial design. I formulated the lessons as practical design principles so that they immediately are operational for education method development. I named the brand 'Label Academic Industrial Design' to bring the intentions behind the brand to the foreground.

'Academic Industrial Design' Brand Promise

The 'Academic Industrial Design' (AID) brand stands for a coherent and consistent approach to education method development that is tailored to industrial design education at an academic level. Development under the AID brand consistently applies a set of design principles that help developers tackle the difficulties in education method development that arise from the integrated nature of academic industrial design and the challenges that education brings. These design principles are the following:

- *Academic industrial design education is pragmatic and focuses on skills, competences, and knowledge that students need to tackle highly complex, multidisciplinary problems. Students need a mix of practical and academic education to become able to do so.*
- *Education methods should first provide hands-on instructions to help students obtain a basic amount of experience with the topic at hand. Education methods can then progress to an academic way of looking at the topic at hand in case that there is a pragmatic need for that.*
- *Education methods seek to provide a coherent, integrated set of norms and practices for academic industrial design while leaving room for teachers to disagree with that. Education methods should make students aware of the situation and not force teachers to accept certain views.*
- *The education methods themselves are exemplary to teachers for how they can address students with instructions and how they can build up education throughout the curriculum. Education methods also provide teachers with instructions to get education started.*
- *Education methods seek to take work out of the teachers' hands that is a waste of the teachers' time so that teachers can focus on the part where students actually need the teacher for. Education methods do not seek to replace teachers altogether.*

4 Conclusion

The value of the Academic Industrial Design brand is in its explicit approach to education method development. This approach includes solutions and choices that education method developers otherwise lose much time on finding. Application of the AID brand would make instructions about different topics more coherent and by that more comprehensible for students. Education quality might also improve with application of the AID brand. Yet the question remains how much support education method developers need before they understand the full meaning of the design principles; the list itself probably does not suffice for that. Another question is what to do if other education method developers disagree with design principles. Enforcing the design principles would be necessary but might not be beneficial to the development process. A further question is what the influence of application of the AID brand might be on education. Teachers might feel forced to accept a certain view on academic industrial design that they disagree with. Development under the brand should be careful with promoting its views as that might frustrate the academic process of developing knowledge.

Actual application of the brand would be a challenge as the diversity in opinions of teachers would provide many hurdles to take. A capable project leader is necessary to involve those teachers at one hand and pursue a consistent brand promise at the other hand. A publisher of education methods would have to take up the brand for multiple development projects to make the brand of use. The strength of the brand namely only comes into play if students and teachers notice that the brand is widely applied and experience benefits of the brand's application. Explicitly adding the publisher's name might strengthen the brand's authority.

I think that this article's value is mostly in the lessons that the article provides for other education developers. This article can make them aware of issues that play a role in education and provide approaches to solve those issues. The brand set-up of this article helps to make those lessons operational. The brand idea may become valuable if this report inspires multiple education method development projects.

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Appendices Section I

Appendix 1: Literature Study into Industrial Designer Professionalization

This appendix gives an overview of the data from the literature study into professionalization. First, this appendix presents the data of the study into industrial designer professionalization. Second, this appendix presents the data from scientific journals of the study into teacher professionalization. Third, this appendix presents the data from professional organizations of the study into teacher professionalization.

1.1 Literature Study into Industrial Designer Professionalization

This section presents the data from the literature study into professionalization, sorted by the categories professionalization of the design field as a whole, the psychological profile of the industrial designer, and industrial design education.

The first category focuses on professionalization of the *design field* as whole; i.e. it looks at how the design field developed into a professional and academic one. Swann (2002) explains how the design profession developed into a professional field and how a reflective approach to the design activity – action research - can improve accountability of design professionals. Pacey (1992) explains how design is not just a professional activity but that all people design to improve their lifes and that one should regard a professional notion of design not without the wider notion that everyone designs. Atkinson (2008) explains that the boundaries between the professional and the amateur designer (the user) have been "constantly contested, transgressed, and rejected" and that professional designers need to learn to co-create with users. Yagou (2010) explains how design education and professionalization in the 1920's and 1930's in Greece was frustrated and how that "undermined the perception and development of design in the long run". Lees-Maffei (2008) explains how interior design actually professionalized while Western culture still labelled it an amateur phenomenon and "professionalization is an extremely useful and revealing focus for understanding the genesis, characteristics and significance of interior design and design and its histories more broadly". Buchanan (1990) explains how design studies at the time was still in a formative stage and that it needs to find its place as an academic field related to the professional field. Kennedy (2010) explains how web design professionalized and how web designers look at it today. Champy (2006) explains how economic pressure influenced the professional discourses of industrial designers and landscape designers. Beegan and Atkinson (2008) explain the difficulties in defining professional and amateur design and the relation between them. Marchand (1991) explains how in the 1930's the role of industrial designers increased in making products appeal to the public. Eneberg (2011) explains the professionalization of industrial design consultancies and that they should shift from a product-oriented approach to a service-oriented approach. Valtonen and Ainamo (2008) explain which processes characterized the professionalization of industrial design in Finland. Bruce and Willis (1990) explain how the opportunities for women are negatively affected in the professionalization of design consultancy.

The *psychological profile* of the (industrial) designer category focuses on what happens in the mind of the individual designer. Lewis and Bonollo (2002) present a model for the design process based on expectations from the field that gives implications for what skills and behaviors designers need learn in education. Bohemia (2002) explains that the integrator role of industrial designers is not valued as such by organizations. Smulders and Subrahmanian (2010) look at design thinking and acting to better understand the transfer of design skills and attitudes beyond the world of design. Buchanan (1992) discusses design thinking. Tomiyama et al. (2009) give an overview of design methodologies and discuss their use and for practical and educational purposes. Cross (2004) gives an account of novice vs. expert design behavior. Lawson (2004) argues that 'schemata' and 'gambits' play an important role in design expertise. Lewis and Bonollo (2002) identified professional skills in design and argue that education does not meet the needs of professional disciplines. Yang et al. (2005) identified competencies and qualifications for industrial design jobs and discuss implications for education. Bohemia (2002) explains that the integrator role of designers in organizations is not valued so much in practice. Perks et al. (2005) offer a taxonomy that

characterizes the roles of design in product development. Valencia et al. (2011) describe how managers look regard designers. Smith and Whitfield (2005) give an account of the public perception of designers. Cross (2001) discusses the relation between science and design and how design knowledge is different from science knowledge.

Literature on *industrial design education* looks into many different aspects. Lewis and Bonollo (2002) identified professional skills in design and argue that education does not meet the needs of professional disciplines. Yang et al. (2005) identified competencies and qualifications for industrial design jobs and discuss implications for education. Levy (1990) discusses the competences and qualifications that industrial design education should include. Hirsch et al. (2002) discuss the benefits for education of collaborating with professional designers. Kolb et al. (2001) discuss their model for experiential learning theory. Swanson (1994) discusses issues in graphical design education. Köksal and Eğitman (1998) discuss the results of the application of a method to improve industrial design education.

1.2 Literature Study into Teacher Professionalization

This section presents the data of the literature study into teacher professionalization, sorted by year of publication. For each article, this section presents a short overview of the study and an interpretation for the analogy.

Professionalization in Teaching and Teacher Education: Some notes on its History, Ideology, and Potential (Popkewitz, 1994)

This study explored how people in the USA used the term professionalization over time and how it is not only used to describe the act of teachers developing themselves, but also how it is used in social and political context where it shows the underlying intellectual, social, cultural, and economic relations that underlie teaching. This study stresses how professionalization is subject to "larger struggles and power relations of the world which include the intellectual production of knowledge and the development of expert mediated systems of ideas".

Interpretation: It is important to understand professionalization not only as a factual event of professionals developing themselves, but also as part of a larger context in which social and political mechanisms influence the 'agenda' of professionalization. One should, for example, also regard the organizations and social groups in which the industrial design alumni involve themselves to determine what is important for them in professionalizing themselves.

Teachers' professional development: a solitary or collegial (ad)venture? (Clement & Vandenberghe, 2000)

> "In this paper the impact of two workplace conditions, autonomy and collegiality, on elementary school teachers' professional development is analyzed. The qualitative research reported makes clear that this influence should be thought of in a balanced way. Certain forms of autonomy and collegiality - and more specifically certain combinations of both workplace conditions - have a far more positive influence on teachers' professional development than others."

Interpretation: In professionalization in general, a balance between autonomy and collegiality is important. As this balance is influenced by the context, it probably needs to be reconsidered for each discipline. So this balance needs attention for industrial design alumni, but it is unclear at this stage where this balance lies.

Intertwining opportunities: participants' perceptions of professional growth within a multiple-site teacher education network at the secondary level (Hudson-Ross, 2001)

This study identified the sites for professional development of teachers in multi-site school partnerships: individual school and university classrooms, school and university departments, the teacher network, and teacher education locally and beyond. Also, the study argues that it is difficult to maintain professional development collaborations over time, so that "the group must be emergent, forgiving, and accommodating; focus on both individual and organizational development; draw on its own members for leadership and expertise; involve all partners in finding and solving problems; seek connections beyond its boundaries; and continue to be self-critical and reflective" (Miller & O'Shea, 1996).

Interpretation: The identification of the sites shows that professionalization happens all the time, on the work floor and in professional networks. This is likely to also be the case for industrial design alumni. The study also gives insight into how collaborations for professionalization should

function. This might very well apply to industrial design collaborations as well.

