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I, Sepideh Shahi, hereby submit this original work as part of the requirements for the degree of Master of Design in Design.

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Business Sensible Design

Exploratory research on the importance of considering cost and profit for undergraduate industrial design students

A thesis submitted to the
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Abstract

This research aimed to investigate how important it is to embed business education into undergraduate industrial design curriculum and help design students understand the financial aspects of their design ideas, particularly in the areas of cost and profit. To respond to this question, a user-centered design approach\(^1\) was applied to understand design students’ perceptions towards business education. Later on, the research findings were synthesized into a list of design requirements for developing a financial assessment tool. After rounds of ideation and looking into other frameworks from business related disciplines, a financial assessment tool was developed. Consequently, this tool was prototyped and piloted in a senior industrial design class in order to test its effectiveness. At last, students who had participated in the experiment evaluated the tool. Their positive feedback proved such methods could be successfully integrated into undergraduate design curriculum and help industrial design students gain a better understanding of the business aspects related to their ideas.

\(^1\) Human-centered design (HCD) is a generative and iterative process through which designers gain deep empathy for people, question assumptions, and explore directions in order to identify new opportunities (IDEO.org, 2011).
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Chapter 1:
Introduction

1.1 Background
The advancement of technology and growth of the corporate culture have had a significant influence on the role industrial designers play in any organization. Designers used to be defined as stylists who got involved in the product development process at its very last stages to make a product more appealing for its target users. However, in our time, industrial designers have become more active in their organizations and they are involved in the product design process from its early stages through the end. These new involvements have led to an increased level of interaction amongst designers and many different stakeholders. For instance, they have to constantly communicate their ideas with clients, investors, and customers and each one of these stakeholders has their own individual financial requirements including lower cost, higher profit margins, and particular price tags. As a result designers should be able to address these needs appropriately during their working procedures. Despite these new responsibilities, the design education system has not been able to adapt its structure to prepare the next generation of industrial designers accordingly. Although many design programs require electives in business, most of them do not integrate business education into their design studios. As a result, students are not able to create meaningful links between what they learn in their business courses and what they practice in their hands-on design classes. This separation also leads to a negative perception towards business courses and makes design students think of financial considerations as limiting forces rather than inspiring factors for creative solutions.
Although there have been some experiments with developing new education models, such as dual programs in design and business, not all these programs have been widely adopted by students who seek higher education in design. Many students choose to be a designer because of all the possibilities it provides for creative thinking and doing. Students who take business elective courses do gain basic valuable knowledge but in most cases this knowledge is not relevant to their needs as inspiring designers who’s goals are to lead companies or bring product to market. Therefore, obligating students to take variety of business courses that are not necessarily relevant to their design education can be discouraging. As a result, many young and professionally inexperienced designers are left with no proper training to understand the financial ramifications of their design decisions. Once they graduate, they enter into a practice that is heavily involved with financial considerations besides design innovation processes. Some designers learn how to modify the way they work to fit into this context while others see it as a challenge throughout their career and it costs them years of trial and error.

As an industrial designer myself, who had studied and worked under these circumstances, I decided to conduct this research in order to understand the possibility of making business education more integrated into the design process and accessible for students. The ultimate goal of this project was to explore the possibility of developing a financial assessment tool, which was specifically created for undergraduate industrial design students who had less than two years of professional work experience. In order to reach this goal and guide the research process, two main research questions were established:
1- How can we make business training more integrated into industrial design education and design processes?

2- Is this type of training important and useful for industrial design students?

To respond to these two questions and come up with a solution, I applied a user-centered design approach, which provided me with contextual user knowledge as well as methods for testing and evaluating the proposed solution.

This process included three phases, which will be explained separately in the following three chapters. After explaining the research scope and methods in this chapter, the interview results with design students as well as design professionals will be discussed in chapter two. In the same chapter, a comparison will be drawn between the two interview groups in order to develop a guideline for creation of a financial assessment tool.