Case stories of facilitating professional development (Jenlink & Kinnucan-Welsch, 2001)

> "This article reports on an 18-month study of teacher study group facilitation in a 25 district consortium. The teacher study group was viewed as an alternative form of professional development within the context of a funded project. Case story, as a form of narrative inquiry, was used to work with participants to construct their own stories of personal experiences as members and facilitators of teacher study groups. The stories shared in this study indicate that facilitation of and participation in a study group as an alternative form of professional development affords an opportunity for transformation through personal growth and professional learning."

Interpretation: This study confirms the need for facilitation and conversation with other professionals to stimulate professionalization. One can probably directly translate this insight to industrial design alumni, who therefore also might benefit from facilitation and conversation with other professionals.

Inquiry as professional development: Creating dilemmas through teachers' work (Crockett, 2002)
This article is about a case study into the functioning of a teacher inquiry group: a collaboration between teachers where they observe each other's lessons and then together reflect on that. The study confirmed that assessing the students' work generated debates that enriched the teachers' thinking about the content of their discipline.

Interpretation: The study presented in the article confirms that professional inquiry groups can help professionals forward in their understanding of their discipline. It is unclear, though, how it precisely would help industrial design alumni.

A systemic approach to professional development: learning as practice (Knight, 2002)
This study stresses that professionalization of teachers does not occur primarily in workshops; courses; and suchlike events, but that it happens mostly on the work floor: in daily professional practice. Furthermore, the study suggests that professionalization should become a continuous effort in daily practice (instead of separate instances like workshops) and that policies should support professionalization in this sense instead of using a managerial approach.

Interpretation: This study implies that one should not understand professionalization of industrial design alumni as singular acts, but as a continuous effort that happens throughout each working day. Providing opportunities for professionalization should align to this understanding of a continuous effort.

Collaboration and self-regulation in teachers' professional development (Butler et al., 2004)
This study investigated the effectiveness of a professional development model with a focus on the interface between collaborative inquiry in a learning community and teachers' self-regulated learning. They found that teachers who reflected on practice constructed new knowledge and made positive changes in how they work. Their study confirmed that teachers benefit from participating in a collaborative learning community and that self-regulated learning can work well in combination with that.

Interpretation: This study confirms the use of reflection on observations made by peers and it confirms that while professionals need to develop themselves individually, they benefit from participating in learning communities.

Professional development in a culture of inquiry: PDS teachers identify the benefits of professional learning communities (Snow-Gerono, 2005)
This study identified two shifts "in traditional school cultures in order for teacher inquiry to thrive as a means for teacher development". First, "teachers in this study spoke about their need for supportive learning communities where they may collaborate and engage in dialogue with colleagues and other professionals". Second, "professional learning communities created opportunities for dialogue which also made it safe to ask questions and work in a community where uncertainty was not only valued, but supported".

Interpretation: The study shows the importance of collaboration (including people and dialogue) through community for professionalization. One should not regard professionalization by industrial design alumni as individual efforts, but as efforts that include multiple people in dialogue. The finding of the study that teachers need an environment where uncertainty is valued and supported seems to be very context-specific:

industrial design alumni might not necessarily experience this need, depending on the organizational culture in which they take part. Nevertheless, room for uncertainty might still be an important feature for effective professionalization.

Teachers' reflections of professional change during a literacy-reform initiative (Nielsen, 2008)
This study investigated the teachers' view about the change process and professional development that supports change during a nationwide instructional reform through professional development. "Three conditions supported their professional growth: professional development embedded in school and classroom contexts, professional development focused on limited and clearly defined learning goals, and on-demand access to time and resources. Changes that occurred did so in three phases: movement from curriculum-centered to student centered practices, increased collaboration, and requests for policy changes via teacher autonomy and advocacy for students."

Interpretation: The conditions for professional growth probably apply directly to industrial design alumni as well: embedding professional development directly in working practice, defining limited and clear learning goals, and providing on-demand access to time and resources. Increasing collaboration and involving the industrial design alumni in setting the agenda for professionalization probably also apply, as this is in line with other literature in this appendix.

The antecedents of teacher satisfaction with professional development programs (Nir & Bogler, 2008)
This study investigated the hypothesis "that the higher the control teachers have over job professional development processes, and the greater the resemblance of these processes to the typical teaching culture in classrooms, the greater the teachers' satisfaction with job professional development processes". The findings of the study "demonstrate that the main factors affecting teachers' satisfaction with the instructional programs are related to their desire to maintain instructional processes ''close to home'', and to shape these processes in accordance with their needs and expectations". The results also showed that "that having a positive attitude towards one's job is connected with the individual tendency to professionally develop".

Interpretation: This study shows the importance of personalized development and on-the-job learning (professionals prefer to develop themselves on their working location itself). The study also indicates that an industrial design alumnus may have more motivation to develop if he or she has a positive attitude to his or her job.

Professional development design: Embedding educational reform in New Zealand (Starkey et al., 2009)
This study investigated teacher professional development as a function of the particular stage of an educational reform in New Zealand. It found that teachers want to involve themselves in setting priorities for the professional development and that networking with other subject area colleagues, personalized learning, and skilled and sensitive facilitation are important features for teachers. The study stresses "the importance of tailoring professional learning to implementation phase of an organizational change".

Interpretation: It is important to note that this study regards a situation in which an authority induces professionalization on a large scale with a top-down approach. Therefore, the results of this study can give insight into organization wide professionalization. If industrial design alumni are subject to professionalization efforts induced by an organization of which they are part, it is likely that tailoring is also important to them. Networking with other subject area colleagues, personalized learning, and skilled and sensitive facilitation can be important features for them as well, just as involving themselves in setting priorities for professional development.

Teachers learning how to learn (James & McCormick, 2009)
This study investigated the learning of teachers in primary and secondary schools. The results showed that teachers' own engagement in collaborative classroom-focused inquiry was a key factor for effective learning. This needed to be supported by school management and leadership to be successful, though. The study also showed that networking between teachers inside and outside of their school is important for their learning.

Interpretation: This study confirms that professional development in groups, by means of reflection on observations, is effective for professional development. The study also indicates that if industrial design alumni want to engage in professional development, they need support from

the organization they work for. Finally, the study indicates that networking between industrial design alumni is important for their learning.

How the structure and focus of teachers' collaborative activities facilitate and constrain teacher learning (Levine & Marcus, 2010)

This study investigated how different kinds of collaboration between teachers leads to different learning and different constraints in learning. The study results "suggest how the structure and intended focus of collaborative activity can influence (1) how often and how concretely teachers discuss their teaching with colleagues; (2) which aspects of schooling collaboration will address; and (3) what opportunities for teacher learning are afforded and constrained". The study stresses that building a community in itself is not enough to make sure that teachers will learn, but that structuring and focusing the community is necessary to establish different kinds of learning.

Interpretation: The study shows that if a learning community is built for industrial design alumni, which other literature indicates to be effective, a proper structure for the community is of great importance to reach the intended goals.

ICT professional development for teachers in online forums: Analysing the role of discussion (Prestidge, 2010)

> "This paper explores the role of engaging teachers in constructive dialogue within ICT professional development activity. The findings suggest evidence of both collegial and critical forms of discussion. Collegial discussion was found to be important in developing and maintaining community while critical discussion was vital for its role in transforming teachers' beliefs."

Interpretation: This study indicates that ICT solutions, such as forums, can be helpful for learning communities to function, because it can stimulate critical discussion. The extent to which this works for industrial design alumni is unclear, though.

Impact of professional development on teacher practice: Uncovering connections (Buczynski & Hansen, 2010)

This study investigated the application of Inquiry Learning Partnership in professional development for teachers. While professional development was achieved, the study identified the following obstacles: limited resources, time constraints, mandated curriculum pacing, language learning (science vocabulary), and classroom management issues.

Interpretation: Some of the identified obstacles are teacher-specific and some can probably be applied to industrial design alumni as well. Limited resources and time constraints are most likely to be applicable to industrial design alumni as well, but the other obstacles indicate that there might be more, unidentified industrial design-specific obstacles which play a role.

Towards a collaborative, interactionist model of teacher change (Kaasila & Lauriala, 2010)

"The aim of this article is to extend the scope of the models of teacher change to an interactionist view which co-ordinates sociocultural and constructivist perspectives." The results show that roles, statuses, expectations, social norms and socio-content-related norms influence the teacher development process.

Interpretation: This study indicates that roles, statuses, expectations, social norms and socio-content-related norms can influence the professional development of industrial design alumni. In other words, the social group in which the alumni take part influences the alumni's learning process.

Effective teacher professionalization in networks? (Hofman & Dijkstra, 2010)

> "Teacher professionalization has been focused to strongly on external experts and a one-size-fits-all set of solutions that often fail to distinguish between the needs of different teachers. This article describes a research into teacher networks that might be more successful vehicles for professional development of teachers. The results show that networks that focus on (self-) reflection, that exploit subgroups and networks meetings with a strong content focus, that stimulate enthusiasm and are instructive, that build a community of teachers and that make room for application of new materials/methods in the classroom, are the most promising ways for professional development and job motivation."

Interpretation: This study emphasizes the point that solutions for professional development need to allow room for different needs, in this case professionalization in networks. The focus points that the article presents are probably applicable to

industrial design alumni professional development as well.

Reflection in a social space: Can blogging support reflective practice for beginning teachers? (Killeavy & Moloney, 2010)

> "This study reports on an investigation on the use of electronic journals to support beginning teachers in developing reflection on teaching within peer support networks. Results show little evidence of the development of a more reflective approach attributable to the maintenance of a blog. However review of earlier postings led to some reflective personal and group dialogue."

Interpretation: This study shows that using blogging to support reflective practice probably has little potential for industrial design alumni in their professionalization efforts.

An integrated professional development model for effective teaching (Kuijpers et al., 2010)

> "This article examines the design of a professional development model that aims to improve student achievement. On the basis of this examination six aspects from the existing models were incorporated in the new model (presentation of theory, demonstration of skills, practice in a secure environment, pre-conference, observation and post-conference). Three further aspects were added to ensure compliance with all nine principles for effective school improvement (creation of the appropriate conditions, evaluation and monitoring conference and a focus on goals at school, teacher and student level)."

Interpretation: This study confirms that professional development transcends disciplines and that the mentioned aspects – which also come forward in earlier studies – are relevant to professionalization.

Teacher professional leadership in support of teacher professional development (Taylor et al., 2011)

> "This evaluation study investigated the results of a professional development initiative for subject specialist teachers seconded to a leadership role in their curriculum areas. The findings of this study indicate expanded leadership roles may further develop experienced professionals while simultaneously supporting teacher knowledge during a period of embedding educational reform."

Interpretation: The insights from this study can be used to give more experienced industrial design alumni a better fitting role in professionalization. Of course, they can always keep on developing their skills, but there might be a mutual benefit from them taking a leading role in this matter: they can transfer their experience to less experienced alumni and they themselves can grow further onto a whole new level.

Teacher professionalization: Motivational factors and the influence of age (Hildebrandt & Eom, 2011)

"This study examines motivational factors of teachers who have achieved a national standard of professionalization. Exploratory factor analysis found five motivators: improved teaching, financial gain, collaborative opportunities, self and external validation. Analyses of Variance (ANOVAs) highlighted differences in the financial gain and external validation motivations, depending on the teacher's age at the time of certification." Financial gain lowers as a motivation is higher with teachers in their 30's – when they have more financial obligations such as children and housing – than with teachers in their 40's and 50's. Teachers in their 30's also feel a stronger need for external validation than teachers in their 50's.

Interpretation: These motivational factors might represent something that is relevant to all people in their work who have achieved a national standard of professionalization. Given the provided reasons, the motivational factors financial gain and validation may very well be applicable to industrial design alumni as well. The factor collaborative opportunities is less likely to be an important factor, as industrial design alumni – in contrast to teachers – usually work in teams and at least need to cooperate with people to do their work. Better teaching would translate to becoming a better designer, which one would expect to be a motivating factor to participate in professionalization.

Do blended virtual learning communities enhance teachers' professional development more than purely virtual ones? A large scale empirical comparison (Matzat, 2013)

"This article examines whether a mixture of virtual and real-life interaction - in contrast to purely virtual interaction - among some members of online communities for teachers is beneficial for all

teachers' professional development in the whole community. The findings indeed show beneficial effects of blended communities." It reduces free riding and problems of trust and increases the practical benefits of the online community for teachers. "Teachers profit from their colleagues' more intensive discussion contributions and sharing of material."

Interpretation: This study gives reason to believe that if industrial design alumni participate in online communities for professionalization, they are likely to benefit from combining this with face-to-face contact.

1.3 Results of Literature from Practice

Organizations need to support professionals in professionalization efforts. They need to create the proper culture and provide the time, resources and opportunities that professionals need for professionalization (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Zijlstra, Meerman, & Van 't Hooft, 2011). Additionally, the organization should provide vision for professionalization and should include the professionals in setting the agenda for professionalization (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013). Organizations can put minimum demands of competence in place and minimum demands for organization divisions to support professionalization (Vrije Universiteit Amsterdam, 2009)

Professionals need personalized learning goals and individual coaching (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Teurlings & Uerz, 2009; Zijlstra et al., 2011). As professionalization is a continuous, cyclic process and learning on-the-job makes professionalization relevant, it is important to integrate professionalization efforts with daily work (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Teurlings & Uerz, 2009). Self-reflection is important for professionalization (Inspectie Van Het Onderwijs, 2013).

Professionalization in groups is effective: it supports cooperation and reflection through dialogue (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013; Teurlings & Uerz, 2009; Zijlstra et al., 2011). Professionals appreciate it and it supports common learning goals as well as individual learning goals (Teurlings & Uerz, 2009).

Professional inquiry groups are an effective method to professionalize. Giving quality feedback, however is not easy (Vrije Universiteit Amsterdam, 2009; Inspectie Van Het Onderwijs, 2013).

For professionalization it is effective to have experienced professionals share their experience with less experienced colleagues. In the process of professionalization it is also important to give experienced professionals the recognition they deserve (Vrije Universiteit Amsterdam, 2009; Zijlstra et al., 2011).

Appendix 2: Teacher Professionalization as Analogy

According to the Oxford Dictionary of English (2006), the word analogy means "a comparison between one thing and another, typically for the purpose of explanation or clarification". This part of the literature study aims to do just that: to compare teacher professionalization with industrial designer professionalization in order to find relevant themes for what constitutes effective professionalization.

Smaling (2008) elaborates on this way of reasoning, which he defines as analogical generalization: "when research results obtained from one case are to be generalized to another case". Smaling then continues on how on should establish analogical generalization. "Analogical generalization is based on analogical reasoning. Such reasoning is only plausible when there are solid arguments that, when a particular researched case has characteristics which are relevant for the research conclusions, another case that has not been researched also has these relevant characteristics."

Continuing this line of thought, Smaling (2008) elaborates on six qualitative criteria to assess the plausibility of analogical reasoning:

- The relative degree of similarity: Analogical reasoning is more plausible when it has more similarities and fewer differences.
- The relevance for the conclusion: Analogical reasoning is more plausible when the similarities are relevant for the conclusion and less plausible when the differences are relevant for the conclusion.
- Supported by other, similar cases: Analogical reasoning is more plausible when there are other similar cases to support the reasoning.
- Support by means of variation: Analogical reasoning is more plausible in case there are multiple comparisons which share the essential similarities for the conclusion, while they differ strongly on their other characteristics.
- The relative plausibility of the conclusion on its own: "The more plausible or probable the conclusion is on its own, apart from the analogy, the more acceptable the analogical reasoning" (Smaling, 2008).
- Empirical and theoretical support: "The analogical reasoning is more plausible insofar as the knowledge about the similarities and differences between the cases and their relevance has been supported more firmly, empirically, and theoretically" (Smaling, 2008).

So how strong is the analogy between teacher professionalization and industrial designer professionalization? Lewis and Bonollo (2002) identified industrial designer professional skills and provided a description of industrial designer professional behavior based on those skills (see Table 1). Creemers and Kyriakides (2006) list eight effectiveness factors for teacher behavior (see Table 2). I used these descriptions of professional behavior to identify similarities and differences between the industrial design and the teacher profession (see Table 3). Using these, I can discuss the strength of the analogy.

Industrial Designer Professional Behavior
Negotiation with clients — includes task clarification, but extends beyond this in cases where clients' ideas change or develop during the project.
Problem solving — the core intellectual activity of a profession, represented in the case of industrial design by design process skills.
Acceptance of responsibility for outcomes — behaving as an autonomous professional.
Interpersonal skills — establishing rapport with clients and colleagues and working constructively with them.
Project management — planning schedules and organising work to ensure that schedules and performance targets are met.

Table 1: Industrial Designer Professional Behavior (Lewis and Bonollo, 2002, p. 396)

Effectiveness Factors Teacher Behavior
"*Orientation* refers to teacher behaviour in providing the objectives for which a specific task or lesson or series of lessons take(s) place and/or challenging students to identify the reason for which an activity takes place in the lesson." (p. 16)
"Structuring – achievement is maximised when teachers not only actively present materials but structure it by: a) beginning with overviews and/or review of objectives; b) outlining the content to be covered and signalling transitions between lesson parts; c) calling attention to main ideas; and d) reviewing main ideas at the end." (p. 17-18)
"*Questioning techniques* – Effective teachers ask a lot of questions and attempt to involve students in class discussion." (p. 19)
"*Teaching modelling* – effective teachers are expected to help pupils to use strategies and/or develop their own strategies which can help them solve different types of problems." (p. 20)
"Application – Effective teachers also use seatwork or small group tasks since they provide needed practice and application opportunities" (p. 21)
"The classroom as a learning environment: The contribution of the teacher - classroom climate is a factor that teacher effectiveness research has found to be significant." (p. 22)
"*Management of time*" – Teachers need to manage time since "time on task" is important for effective learning. (p.25)
"Teacher Evaluation - Evaluation is seen as an integral part of teaching and especially formative evaluation is one of the most important factors associated with effectiveness at all levels and especially at the classroom level" (p.25)

Table 2: Effectiveness Factors Teacher Behavior (Creemers and Kyriakides, 2006)

Comparisons		Similarities	Differences
1	Negotiation vs. orientation	Both are about task clarification between someone who gives the task and someone who carries out the task	The teacher is like the client as the student is like the industrial designer; learning is process-oriented whereas design is result-oriented
2	Problem solving vs. structuring, questioning techniques, teaching modelling, and application	Structuring and problem solving is part of both professions; reflection in design is like questioning oneself	Teacher's work is about putting others to work whereas the industrial designer puts himself to work
3	Acceptance of responsibility vs. teacher evaluation	Both professions require taking responsibility and actively improving oneself with feedback	The formal setting for evaluation is different for the professions
4	Project management vs. the classroom as a learning environment and management of time	Both professions require management of the time schedule and physical and cultural environment	The professions have a different culture
	Interpersonal skills vs. orientation, questioning techniques, and teaching modelling	Interpersonal skills are important in both professions to carry out work; the conversations have similar set-ups	The industrial design profession focuses on what the designer does, the teacher profession focuses on what the student does