The third chapter will analyze a typical product design process in order to understand its phases and identify opportunities for incorporating a financial assessment tool. In this phase, various financial assessment strategies will be studied to seek opportunities for applying them in the design process. Consequently, chapter four will discuss the development of a financial assessment tool, and will explain how and where it can be applied.

Chapter five will be dedicated to the tool’s testing process and evaluation results. Finally, the conclusion will provide readers with a summary of the entire research process and briefly discuss how this project can be taken forward.
1.2 Research Scope

Due to the short span of this research (18 months) having access to the target group was the main factor in defining the scope. Thus, my search was limited to the undergraduate industrial design program at the University of Cincinnati, DAAP (College of Design, Architecture, Art, Planning) in Ohio where I had full access to students and their studios. I specifically narrowed down my scope to a group of senior industrial designers who were graduating in less than one year. This clearly defined scope gave me an opportunity to not only have unlimited access to these students for observation and interviews, it also enabled me to apply my proposed tool in their recent projects in order to test its effectiveness.

1.3 Research Methods

To investigate this issue from different perspectives, a combination of qualitative research methods were applied.

Direct Observation: was utilized in the preliminary stages of this project in order to investigate deeper layers of information that did not come up during my interviews. A three-day observation session was held while 36 industrial design students presented their thesis projects to people from the design industry during DAAP WORKS 2012. The goal of this session was to observe whether students had created a business argument around their concepts and were able to respond to financially related questions raised by the audience.

Contextual Interviews: played an instrumental role in different stages of this project. during preliminary research phase, 20 senior and junior industrial design (ID) students were interviewed to understand how they perceived financial factors, such as cost and
profit in their design processes. At the time of interviews (Fall 2012) many senior industrial design students were out of school and completing their last Co-op in different cities. As a result, eight out of the twenty interviews were conducted through Skype video calls. Each one of these interviews took about 20 to 30 minutes and was recorded for further analysis. Later, seven industrial designers who had less than 3 years work experience were interviewed, four of which had started their own business and the rest working for design consultancies or in corporate in-house design teams. The main purpose of this set of interviews was to fully understand what kind of challenges recent graduates face in addressing financial bottom lines in different work settings. Three of these interviews conducted in person, two through Skype video calls and two through phone conversations. Each interview was recorded and on average took about 25 minutes. Consequently, seven interviews were conducted with business and design hybrids whose background was mostly in business innovation and strategy development. The goal of these interviews was to identify methods the interviewees used to financially evaluate their projects and study whether those methods could be modified for design education. Four of these interviews were conducted in person and lasted 45 minutes each. The other three were phone interviews that took about 20 minutes each.

Secondary Research: was applied throughout every stage of the process to evaluate research findings against current literature and redefine the project’s directions. Issues such as design methods, design process, design education, design management, design thinking, disruptive innovation, and measuring value of design were this paper’s secondary research focus.
Participatory Research: was applied after development of a pilot financial assessment tool. This tool was used as a business awareness tracking system for an undergraduate entrepreneurship design studio with 15 senior ID students. Seven of the 15-week course was dedicated to using the tool to create a business strategy that complemented the students design based ventures. The aim of this experiment was to test the tool in the right context and evaluate its effectiveness in students’ design projects.
Chapter 2:
Interview Findings Analysis

As stated in the introduction, contextual interviews with industrial design (ID) students and professional industrial designers played a substantial role in this project. This chapter will cover a thorough analysis of the interview results in the following three sections. First, ID students' perspective towards cost and profit will be analyzed. Second, professional designers' point of view regarding the importance of cost and profit in real design projects will be discussed. Lastly, the two former sections will be compared in order to identify gaps and find opportunities for developing a design requirement list for a financial assessment tool for designers.

A list of detailed interview questions has been provided in Appendix A.

2.1 ID Students Interview Analysis

In order to design the right tool, first I needed to understand how young designers and students think about considering financial aspects during their design process. Talking to these individuals and listening to their concerns, helped me understand what they really wanted to gain from business courses and how they wanted this process to benefit them.