Table 3: Analogy Similarities and Differences

The industrial designer and teacher profession have a relatively strong degree of similarity since there are similarities visible between all aspects of professional behavior for both professions. These similarities are about the work processes of the professions and therefore are relevant to the analogy since professional development – a main part of professionalization – seeks to improve the work processes of professionals. One recurring difference is that the designer is the person of attention in the industrial design profession while the student is the person of attention in the teacher profession. In similar processes, like task clarification, the industrial designer and the teacher do not always assume the similar role. This implies a different accent for professionalization, although both professions require training of similar processes. Other differences are different formal set-ups for professional activities and different cultures in both professions. These differences do not make the analogy uncredible since both regard adjustment of work processes and not a change of work processes. The conclusion that the industrial design and teacher profession are similar is also plausible on its own since industrial designers can directly enter teacher education: they have a fitting profile. The only limitations there are about preknowledge. Support by means of variation and further empirical and theoretical support fall outside the focus of this study. My conclusion is that the proposed analogical reasoning is plausible for the intended application

Appendix 3: Interview Guides

Interview Guide Alumni R1

Estimated duration: 20-25 minutes
Before the interview:

1. Introduce the aim of the study; introduce the term professionalization
2. Explain the purpose of the first and second interview
3. Explain the confidentiality of the interviews
4. Ask permission for recording the interview

During the interview:

1. Ask for demographics: age, education, graduation year, profession
2. Ladder on each question with 'why?', 'can you give an example', 'how did that come to be'…
3. Ask for descriptive answers
4. In the end, ask if the participant has anything important to add

After the interview:

1. Thank the participant for his/her participation
2. Repeat what is done with the interview results
3. Explain how the participant will be informed about the study results

Questions
1. **In which professionalization activities do you take part?** Which other professionalization activities are available? In which professionalization activities did you take part before?
2. **Which aspects of those professionalization activities make them effective?** Why?
3. **How should you not go about professionalization activities?** What is wrong about this? Do you see other people make mistakes in professionalizing themselves?
4. **Do personal preferences play a role in choice for professionalization methods?** How? What is the consequence of this? How should on deal with that?
5. **How do you determine what is important to learn?** Which different influences are there? How important are those?
6. **Other remarks:**

Interview Guide Alumni R2

Estimated duration: 10-15 minutes
Before the interview:

1. Repeat the aim of the study and the purpose of the second interview
2. Explain the confidentiality of the interview
3. Ask permission for recording the interview

During the interview:

1. Read the solution description to the participants, then give the description to the participant
2. Ask the questions, ladder on each question
3. In the end, ask if the participant has anything important to add

After the interview:

1. Thank the participant for his/her participation
2. Repeat what is done with the interview results
3. Explain how the participant will be informed about the study results

Questions
1. Does the presented solution appeal to you? Why?
2. What are strong points of the solution? Why?
3. What would you change or add to the solution? Why is that important? What would you give priority?
4. What is your top three of things to include in the solution?
5. Do you know what industrial design precisely comprises? What is unclear? Did this cause you problems? What were the most important ones?
6. Other remarks:

Solution Description

The key insight for the solution is that the Delft University of Technology already organizes much for industrial design professionals, such as alumni drinks, master classes, career counselling, online and offline courses, informative materials, and so on. Currently, these are separate efforts. However, in professionalization, i.e. from the perspective of professionals, all these come together. Professionals often look for a combination of activities, such as receiving instructions; talking to other professionals; and self-study afterwards.

Therefore, I propose that the Delft University of Technology brings together in one **interface** for professionals. I mean a literal interface, online, that professionals can access. Ideally, professionals can there assemble their own 'curriculum' of activities. On the interface they see an overview of everything that the Delft University of Technology offers and they can register their own account where they can access a tool to put together a scheme of professionalization activities. They can also express wants and needs for professionalization activities that are not available at that time. The interface should at least offer the following parts:

- **Career counselling** by Career Centre professionals and by volunteering professionals from the field for whom this is an opportunity to develop coaching skills.
- **Courses**, both online and offline.
- **Access** to Delft University of Technology knowledge databases.
- **Meeting** other professionals.
- **Proactive suggestions** from the Delft University of Technology for frequently identified needs.
- **Profiling** of Delft University of Technology studies and expertise areas.
- **Evaluation** of the participated activities.

The tool, combined with the career counselling, should enable the Delft University of technology to better monitor the needs and wants of professionals and to adjust its offerings accordingly.

Industrial design students receive an introduction package at their graduation that explains what the Delft University of Technology offers to professionals and which specific needs are frequently present in the student's area that the Delft University of Technology can support them with.

Interview Guide CC employees R1

Estimated duration: 20-25 minutes
Before the interview:

1. Introduce the aim of the study; introduce the term professionalization
2. Explain the purpose of the first and second interview
3. Explain the confidentiality of the interviews
4. Ask permission for recording the interview

During the interview:

1. Ladder on each question with 'why?', 'can you give an example', 'how did that come to be'…
2. Ask for descriptive answers
3. In the end, ask if the participant has anything important to add

After the interview:

1. Thank the participant for his/her participation
2. Repeat what is done with the interview results
3. Explain how the participant will be informed about the study results

Questions	
1	**How is the Career Centre involved with industrial design students and alumni?** What activities do you organize? What do you focus on?
2	**What is your vision on how you work with industrial design students and alumni?** How do industrial design students respond? Are the results satisfying?
3	**What needs do you see with industrial design students and alumni concerning them presenting themselves to companies?** Which difficulties do they face? Which needs can you fulfill and which not?
4	**How are the needs of industrial design students and alumni different from other disciplines?** Why?
5	**What do you think are success factors of professionalization activities for industrial design students and alumni that root?** What are motivational factors? What are circumstantial factors?
6	**Other remarks:**

Interview Guide CC employees R2

Estimated duration: 10-15 minutes
Before the interview:

1. Repeat the aim of the study; give overview of the progress
2. Explain the purpose of the second interview
3. Explain the confidentiality of the interview
4. Ask permission for recording the interview

During the interview:

1. Introduce solution for IDE case; introduce solution for CC case
2. Ladder on each question with 'why?', 'can you give an example', 'how did that come to be'…
3. In the end, ask if the participant has anything important to add

After the interview:

1. Thank the participant for his/her participation
2. Repeat what is done with the interview results
3. Explain how the participant will be informed about the study results

Questions
1. Does the presented solution appeal to you? Why?
2. What are strong points of the solution? Why?
3. What would you change or add to the solution? Why is that important? What would you give priority?
4. Other remarks:

Interview Guide IDE employees

Estimated duration: 30-40 minutes
Before the interview:

1. Introduce the aim of the study; introduce the term professionalization
2. Explain the purpose of the first and second interview
3. Explain the confidentiality of the interviews
4. Ask permission for recording the interview

During the interview:

1. Ladder on each question with 'why?', 'can you give an example', 'how did that come to be'…
2. Ask for descriptive answers
3. Give and introduce the solution description to the participants after question 2
4. In the end, ask if the participant has anything important to add

After the interview:

1. Thank the participant for his/her participation
2. Repeat what is done with the interview results
3. Explain how the participant will be informed about the study results

Questions
1. **How are you involved with professionalization activities at the faculty? How did you approach those activities? What were your conclusions afterwards? What other professionalization activities does the faculty offer?**
2. **What is the faculty's position towards offering professionalization activities?** Why is offering that important? Do people oppose? How does the faculty see its role concerning professionalization?
3. **Does the presented solution appeal to you?** Why?
4. **What are strong points of the solution?** Why?
5. **What would you change or add to the solution?** Why is that important? What would you give priority?
6. **Other remarks:**

Appendix 4: Transcripts Alumni Interview Round 1

Confidential

Appendix 5: Codes Alumni Interview Round 1

Confidential

Appendix 6: Transcripts Employee Interviews

Confidential

Appendix 7: Codes CC and IDE Employee Interviews

Confidential

Appendix 8: Transcripts Alumni Interview Round 2

Confidential

Appendix 9: Codes Solution Evaluation

Confidential

Appendices Section III

Appendix 1: Summary Earlier Research

In an earlier research project, I analyzed the problem situation for writing education in Industrial Design Engineering education at the Delft University of Technology. This chapter gives a summary overview from the interview results. Section 1 gives an account of the participants in writing education. Section 2 describes learning situations that the WEM needs to facilitate. Section 3 gives an overview of the contents that the WEM needs to cover.

1.1 Participants

Writing education involves multiple participants, either on the teaching side or on the learning side. This section gives an account of respectively students, teachers, the education institute, and alumni.

1.1.1 Students

Their education requires industrial design students to learn writing reports, scientific articles, and such. Writing skill is important to an academic career but in design practice writing skill is less important as extensive written documentation is too time consuming. Designers there can compensate lacking writing skill with oral communication. Writing skill is beneficial for students themselves to help them structure and reflect on their work. Also, design work can require the designer to produce text as part of the design.

Industrial design students often do not have the ambition to learn writing unless they have an interest in research and/or a general interest in writing. A feeling of competence, writing about an interesting topic, and clarity about assessment criteria can improve a student's motivation.

Practice shows that in general industrial design students have difficulties with most aspects of writing. Writing requires a different way of thinking from design thinking: a linear, conversational mode of thinking that is different from the design approach to making a 'writing product'. A design approach may be beneficial for setting up the structure of and designing the visuals of the writing product, though.

Education materials that deal with the specific needs of industrial design students are scarcely present and fragmented. Students strongly depend on coaching by teachers or opportunities outside education to develop their writing.

1.1.2 Teachers

Teachers in industrial design education need integrate writing education in their courses and they need to compose that writing education themselves: defining learning goals, devising a course set-up, and compiling education materials. Sharing experience between teachers can only occur to a limited extent and teachers have different ideas about what constitutes good writing. Teachers largely need to 'reinvent the wheel' for writing education and adapting different courses to each other can be difficult.

1.1.3 Education Institute

The industrial design education institute's concern is to provide an academic level of education of which written communication competency is a part. Students should develop a critical and constructive attitude, become able to provide clear reasoning and a clear position, and develop the skills to document and communicate their work in written form. So quality management, coherency, and learning goals are main priorities for the education institute.

1.1.4 Alumni

Industrial design alumni can still want to learn writing out of general interest and/or out of practical need for their work. They have a similar need for education materials like industrial design students since the offerings on education materials for students and professionals are largely the same. A difference is that alumni need to find opportunity to attend education or do self-study whereas education is the students' full time occupation.

1.2 Learning Situations

Students learn and develop their writing skills in multiple settings: learning situations. This section describes three learning situations that the WEM needs to facilitate.

1.2.1 Focused Courses

Multiple courses in industrial design education include writing education as a separate part with learning goals and assessment. The WEM should be adaptable to the set-up of these courses and

provide common ground between courses that educate writing.

1.2.2 Group Assignments

Industrial design students often work in teams on projects and need to communicate in written form as a group. The WEM should preferably stimulate the group writing process.

1.2.3 Individual Assignments

Industrial design students need to do individual assignments and communicate in written form individually, possibly with limited coaching. The WEM should support individual students in all relevant aspects of writing.

1.3 Contents

This section gives an overview of the contents that the WEM needs to cover: writing situations, genres, and themes.

1.3.1 Writing Situations

The following writing situations are common for industrial design students or alumni:

- Design projects
- Research projects
- Consulting projects
- Entrepreneurial projects
- Applications for jobs or projects

1.3.2 Genres

The following genres are common in the writing situations of industrial design students or alumni:

Design Projects	**Research Projects**	**Consulting Projects**	**Entrepreneurial Projects**	**Job Applications**
Design report	Research article	Advisory report	Business plan	Curriculum Vitae
Design brief	Research proposal			Motivation letter
				Portfolio

Table 1: Genres

More genres are relevant to industrial designers (like the business case for design projects and the conference article for research projects) but this set of genres should provide them with sufficient understanding and competency to make the switch to related genres.

1.3.3 Themes

The following themes are relevant to industrial designers in the mentioned writing situations:

General Writing Themes	**Writing Aspects Themes**
Written communication	Structure
Subjectivity in writing	Reasoning and argumentation
Writing methodology	Visuals and lay-out
Writing process	Writing style
Writing as reflection	Spelling, grammar, and referencing
	Quality of sources

Table 2: Themes

Education of these themes needs to build an understanding and competency that enables the industrial designer to apply these themes to other writing situations as well.

Appendix 2: Lead User Research Teachers

Teachers play a major role in writing education as they select the education materials for their course and use them in their teaching. In my previous research project I gained little insight into the difficulties that teachers currently experience in writing education and in how they – preferably – use education materials. I needed additional insight into these matters in order to design a WEM that suits the needs and preferences of the teachers well. I therefore conducted a study into the difficulties that teachers face in writing education and their preferences for writing education materials.
Section 1 explains the research method that I applied. Section 2 presents the study results. Section 3 discusses the study's reliability and validity. Section 4 draws conclusions for the design project.

2.1 Method

2.1.1 Lead User Approach

I decided to use a lead user approach. In this approach, one includes a small group of participants that one can label to be 'lead users': users who are on the forefront of their field, who are knowledgeable about the topic, and whose opinions are leading for other users in their field. The main assumptions of this method are that their opinion is a good indicator for other users' (future) opinions as they key players in developing the field and that they have better insight into what users need as they are more knowledgeable about the topic. In the case of writing education, lead users are teachers who are leaders in the development of writing education at their university and who have considerable experience with teaching writing and with teaching in general. This approach was suitable since it requires inclusion of few participants (the time budget for this study was two weeks) and since I expected that lead users among teachers can give a better account of their needs since other teachers cannot spend much time on improving writing education as it is a side topic in industrial design education.

2.1.2 Interview Procedure

For this lead user approach, I conducted semi-structured interviews of 45-60 minutes with 4 teachers at the DUT IDE faculty who I expected to be experienced with teaching and leading in the development of writing education at their faculty. Semi-structured interview was a suitable method to cover all topics and to give flexibility to move into other topics or directions in case participants gave unexpected insights. The interview guide is available in Appendix 3 and the transcripts are available in Appendix 4.

2.1.3 Analysis

To analyze the data, I grouped the participant's responses relevant to the study into topics. Appendix 5 provides the topics with their respective quotes that resulted from the analysis. Then, I summarized the participants' responses per topic for the results chapter.

2.2 Results

This section presents the results of the interview: the insights into the difficulties that teachers currently experience in writing education and how they preferably use writing education materials. In between the results I regularly placed illustrative quotes from the participants. I grouped the results into four main topics: first 'teachers' situation', then 'difficulties in the learning process', following 'when students should learn what', and finally 'what writing education materials should be'.

2.2.1 Teachers' Situation

Teachers can give a clear opinion about how one should set up writing education. In a course, the teacher should first define clear learning goals. Following, the teacher needs to assess the students' progress on those learning goals. So for that the teacher needs to define an assignment and provide the information that students need to perform the assignment. Also, the students need feedback to become aware and learn of their mistakes and to improve their work. If students think they write well while they do not, confronting them harshly is the most effective to make them aware.

"So they first have to… it sounds crazy, but they first have to see 'it does not work well', they first have to fail or receive pain or a hefty criticism from a supervisor and then they think 'o yeah, we will have to do it this way'." [TE-4]

Clear learning goals for writing education should be divided into sub-goals and spread

throughout the curriculum, which then logically becomes the responsibility of the curriculum's coordinator. The writing competence of students needs to grow stepwise throughout the curriculum. Students do not need to become outstanding writers as much as they should become aware of their strengths and limitations so that they will seek proper help in case they experience difficulties with an aspect of writing. Students should learn writing by learning to ask the proper questions, like: who is my audience, what is my message to them, so how should I structure my report, and so on. The participants do not all agree on how much teachers should prescribe writing for beginning students. Some state that writing education should only teach them to ask the proper questions while others state that students first need some degree of practical help and writing experience before they can really understand what the proper questions mean; especially since teachers have different opinions and therefore give different instructions. Students first need a framework of understanding from experience before they can handle those seemingly conflicting instructions. The participants agree that a prescribed format can be useful in a course for practical reasons; to ensure that students do all parts or to make the amount of assessment comprehensible, for example.

"I do think that when students have experience with it that they can see 'hey, I can play with it, I can deviate from it'. But they first need to have that experience." [TE-2]

Reality can be different. Writing education at the IDE faculty is part of courses for which students have to deliver a writing product where the course coordinator takes the initiative to include writing education. In those courses there is little time for writing education since writing education never is the course's first priority: teachers include writing education on top of the course's 'normal' program. The large number of students also limits the amount of time the teachers can spend per student.

"So I looked with here into 'what are the basic things that we can do in [course name]?' Not too much of course because then it becomes too much… not comprehensible for the students." [TE-4]

The actual set-up of writing education by the respondents reflects this. Teachers focus on a part of writing education in their course and devise an assignment for the students. Writing education starts with one or multiple lectures, giving instructions about the writing topic, and then students have to perform the assignment individually or in groups. Teachers sometimes provide a prescribed format for the assignment to steer the students in a certain direction. During the assignment, students can ask for help, in a special hour for questions for example. Following, the students receive feedback from either teachers or other students by peer review. The feedback moment is when most of the learning takes place.

"[…] at this moment it happens mostly afterwards in the feedback and you hope that they take what they learned with them for next time" [TE-2]

The current set-ups do not always lead to the intended results due to multiple difficulties. A question hour may be available to students but they often do not show up. Information may be online, about referencing for example, but students may not look for it or may not find it. Giving feedback to individuals is difficult if students work in groups since one can then only give feedback about the group result. And not all teachers are equally competent in teaching writing. Some teachers are not such good writers themselves. Others are so far in their development that they have difficulties to adapt their instructions to the students' level. Teachers from other fields can have difficulties to adapt their writing instructions to the industrial design field. For example, one such teacher instructed that for a collage, students should list the source of each visual they used in making the collage; something that industrial design teachers have a different opinion about. Continuing, courses often deploy multiple teachers and different teachers give different instructions about writing, depending on their opinions and their own writing competence.

"So I hope it works that way, but yeah, the final results often do not show that it succeeded." [TE-1]

2.2.2 Difficulties in the Learning Process

The learning process for students has its own difficulties as well. The first challenge is to motivate students to learn writing as most students are not so much interested in that. They attend their education to learn design, not writing. Ambitious students are typically the ones who are interested in writing as they need that competence to get higher grades and such. Other students do not feel motivated unless they would otherwise fail their assignment; confrontation with their insufficient results is what they need to get their

attention. Writing in groups makes the learning more difficult. Practice shows that students sometimes not even discuss the different parts but that they make them individually and then place them into one document. Students first need to learn proper group dynamics before they can look at the writing.