One of my main challenges during interviews was to comprehend how ID students truly perceived abstract financial concepts, such as cost and profit in their design works. To address this challenge, I asked the same question several times in different scenarios to clearly differentiate between what they say, what they really do and what they wish they could do. For instance, the interviews were started with two design briefs of similar
nature, but with different restriction levels. The first one was kept very general while the second one had clear financial goals and cost restrictions. I was trying to indirectly ask students how they perceived projects with financial constraints. Surprisingly 11 out of 20 students chose the restricted brief. Most of them referred to their co-op experience and stated the restricted brief had real implications and in reality designers have to deal with budgets and profit requirements. The common words students used to compare those two briefs are illustrated in the following word clusters, figure 2.1, to provide readers with a quick visual reference of how design students thought of each brief.

![Figure 2.1](image)

In spite of their enthusiasm for the restricted brief, when they were directly asked to express their attitudes towards projects that had financial requirements, their response was different. In their opinion, design projects with financial goals forced designers to cut cost anywhere possible, which led to low quality and less innovative solutions. They also believed thinking about profit shifted designer’s attention from customer’s needs to client’s need and consequently from problem solving to money-making, thus, greatly affected their design process. As shown in figure 2.2, they assumed that considering these factors not only expanded their research phase to find the least expensive materials and manufacturing procedures, it also squashed their creative thinking process and forced them to discard many good ideas simply because they did not seem financially viable.
In contrast to what they had said regarding financially restricted projects, students ranked market studies, promotions, distribution methods, business plans, and branding higher than human factors and aesthetic appeal as basis for making a design concept successful in the market, as shown in figure 2.3. They continued by emphasizing that having fundamental business knowledge would enable them to make more informed decisions that would not be changed by engineering or marketing teams during product development. However, when they were asked whether they had taken any particular business courses to reinforce their knowledge in any business related area, their responses revealed that they had hardly completed their two required business electives. They expressed that these elective courses were either too basic or too complicated with little application in their design projects. As a result, they gradually became disengaged and could remember very little from the courses’ content as displayed in figure 2.4.
To sum up the ID student interview findings, it is worth mentioning a few important points. Students’ co-op experience had a significant impact on their responses. Thus, if I had done the same interviews in another design school that did not offer a Co-Op program, I might have reached a completely different set of results. I also noticed two interesting concerns regarding concepts of cost and profit, which repeatedly came up during the ID students’ interviews. In terms of cost, they associated it with dollar numbers instead of cost structures. Thus, whenever we talked about cost, they thought of cutting expenses and making a product cheaper instead of seeing the bigger picture and considering the expenses that are involved in a project. In terms of profit, most students associated it with making a lot of unjust money and considered profitmaking as an unethical act towards their users. Overall, there was a noticeable contradiction in students’ responses, which was a result of inconsistencies between their short
exposure to professional practice and their training system at school. Despite acknowledging the importance of considering cost and profit, most students believed these factors prevented them from freethinking and developing better solutions for a problem at hand. Unfortunately, the offered business electives had not done a fulfilling job in changing this perception.

2.2 Professional Designers Interview Analysis

In conjunction with student interviews, professional interviews were also completed. In order to understand how issues of cost and profit affected professional design process differently, wide ranges of designers in various positions were interviewed. Talking to these designers also revealed that, they were not financially motivated and considering cost and profit was not the main focus of their work. However, they were always aware of it and they could not justify any of their creative decisions without thinking about their financial capabilities, limitations and goals.