"And the ambitions of students vary. […] it only is fun for the students that want to get a 9. [TE-4]

Most difficulties that students experience are not so much about writing skill as they are about proper thinking: dealing with information critically, empathizing with the reader, formulating a clear message, providing clear argumentation, thinking sequentially, thinking iteratively, reasoning from a question to method to analysis to conclusions, and so on. The participants also found that if students have difficulties with writing the problem usually is not in writing skill but in the thinking part. If the students have their reasoning and such straight, then expressing that reasoning in the form of writing is not so difficult. The thinking part is about the contents of the course. Providing instructions on that is therefore difficult since each assignment is different; thinking is typically the part that teachers need to give personal feedback on for the students to learn and improve their work. Providing instructions for the formal aspects of writing, the expressing part, is better doable.

"And there are people that think much more 'woolly', yeah, then they need much more coaching so that they think more clearly about 'what is it you are doing and what is most important?' [TE-4]

2.2.3 When Students Should Learn What

The participants gave an indication for when students should learn which aspects of writing. In terms of genres, students should start in their bachelor with design report, research report, and advisory report. Design brief comes later in the bachelor. Business plan and research article become relevant in the master. Curriculum Vitae, motivation letter, and portfolio become relevant at the end of the students' education, the end of the master. Research proposal, in its full form, is more something for PhD students although a simplified form can be relevant for bachelor or master education. The participants mentioned that other genres, like web blog, may be relevant to some of the students as well but not to all of them.

In terms of writing aspects, the participants mentioned that bachelor students should start with message, structure, and referencing. They should have a basic level in spelling and grammar before they start their bachelor education. Visuals and lay-out should also start in the first year of the bachelor. Reasoning and argumentation should follow in the second year of the bachelor. Quality of sources can briefly begin in the bachelor but is mostly something for the master. Writing style is a topic for the master.

In terms of general topics, writing methodology and writing process are the things to start with in the bachelor. Understanding writing as a conversation on paper is an insight that slowly needs to grow throughout the curriculum. Writing as reflection can come near the end of the bachelor and subjectivity in writing is mostly a topic for the master.

The participants also mentioned that the indicated times are only starting points: each aspect of writing needs to begin at a basic level and then develop throughout the education. Follow-up courses can teach aspects at a higher level and increase in complexity.

"[…] it may be good if it does not start directly with very complex things but more in a way that they can build a practice: a practice that feels natural to them. A practice of reasoning, of designing, of research results. And that you go to more complex things after that." [TE-3]

2.2.4 What Writing Education Materials Should Be

Currently, teachers use different writing education materials and state that there are not many good writing education materials available. One respondent mentioned that he does not refer to any education materials at all. Other participants mentioned to refer to a book by Elling et al. (2005) about written communication. Other participants also mentioned to refer to papers or online sources for specific aspects of writing. The participants mentioned that they refer to these education materials so that students can perform their assignments without help of teachers as the teachers do not have the time to coach the students on those tasks.

The participants mentioned that for writing education materials there should be one central place, accessible for all students, that gives a clear explanation about all aspects of writing; a place that teachers can refer to so that students can work on those aspects independently. This central place should therefore be online. Participants mentioned that they now have to explain the same things over and over again, whereas to would prefer to refer to one such central place for explanation. The set-up of this central place should enable teachers to integrate

the explanations in their course and participants emphasized that they do not want the writing education materials to prescribe how they should set-up their courses; teachers want freedom to shape their own course and to give their own interpretation to writing education. Participants noted that they want writing education materials also to provide examples of writing that teachers can include in their course and exercises that students can do independently online.

"[…] that you can refer students much quicker, like 'in here they explain it really clear, look at this'." [TE-1]

Writing education materials can also help teachers. The materials can give an overview of what aspects writing education constitutes; currently not all teachers are fully aware of all aspects. Writing education materials can give tips and tricks for teaching: information about how teachers can support to students in different stages of student development.

Writing education materials should cover all aspects of writing so that students can look back if they forgot about instructions they received in the past and so that teachers can also refer to aspects of writing that they do not deal with in their course. This completeness is also necessary for international students who need to learn what teachers in Delft expect from them in their writing and so that they can practice that on their own.

One participant stated that she could not imagine what writing instructions can be added to the book by Elling et al. since that book is of high quality and very complete.

2.3 Discussion

Concerning the reliability of this study, the semi-structured set-up and transcription of the interviews contribute to the reliability whereas the freedom in follow-up questions and interpretation of the answers lower the study's reliability. The study did not triangulate the data which lowers the study's reliability as well. Looking at the purpose of the study, to obtain insight in an applied specific case, I think the study's results are sufficiently reliable to use in the design process under the condition that the design is evaluated with teachers.

The lead user approach assumes that the results are generalizable if the participants qualify as lead users. Two participants in this study qualified as lead users since they actively develop writing education at their faculty and since they are experienced in writing education on an academic level. One participant was experienced in writing education at an academic level but so active in developing writing education. The participant was aware of that and the limitation was that the participant's answers were more superficial and therefore less insightful than one would expect from a lead user. One participant actively develops writing education but is less experienced with writing education at an academic level. This became apparent in the participants responses, for example when the participant stated that analysis in design research should be objective and based on facts (design research being objective is disputable to say the least). This made the participant's responses about contents of writing education less credible, which was especially relevant in the cases where participants disagreed on the contents of writing education. So in short, the selection of participants was not optimal but useful nonetheless to generalize the insights to a wider range of teachers.

The construct validity of this study becomes a point of discussion when the participants interchanged responses about how things ought to be with how things are. I deliberately asked the participants explicitly about both in order to prevent that problem. The lead user approach contributes to the construct validity since lead users work actively on the topic at hand, recalling information is more difficult for participants who do not work that much on the topic at hand. Yet the set-up of the study only collects overall experiences that the participants can recall; no direct recording of actual practice. This lowers the construct validity of the study. Another difficulty with the construct validity was that all respondents spoke Dutch during the interviews – they preferred to themselves – while to participants are not native Dutch speakers. It could be more difficult for them to express themselves so that it took more effort to answer the questions. When necessary, I asked more additional questions to confirm that I understood them right. Furthermore, the transcripts needed translation from Dutch to English for this report. Some meaning may have been lost in the translation. A final point is that I could not always perform the last part of the interview: discussing starting points for the WEM design. Yet this part mostly recalled earlier discussed topics so not much information was missed.

The internal validity of this study can be a point of discussion since the step from grouped responses to a summary of the responses included much interpretation by me and considerations of how strong I should take different responses, especially when responses conflicted. I kept the

transcripts and the grouped responses available so that other researchers can make the same analysis and see what their interpretations are.

2.4 Conclusions

This section first concludes on insights that I confirmed with these interviews and new insights that I gained. Following, this section elaborates on the implications of the acquired insights for the WEM.

2.4.1 Confirmed and New Insights

For me, the most valuable new insight was that learning writing is mostly about learning thinking. I was already aware that many writing related aspects were about thinking rather than writing but the responses that students' difficulties are with the thinking part and not so much with the writing part were new to me. The challenge that arises from this insight is that this thinking part also is the hardest to teach with education materials: it requires coaching of teachers (who do not have time for writing education). Still there is the need for writing materials that these teachers can refer to. Also, if students have difficulties with the thinking part, that is an indicator that those students have difficulties with the contents of the course. So even if there is no time for writing education, the writing product is a good indicator of how well the students understand the course's topic and bad writing should be a good reason for teachers to coach the students on the contents of the writing (and thereby on the contents of the course).

Another valuable insight was that a key indicator for students' motivation to learn writing is their ambition and that the most effective way to motivate uninterested students is to let them fail and then confront them harshly with their bad results (that creates a relevant need for them). Previous insights that I had into this topic were not so specific. I received confirmation that student group work complicates writing education as a teacher can only give feedback to the group and the advice that student groups should discuss the contents and set-up of their writing before they start writing.

The interviews confirmed that a number of teachers lack the writing competence themselves to teach writing and that teachers from different fields can have difficulties to adjust their instructions to the industrial design field. A new insight was that some teachers developed their own writing competence so far that they have difficulties to empathize with the student's level. To me this is recognizable: I typically see that experienced start their instructions by providing abstract principles that they learned themselves over years of experience. Students can understand these instructions on a syntax level but they cannot link those instructions to own experience as they do not have that experience. Thereby the instructions become useless to students: the abstraction level of such instructions leaves out all 'color' of the variety of concrete situations which is precisely what the students first need to become familiar with. Instructions need to start where students start: with their first assignment on a concrete level.

This insight also indicates how I should deal with the balance between learning students to ask the right questions to learn proper writing and prescribing students' writing to help them through a number of aspects that are too difficult at that point; a topic on which the respondents disagreed. I agree that teachers and a WEM should introduce each aspect first by briefly explaining what it is about and what the proper questions are to ask. Yet, for beginning students, I think that writing education should first focus on allowing students to gain useful experience: experience with good writing (and not only failed writing). Therefore I think that instructions for beginning students should help students get through their first writing products and that following instructions can discuss aspects of writing one by one by building on the previously gained writing experience.

New insights for me were that currently the feedback moment is the main learning moment for students as few good writing education materials are available and that teachers would not give a WEM a place in their lessons but that they would want it so that they can refer students to it for self-study. On one hand this saves them the effort of explaining the same things over and over again and on the other hand this allows students to learn things that teachers do not have the time for to teach to them. A WEM that focuses on self-study also allows learning to take place at the moment when the students are doing their writing; students can do the learning when they need it the most. I received confirmation that a WEM should cover all topics related to writing so that teachers can refer to any topic they do not have the time for to teach themselves and so that international students can get up to speed with writing education at the DUT IDE faculty.

I also received confirmation that a WEM should be of high quality, relevant, split up in bits/modules. This may sound obvious, but it becomes especially important regarding the suggestions of the respondents' suggestions to

make the WEM an online place that one can continuously expand by contribution of multiple dedicated teachers. I have multiple critiques on that proposal:

- How can one maintain consistency and quality in such an open source system at the high quality level that teachers demand? Such current efforts by having many teachers develop a part of writing education leads to the low quality and inconsistencies that teacher currently complain about.
- Who is going to moderate the online platform? Who will decide on what good work is and what should be changed or removed? Such a platform implies a democratic approach in decision-making which I think will result in a crippled decision-making system.
- Building, maintaining, and moderating an online platform costs money. Who will pay for that and who will do that?

In short, I disagree with an online platform set-up. Also because the respondents confirmed that students do not make use of current online sources (for references for example) since they either not look for it or cannot find it: I do not see how that would be much different with an online platform. I do agree, though, that another book also would bring no solution since students do not read whole books or do not read them at all.

Participants also mentioned the idea of making online writing exercises: I agree with the idea in principle but since writing education needs full-task assignments with contents (see the TSCL method for this point) such exercises should also give feedback on the contents of writing. I would not know how to realize that. Furthermore, developing such exercises is a lot of work. Participants also mentioned the idea to develop instructional (YouTube) movies. I do think that such movies can be valuable to students learning as they dynamically can show instructions but developing such movies is too time consuming for my project.

Concerning the contents of the WEM, there were few surprises for me in when students should learn what. I was a bit surprised that subjectivity in writing and source quality were mostly mentioned to be topics for master education: I had expected them to be necessary earlier. In the interviews I received confirmation that the WEM can support teachers by giving instructions for teaching writing. A new insight was that the overview itself of which aspects are relevant to writing education are valuable to teachers as they are not always aware of all these aspects.

2.4.2 Implications for the WEM

The first implication for the WEM is to start with hands-on instructions for design report, research report, and advisory report so that students can directly get to work and gain the basic amount of writing experience they need to learn more abstract instructions for writing. These hands-on instructions should first briefly introduce the task and the questions that students need to ask but then continue with hands-on instructions on how students can approach the task at hand. Instructions for teachers should explain this set-up and how to use it properly (not teaching that the proposed approach is the only way, but teaching that it is one way that students can start with, and so on).

Another implication is that I should include a separate part to explain the thinking part and the expressing of writing and how they relate to each other. One explanation should be tailored to students to guide them in their learning and one explanation should be tailored to teachers to support their teaching and to urge them to look into the contents of a writing product as it reflects the students thinking quality, even though there is no time for writing education.

Further implications for the WEM include that I should design it for self-study and for easy referral since that is how teachers want to use it. Use in lessons at the faculty is much less relevant. Other implications are that the WEM should include tips for teachers on student motivation and how to trigger that via harsh confrontation, tips on dealing with group assignments (probably the easiest solution is to focus writing education on individual assignments and to only teach group writing in group assignments), and an overview of all relevant writing aspects and a general indication on when to start teaching what.

I think that both the forms of an online platform and a book are not suitable for the WEM. Instead, I want to make the WEM in form of a magazine. This form has multiple aspects that I think appeal to the students and teachers who need to use it. It consists of comprehensible bits (articles) that are divided over specific topics, which make them easy to refer to and not so labor intensive to read for the students. A magazine is graphically much more attractive (which apparently is of high concern to industrial design students) and a magazine does not have the vast weight of a book, yet it can be complete and easy to explore. Moderating a magazine is contained to a few moments, making it better doable, and

publishing a new improved edition every so many years, for example, is definitely feasible; also since the (relatively) low production costs and therefore a low sales price is doable for users.

Appendix 3: Interview Guide Lead User Research

Duration: 45-60 minutes.
Before the interview:

1. Introduce the aim of the study:
    a. I am developing writing education materials tailored to industrial design education
    b. This goal originated from the needs that I experienced myself as a student
2. Introduce the purpose of the interview:
    a. At this point I can design the contents of the materials, but I miss the teacher's perspective
    b. I want to talk about problems that teachers experience in teaching writing, how writing should be taught, and how education materials can be useful to teachers
3. Explain the confidentiality of the interview: full transcripts will not be included in the report, only quotes
4. Ask permission for recording the interview

During the interview:

1. Ladder on each question; steer towards an account of their needs
2. Ask for descriptive answers on question 1 and 2; ask for normative answers on the other questions
3. In the end, ask if the participant has anything important to add

After the interview:

4. Thank the participant for his/her participation
5. Repeat what is done with the interview results
6. Explain how the participant will be informed about the study results

1. Students learn to write for academic and professional communication purposes. How are you involved with this part of education at the IDE faculty? What difficulties do you encounter? Ask for specifics (who, what, where, when, and so on).
2. Which writing topics should be taught in which part of the curriculum? Provide Sheet 1.
3. Which education materials do you prescribe or refer to? What do you use them for?
4. Do available education materials give you the support you would want in teaching writing? What support should education materials give you?
5. Introduce starting points for the WEM design, then ask if the teacher can agree to them: • Writing education materials become most valuable for students when they can use it throughout their education; writing education materials should cover all writing-related topics • Students with different levels of writing competence will react differently to writing instructions, but writing instructions should be formulated the same way; different levels of writing competence require different supervision by teachers • Students build academic competence on applied competence; it is fine when students first learn to follow a prescribed format before they learn writing on an academic level • Writing education materials cannot replace a teacher since it cannot express a full understanding of writing competence; practice and expert (teacher) feedback is indispensable

Sheet 1 – Role and Format of the Writing Education Method

Feel free to add, highlight...

General topics:

- Written communication: understanding writing as a conversation on paper
- Subjectivity in writing: dealing with different norms and expectations
- Writing methodology: making and using a writing plan
- Writing process: planning and structuring your writing
- Writing as reflection: using writing to consider and improve your own work
- …
- …

Writing genres:

- Design report
- Design brief
- Research report
- Research article
- Research proposal
- Advisory report
- Business plan
- Curriculum Vitae
- Motivation letter
- Portfolio
- …
- …

Writing aspects

- Structure
- Reasoning
- Argumentation
- Visuals
- Lay-out
- Writing style
- Spelling and grammar
- Referencing
- Quality of sources
- …
- …

Appendix 4: Transcripts Lead User Interviews

Confidential

Appendix 5: Categorized Lead User Responses

Confidential

Appendix 6: Evaluation Instructions

First of all, I want to thank you once more for helping me to evaluate the education method 'written communication for academically educated industrial designers' that I am currently developing. In this document you can find instructions for evaluating the education method.

I decided to set up the education method in the format of a magazine that provides instructions that students can use for self-study. These instructions are divided by topic and written in the format of articles. Below are some main outcomes of my research prior to writing the magazine.

In my research, I found that the main reason for teachers to use writing education materials is to refer students to a source of explanation. Teachers set up learning goals for their courses, give at some point instructions for the (writing) assignments, and assess and provide feedback on those assignments. Time to give instructions is always limited and students will have more questions. These questions are largely the same and written instructions can answer many of them. Teachers want a source of written instructions that they can refer students to for these questions. This source needs to be complete and coherent, of good quality, and accessible to all teachers and students. A magazine format can fit these requirements well.

Another important point that I looked into is to what extent written instructions may prescribe students what to do and to what extent instructions should help students to ask 'the right questions'. Since we are dealing with academic education, teachers prefer that students mostly learn to ask the right questions, rather than carrying out a prescribed task. Yet, I found that inexperienced students first need a basic amount of writing experience before they can handle more abstract instructions like theoretical models or an overview of proper questions. Without experience, they can only understand abstract instructions on a syntax level, not on a pragmatic level. Therefore, they experience great difficulty with making the link between abstract instructions and the actual task. If students first receive hands-on instructions to help them through their first assignments, they obtain pragmatic understanding through experience, from which they can continue their development with more abstract instructions. The magazine uses such a set-up.

Teachers experience more difficulties in writing education. I identified them and dedicated the last part of the magazine to teachers with articles about these problems, how to deal with them, and how to use the magazine in that. Furthermore, I tried to identify all aspects that are relevant to writing and to give students basic instructions for them all. I kept the articles brief (max 2 pages) to make the instructions comprehensible. If articles do not give complete instructions, they should trigger the right questions with students so that they look for the information they should be looking for.

So, in short, the magazine allows students to study writing independently; provides them with basic instructions, tailored to their development; and gives teachers a source to refer students to as well as practical instructions to set up writing education. The magazine should provide students with a basic framework of understanding and 'put their noses in the right direction' for their further development by showing them the right questions to ask and the topics that are relevant.

At this point, I wrote a number of articles for the magazine. You will receive a file with those articles separately. In that file, you will first find the table of contents for the magazine. My question for you is to read those articles with the following criteria in mind.
The education method…

1. Teaches the right skills and subjects.
2. Fits existing abilities of students.
3. Progresses to an academic way of looking at written communication.
4. Motivates the student with its writing style.
5. Has a comprehensible size and sufficient a level of detail to give the readers a basic understanding to work with and to possibly trigger further questions that stimulate the readers to look for additional sources.
6. Supports inexperienced teachers sufficiently.