Specifically for design entrepreneurs who had started their own business, various financial forces heavily influenced their entire business model and design process as shown in figure 2.5. Their most significant challenge was encouraging investors to fund their projects. Even though online platforms, such as Kick-starter or Quirky had made it easier for them to promote their ideas and connect with various investors, they still needed to have clear business objectives and financial projections in order to encourage people to fund their vision. Their other concern was being jack-of-all-trades in their newly established companies. Although they could benefit from professional help in specialized areas, they were mainly responsible for managing aspects they were not taught in design school such as finances, networking, cost analysis, pricing and
promotions. Another concern raised by these fresh entrepreneurs was their uncertainty to scale up their business. Although they could live without paying themselves for a while, they all envisioned a comfortable future where they could grow their business, pay themselves and make a reasonable amount of profit. Some of them admitted, to accomplish this vision, they needed to gain a general understanding of financial forces to estimate whether their ideas were profitable enough to cover extra expenses caused by growing their business.

Figure 2.5

In comparison to design entrepreneurs, the interviewees who worked as corporate in-house designers had less trouble working around cost and profit, because they could benefit from working directly with business experts, as illustrated in figure 2.6. However, this advantage had also created a drawback for these designers. Their vocabulary and working processes were distinctly different from their business counterparts. Therefore, they had difficulty communicating their ideas across the team. As they expressed,
having fundamental business knowledge not only could lessen this communication barrier, it would also make their decision-making processes easier and more meaningful for each party. Furthermore, understanding these factors helped them define the right scope from the start and establish realistic goals based on their client’s resources, limitations, and financial interests.

Figure 2.6

Young designers who had started their professional careers in consultancies expressed that they could not isolate cost and profit in their process and preferred to take a holistic approach in solving a problem. However, they admitted that these financial factors were very important pieces of the process that connected them to their clients and gave them leverage to defend their ideas. In their view, understanding cost and profit helped a consultancy to meet its clients’ financial goals and fit its solutions into their business models. It also enabled consultancies to justify how their solution would lead to financial growth if they decided to go beyond clients’ financial requirements.
Another core issue that was discussed with all these young professionals was regarding tools or methods they used to financially assess their design projects. The purpose of this discussion was to investigate whether these methods could be taught at design schools. This conversation revealed that most design entrepreneurs and consultants did not have any specific method to financially evaluate their work. Only a few of them had applied cost analysis to estimate their required initial investment in some projects. The in-house corporate designers were also on the same page. They mostly relied on their business partners for evaluating the financial viability of their ideas.

2.3 Framing Interview Results Into Design Requirements

Further analysis of student and professional interviews led to the following four design requirements for developing of a financial assessment tool for undergraduate industrial design (ID) students:
1. Create a tool that provides **general knowledge of cost and profit structures** for ID students and could be applied in various professional contexts after graduation.

Looking diligently to the world of ID students as well as design professionals revealed that most students have to integrate business thinking into their work regardless of the context they will end up working in. Although the degree of this integration may vary based on the type of projects, position or organization, having financial constraints is a reality that cannot be ignored. Many professional designers emphasized that in an ideal scenario, designers do not have to figure out everything by themselves and they would team up with business experts. However, that is not a prevalent situation and in many cases, designers are responsible for financial evaluation of their ideas as well as their design and development.

2. Develop a flexible tool to **inspire designers with more ideas instead of limiting them to prevailing financial considerations**.

One similarity discovered through comparisons of student and professional interviews was their perception towards financial constraints. Both groups did not like to center their design process on financial aspects. In their opinion, either in academic or professional environments, thinking too much about cost and profit limited designers’ outlook onto potential solutions. Thus, the proposed tool should effectively address this concern.

3. Create a tool that helps ID students learn **the basic business vocabulary**.

Another important point that constantly came up throughout professional interviews was to bridge the communication gap with internal team members as well as external partners. They believed having a common vocabulary would help them play a more dynamic role in multidisciplinary contexts.
4. Develop a tool that could be taught in short workshops through simulating real design projects.

Through analyzing professional interviews, it was realized that designers preferred to experiment with different aspects of their project to reach a desired financial outcome, instead of solely focusing on numbers. This behavior confirmed that teaching ID students about business methods in isolation and away from hands-on projects would not be very effective. Teaching the tool through simulated design projects would greatly help students to experiment in iterative cycles and learn its content for future applications.

In summary, it can be concluded that both groups of interviewees (students and young professionals) were not very comfortable with financially restricted projects. Their ultimate goal was to create value for their users rather than profit for their clients. However, the reality of a financially competitive market forced them to constantly face issues, such as cutting cost and increasing profit margins. Thus, both students and professionals admitted that it is beneficial for designers to integrate cost and profit considerations into their design process without making it a lead for the final outcomes.

At the end, the insights from interview framed into four main requirements for developing a financial assessment tool, which will be thoroughly discussed in the following chapters.
Chapter 3:  
Design Process Analysis  

After understanding designers’ perception towards cost and profit, it was time to 
explore their working procedures. This phase began by studying the design process to 
understand its various phases and explore the methods used in each one. The ultimate 
goal of this investigation was to compare the design process and methods with other 
disciplines such as design management, business strategy, and design thinking to 
identify points of parities as well as differences. In doing so, I could map out designers’ 
product/service design development journey and identify critical areas for integrating a 
financial assessment tool into ID students’ design process. In the following pages, 
these three sections will be discussed:  

1- Studying the design process  
2- Analyzing methods across different disciplines  
3- Identifying opportunity areas for application of a financial assessment tool  

3.1 Studying The Design Process  
This phase started by fully understanding different phases of Industrial Design’s most 
common development processes. Studying “How do you design?” (Dubberly, 2005) 
introduced me to more than 131 design process models that are applied in different 
contexts. Although some of these models had significant differences, many had similar 
structures with slightly different arrangements. 10 of these methods, which were more 
in accordance with what is currently taught at undergraduate level, were picked for 
further analysis. Integrating these 10 processes with our prior knowledge from 
interviews helped me build a generic design process that was relevant to both design
students and young design professionals. As shown in figure 3.1, this process begins with “Identifying” a problem. The second phase is “Understanding”, which refers to researching the context surrounding the identified problem. The third phase is “Synthesis”, which relates to framing the research findings and structuring a guideline for the rest of the process. “Conceptualization” is the fourth phase where designers start ideating based on their prior research. The fifth phase is “Selection” where ideas will be converged and a few concepts move forward. “Evaluation”, the sixth phase, is where designers need to test their selected concepts in order to choose their final design. The seventh phases is “Realizing” where designers have to start thinking more rationally about their concept and provide technical specifications about their solution. “Delivery” is the last phase where designers plan for distribution methods and think about their idea’s life cycle.

![Figure 3.1](image)

Although the order and length of each phase may vary in an actual design project, it was decided to keep this process linear with equal phases to help organize the methods I later examined.

**3.2 Analyzing Methods Across Different Disciplines**

Creating this process provided me with an overview of the actions designers take in each phase of their design process. Subsequently, I began to study what types of tools
and methods designers utilized in each one of these phases. Most of these methods made designers more empathetic towards their users and enabled them to envision alternative scenarios. However, almost all of them were very descriptive and dependent on designer’s personal interpretations. Thus, they would lead to subjective outcomes.

To draw a comparison, the same study was conducted for design management and business strategy methods along the same eight-phase process. The found techniques were mostly based on large bodies of demographic data, market research and trend analysis. Unlike design methods, most of them had a statistical structure that could provide measurable outcomes. Although their scientific foundation made these methods more reliable, it also made them very difficult to be internalized and used in quick and iterative cycles of the design process.

Comparing these two disciplines revealed that the gap between their methodologies was greater than what had been assumed. Therefore, the cross-disciplinary field of design thinking was added to this overview to investigate methods that try to bridge this gap. Most of these methods were created to help researchers become more empathetic towards their users, and visualize and prototype their solutions iteratively to get feedback from their target audience. However, these techniques had another dimension that design methods mostly overlooked: they integrated viability testing and financial assessments in their process to make sure their solutions were feasible.

Looking into design thinking methods demonstrated that in spite of their ingenuity, their number was limited to a few techniques, which were mostly developed for a specific project by a particular firm and were not commonly used by the design community. Figure 3.2 illustrates an overview of collected methods across these three disciplines. The blue squares represents design methods, while the orange squares show design
management and strategy methods and green squares represent design thinking techniques. A complete list of all methods studied for this analysis has been provided in appendix B.