After you read the articles, I want you to evaluate the education method with me on the above criteria. We will do this in the interview that we scheduled, so you do not have to write evaluations down: it is sufficient to read the articles and then discuss them with me.
You do not have to evaluate the lay-out of the articles since I did not make a design for that yet. Neither do you have to check spelling and grammar and such; that would require more effort than I would want to ask of you.

If you have any more questions, please let me know!

With kind regards,
Daan Vos
06-36182019

Appendix 7: Participant Responses WEM Evaluation

Proofreader [PR-1], 04-07-2014

The education method teaches the right skills and subjects.

- The WEM has a systematic set-up, it has a good structure. Small improvements can be made to improve coherence and completeness.
- The selection of subjects is good.
- PR-1 has multiple small improvements for the article's texts. Some articles need considerable structural changes.
- The magazine is a very suitable format to support students with writing compact and attractive reports and other documents.

The education method fits existing abilities of students.

- You never know with first year students, but let them give it their best shot.
- Examples can make the instructions more concrete. They are useful to clarify things like writing style and visuals. You can also show wrong vs. right examples to show the difference clearly. The text becomes easier to read and to remember with examples. Anyway, I should ask myself that question.

The education method progresses to an academic way of looking at written communication.

The education method motivates the student with its writing style.

- Remove all exclamation marks; they overdo it. Be original and attractive in the text itself.
- Sometimes the introduction titles do not deliver what they promise; they should in order to avoid disappointment.
- The writing style contains many small errors; let a native speaker check those.

The education method has a comprehensible size and sufficient a level of detail

- The articles have a reasonable size; the text parts are never long.
- The comprehensible size of the 'my first report' articles probably will put many first year students on the right track.
- The magazine should include more visuals to give overview and such. I should take my own advice: "show and tell".

The education method supports inexperienced teachers sufficiently.

- PR-1 thinks it does, the articles for students themselves already support teachers well. Teachers, however, also need to put in some effort and actually read the magazine and re-read it and internalize it so that they become able themselves. They have a responsibility themselves to learn that themselves. They need to support the method that way.

Proofreader [PR-2], 08-07-2014

The education method teaches the right skills and subjects.

- With regarding to writing, right? Yes, that's great. I miss a link with oral and visual communication.
- PR-2 has multiple small improvements for the article's texts.

The education method fits existing abilities of students.

- In principle, yes, though example situations would help in which the students can recognize themselves.

The education method progresses to an academic way of looking at written communication.

- Yes.

The education method motivates the student with its writing style.

- Um … it's carefully written but rather cautious.
- Do not give 'empty' motivational phrases; give the reader precisely what he needs when he needs it.
- Show and tell! Mainly text now.

The education method has a comprehensible size and sufficient a level of detail

- Yep, I thought that it would help to point to additional sources. But students might have a different reaction.

The education method supports inexperienced teachers sufficiently.

- Not sure about that. Concrete cases are missing.

Proofreader [PR-3], 14-07-2014

The education method teaches the right skills and subjects.

- The magazine is a very suitable format since it is hands-on (not a dry book) and that works best for students. This format teaches new skills in a fun way.
- It is good that such a complete set of subjects is available early in education.
- Dealing with group work in a separate chapter.
- Argumentation instructions can help the group process as well; make that link.
- Explain the differences between design and research and how the reports thereby also are different.
- Possibly include a separate article about the genre graduation report.

The education method fits existing abilities of students.

- It starts at zero which is good for students who have difficulties with writing.
- Make instructions very hands-on to help students on their way; about making the switch from understanding the provided framework to getting started with writing. Practical tips and/or small exercises. "Just start like this."
- Also provide searching strategies for students when they cannot find an answer.
- Include links to other sources for further reading at the place in the articles where they are relevant.

The education method progresses to an academic way of looking at written communication.

- Yes, because of using the theoretical models and instructions about how to use that to improve your thinking.

The education method motivates the student with its writing style.

- PR-3 likes the comments such as 'try it out yourself'; that should be combined with a link for further reading; to get started; providing the right means at the right time to fulfill the student's need is an effective way to motivate the student.
- PR-3 likes the informal, hands-on writing style.
- If the states a phrase like 'try it out yourself', it should immediately help the student in how to do that; other motivation goes up and then immediately down.
- Some things students do not want to try out themselves; better provide examples.

The education method has a comprehensible size and sufficient a level of detail.

- PR-3 likes the set-up with introductions on one page and articles in two columns because it gives air to breathe; especially pleasant since PR-3 has dyslexia.
- The method is a good introduction for people who are unfamiliar with the topic; needs getting started instructions still.
- Articles can be longer than 2 pages if that makes sense; some articles may comprise 4 pages if they go deeper. Boxes and visuals can definitely make articles more pleasant to read.

The education method supports inexperienced teachers sufficiently.

- Importance of writing education is well-written.

- Too much text in the article ‘Our courses are already stuffed, how can we include writing education?’; use bullets and visuals, be more brief. Also provide examples, best practices and such.

Proofreader [PR-4], 14-07-2014

The education method teaches the right skills and subjects.

- Yes, the magazine includes the important points to write on an academic level.
- Case studies of good examples can be a good addition to clarify instructions. Case studies would fit the magazine well. Also to be more specific.
- PR-4 attended an international high school where they prepare their pupils well for an academic career, also in writing, and thereby PR-4 was better prepared than most students; PR-4 also lived in the USA for multiple years and thereby has an advantage in writing in English; PR-4 already was aware of the contents of the articles that PR-4 proofread and the articles were thereby too easy for PR-4.
- Sources for further reading are important to fulfill students’ needs and to ensure that the articles do not include too much text.
- The magazine feels to PR-4 like a midway between a book and a tool; PR-4 thinks it can be more of a tool, like a field guide with overview sheets for the different topics to get started quickly. Overview sheets are necessary for students who work hard on a writing product and need a quick overview.
- The articles should not be longer than this size; also provide a suitable ‘speed’ to teachers to go through the articles to make sure that students keep up.
- The skills and subjects are also useful in practice besides writing.
- The magazine becomes more convincing with more references (I did not include references yet as I made a quick first draft); also necessary for an ‘academic’ magazine.
- The magazine is quite basic still; it can go deeper into writing and adjust more to industrial design specifically besides ‘general academic writing’. It can go deeper in design methods for example, or like how to use analogies to convince a client.

The education method fits existing abilities of students.

- The starting point of the writing method is good for starting students who have difficulties with writing since it starts at point zero.
- The instructions are clear enough for teachers to refer students to; if students read them, then the teachers probably do not have to explain that anymore.
- Difficult to say whether the magazine fits all target groups as their need vary. The magazine is already well adjusted to different target groups.

The education method progresses to an academic way of looking at written communication.

- Yes, the magazine leads the user in an academic way through the different steps of learning writing.

The education method motivates the student with its writing style.

- The style is good (easy written).
- Exclamation marks do not motivate more, remove them.
- A quick way to get to the information that you need is what motivates. Use further reading references and such. Give the students precisely what they need with interesting content.

The education method has a comprehensible size and sufficient a level of detail.

- Magazine is the right format in terms of size. Should include further reading references. Also some case studies.

The education method supports inexperienced teachers sufficiently.

- PR-4 thinks it does. If teachers lack experience, and thereby are ‘at the level of the student’, they can use the writing instructions themselves.
- Such an industrial design specific magazine can help teachers to go through their course quicker; if it is specific enough!

Proofreader [PR-5], 08-07-2014

The education method teaches the right skills and subjects.

- Yes. The subjects are right.
- PR-5 thinks that the guideline 'writing like speaking' is not suitable since spoken language is different from written language.
- Explain more explicitly the difference between the contents of the design process and the writing; right now that is not so clear.
- Use more visuals to provide overview and explanation.
- Explain the similarities and differences between a design and a research report; possibly include a separate article about reports in general.

The education method fits existing abilities of students.

- The magazine starts very much at point zero. Students attended high school and might be ahead. The magazine can start at a higher level.

The education method progresses to an academic way of looking at written communication.

- Yes it does, but the magazine can use more structure to clarify that (in all articles).

The education method motivates the student with its writing style.

- The writing style now is very primary school like; PR-5 thinks that not everyone will appreciate that.
- The writing style contains many small errors; let a native speaker check those.

The education method has a comprehensible size and sufficient a level of detail.

- Two page articles is a good size. The topics are of course much larger but the magazine at least gives a brief overview of all topics.

The education method supports inexperienced teachers sufficiently.

- Didactic advices should be put in different paragraphs; currently they go through each other; makes the instructions unclear. Improve the structure. Different topics address different target groups and therefore they should be put in different paragraphs.
- Avoid cliché sentences.

Proofreader [PR-6], 16-07-2014

The education method teaches the right skills and subjects.

- Rules of thumb that I offer eventually do not lead to good grammar. An advanced level of grammar requires a different approach. PR-6 thinks that the rules of thumb oversimplify things.
- When I present rules of thumb I should present them as such. It now looks as if they are more than that, which is confusing to students.

The education method fits existing abilities of students.

- The starting articles start at point zero, which PR-6 beliefs is too low. PR-6 beliefs that writing instructions should directly be at the level of regular books for writing instructions.

The education method progresses to an academic way of looking at written communication.

- The articles do not contain references yet; they should be included as soon as possible.

The education method motivates the student with its writing style.

The education method has a comprehensible size and sufficient a level of detail.

The education method supports inexperienced teachers sufficiently.