Figure 3.2

3.3 Identifying Opportunity Areas for Application of a Financial Assessment Tool

Comparing the found methods across these three disciplines led to several very important insights. For designers, as illustrated in figure 3.3, there were two peaks in concentration of methods during their design process: one was the “Understanding” phase as designers tried to get to know their users and gain empathy. The other was during the “Conceptualization” phase where designers used various techniques to develop a great number of solutions for a problem at hand. However, the same analysis revealed that the concentration of design methods in other phases was not as significant particularly during the first phase of “Identifying”, and the last two phases of
“Realizing” and “Delivery”. In these stages, designers were faced a lack of methods to align their preliminary goals with final execution strategies. In contrast, design management and business strategy methods were spread more evenly across the process, which enabled managers and strategists to continuously evaluate and refine their directions throughout the process.

Figure 3.3

Ultimately, these comparisons not only provided an overview of the available methods in three different disciplines and their structures, they also enabled me to identify three opportunity areas for introducing a financial assessment tool into the design process, as displayed in figure 3.4. The first area is during the “Identifying” phase. Traditionally, a design brief or a design problem is given to ID students in this phase and they immediately begin the process’s next phase “Understanding”. For design students, this is a great stage to set initial goals for their project, develop plans for reaching those
goals, and determine strategies for constraints that may arise throughout the process. By optimizing this phase, students would become more informed about their goals and make more realistic decisions in the following phases. The next potential area for applying a financial assessment tool is during “Synthesis”. A tool in this stage can help students filter their ideas through stakeholders’ capabilities and financial desires and stay away from solutions that are not economically viable. Finally, applying a financial assessment tool in the last two phases of the design process “Realizing” and “Delivery” helps designers to turn their ideas into actionable solutions with clearly defined business models.

Figure 3.4

To sum up, in this chapter many methods were explored and analyzed from different perspectives. The result of this analysis revealed that there are opportunities in the design process for merging methods across the three layers of industrial design, design management/ strategy and design thinking. The result of this fusion will be a framework, which is tailored for creative processes and enables designers to consider financial aspects of their ideas throughout their product/service development process.
Chapter 4: Development Of A Financial Assessment Tool

After understanding designers’ behaviors and perceptions towards cost and profit and studying their design process, a list of design requirements was developed in previous chapters to be used for creation of a financial assessment tool for ID students. With those requirements in mind, a pilot tool was developed, which its formation process and structure will be fully discussed in this chapter.

4.1 Tool’s Development Process

As discussed in chapter three, the primary goal of a search for design methods was to understand what tools and strategies are applied in different disciplines. However, the secondary intention was to identify particular financial assessment methods that could be modified for ID students. In this quest, two frameworks were found: “Big picture” (Nordhielm, 2006) from Marketing Strategy, figure 4.1, and “Business Model Canvas” (Osterwalder & Pigneur, 2010), from Design Thinking, figure 4.2. These two frameworks had the following characteristics that made them appropriate for application in the design process:

Figure 4.1
They both created a visual overview of the entire product/service planning from an idea to execution on one page.

They both consisted of smaller modules that could be completed sequentially.

Through completion of these modules, most of the required material for development of a business plan became available.

“Business Model Canvas” did a better job in associating each module with a proper visual to make it more comprehensible.

“Big Picture” incorporated issues such as core competence and marketing objectives that the “Business Model Canvas” did not emphasize.

To entirely grasp the structure of these frameworks and understand their details, I complemented my readings with two graduate courses that were mainly centered on the application of these frameworks.
First, I participated in a seven-week long graduate marketing strategy course at Lindner College of Business, which was exclusively designed to teach the “Big Picture” framework. Upon the completion of the course and reading Marketing Management: The Big Picture (Nordhielm, 2006), I had developed a strong understanding of the tool and applied it in three different projects.

To learn about the “Business Model Canvas”, I attended a three-day master class workshop where students applied the “Canvas” to invent new social enterprises. Later on, I expanded my understanding of this framework by studying Business Model Generation (Osterwalder & Pigneur, 2010), and reading’s Osterwalder’s blog (Osterwalder, 2004) in full to understand how he had developed this tool and how he was planning to take it further. At the end, I sent out a short questionnaire to the design students who had participated in the workshop to get their feedback on the tool and its pros and cons.

Although both of these frameworks were effective in broadening users’ perspective towards financial aspects of their projects, a few issues were identified through studying and application of these two frameworks:

- None of these tools had been developed specifically for designers; thus, some of the modules were not clearly defined, and they led to confusion amongst ID students.
- Despite expanding students’ horizon towards financial factors, these frameworks did not provide any further guidance for developing new ideas in each module.
- None of them provided students with means to evaluate their ideas and assumptions.
• None of the tools incorporated trend analysis and context research, which are essential stages during the preliminary phases of the design process.

4.2 Tool’s Structure

Based on the pros and cons of these two frameworks and also the design requirements discussed in chapter two, a new financial assessment tool was developed, which was visual, consisted of complementary modules and provided design students with further assistance for ideation and evaluation throughout its application.

The final iteration of the tool was actualized as a paper prototype that could function as a playful game, as shown in figure 4.3.

Figure 4.3

This game consists of three complimentary levels. Each level includes four main questions that ID students need to respond in order to move on to the next level.
The goal of the first level’s questions is to provide students with a general understanding of the context they want to design for. Therefore, students will not be exposed to any financial concept related to their project. To visually represent this interaction, as shown in figure 4.4, the first four questions are located outside of four folding flaps that conceal the next two level’s questions, which are more business oriented. Design of this feature is drawn from the interview insights, where both students and professionals mentioned they did not want to think about financial forces right from the beginning.

![Diagram](image)

**Figure 4.4**

In this phase, ID students collect current and future trends that are relevant to their ideas and spread them in four sections of Social, Economic, Technological and Environmental trends. Students are able to change any of these four themes to something that is more meaningful for their projects. For instance, if they are designing something for an academic institution, they might want to replace the environmental trends with educational trends. After collecting trends, students should prioritize them along two axes. One axis is about trend’s impact on an idea and the other axis is about
likeliness of the trend to occur. By organizing the collected trends along these axes, students will have high impact trends that are very likely to occur in the center of the framework. This matrix has been borrowed from STEEP (Social, Technological, Environmental, Economic, Political) Analysis Mapping (Fraser, 2012) and modified for this project’s purposes.

As students complete this level, they can unfold the flaps, as shown in figure 4.5, and move on to the second level’s questions. These questions help students assess their core strength and weaknesses for delivering a concept. Through completion of this level, students can clarify what skills, resources and partners they need and what kind of benefits they should create to compete in their current landscape.

![Figure 4.5](image)

Finally, students can move on to the last round of four questions that are more specific to planning a successful entry to the market. The difference of these questions with the other frameworks lays in giving students a pathway for ideation and evaluation of their
ideas. Each question is linked to a stack of four color-coded cards that are based on specific iterative functions, as illustrated in figure 4.6.

**Figure 4.6**

The top layer provides a simple explanation of a particular financial concept, such as cost structures, distribution channels, customer segments and revenue streams. These explanations are designed in a way to be quickly understood by ID students.

The next layer gives students methods and tips about ideating with those financial forces. For example, at the back of “How is your idea going to create revenue?” eight revenue models have been presented, and students are asked to re-envision their idea through each one. This process encourages students to imagine their ideas in scenarios that they had not considered before. While they keep the essence of their idea, its physical representation morphs during these ideation rounds. In addition, students learn how to be agile and quickly come up with more and better ideas if a financial constraint is imposed to their project.
The third layer requires students to design a quick and inexpensive way to put their ideas into practice. By piloting their ideas, they can get consumers’ feedback and evaluate the feasibility of their concepts. For instance, if they want to start a food service company, they can design a small food stand and sell their food on campus to see how people react to quality, price, delivery, and every other aspect that is important for realizing this service idea. This would give them a chance to test the feasibility of their ideas and take them one step further from undeveloped assumption.

And the final layer asks students to clarify their findings and decide on their final strategies regarding their cost structure, distribution systems, customer segments, pricing strategy and revenue streams. By completing this level, ID students would have all the components ready for writing a standard business plan.

Although the collected information is not finalized and can be changed during the process, it helps students refine their idea and try different approaches that they would never have considered otherwise. In addition, going through this tool helps ID students become familiar with general business terms and equips them with information they need to pitch their ideas to non-designers.

**4.3 Application of the Tool in Students’ Design Process**

This tool can be applied throughout the design process in two different ways. In the first method, which is illustrated in figure 4.7, the tool will be integrated into the process in three different phases. First, students can complete the first level of the tool – trend analysis- while they are trying to identify a specific need and understand a particular design brief or project proposal. Next, students can go through the second level’s questions to assess their required resources, partners and skillsets to carry on with the
project when they are done with their initial research and are ready to frame their research findings into design requirements. This assessment will help them to define more relevant design requirements and develop better strategies for the rest of their project. Finally, students can apply the tool in the last two stages of the design process to refine their concepts and validate opportunities to transform design ideas to actual product/services proposals.

Figure 4.7

Although the first method is the desired application of the tool in the design process, in some cases ID students prefer to not limit their thinking and concept development processes with financial considerations from the beginning. In this case, as shown in figure 4.8, the tool can be applied after the concept development phase in order to help students re-assess their ideas, envision alternative applications, and develop solid business foundations for their concepts’ future developments.
To sum up, based on the design requirements that had been developed in previous chapters and an extensive study of the design process as well as various methods across three different disciplines, a financial assessment framework was developed for ID students and their creative design processes. In the next chapter, the process of testing and evaluating the effectiveness of this tool will be discussed in detail.
Chapter 5:
Tool's Testing And Evaluation

After development of the financial assessment tool, it was time to test it with ID students to study its effectiveness in their design projects. This chapter will discuss how the tool was implemented in a design course and evaluated by different stakeholders in the following two sections:

1. Testing procedure
2. Evaluation process

5.1 Testing Procedure

To test this tool in practice, Professor Steven Doehler, who teaches industrial design at DAAP and is also advising this research project, offered me to collaborate with him in an entrepreneurship studio that he teaches every spring semester. This course is designed for senior ID students who are planning to pursue their design ideas as a business venture after graduation. They participate in this studio to learn about legal and financial issues related to starting a business. Prof. Doehler recommended applying this tool as a structure for the first half of the semester, and then using the collected information to write a business plan throughout the remaining weeks.

In week one, a presentation was given to introduce students to the tool's structure and explain how it is going to be implemented into their class. In the second week, paper prototyped tools were distributed amongst all 15 students for utilization throughout the semester. In the same week, students were asked to complete the first level of the tool, trend analysis, as their homework. In the following week, students were split into teams...
of two to discuss their homework and get feedback from their peers. Then, they were asked to unfold the tool, and bring their most important trends inside and move on to the second level’s questions. In this stage, they were asked what skill sets they had, which partners and resources they needed and what kind of benefits they were trying to create. Before responding to these questions, they were presented with a brief case study of a DAAP ID alumnus who had started his business right after graduation. The purpose of sharing this case was to explain how this entrepreneur had successfully fulfilled each one of these four questions in his venture. After the presentation, students were asked to spend five minutes on each question, and assess their strength and weaknesses in each area. Later, they were split into groups of four to discuss their responses and get feedback. For homework, they were asked to further refine their responses for each question.

In week four, we moved to the four cards in the middle. In this stage, I used a cake shop metaphor to explain each card’s content. First, they were asked to take out the top card in each stack, and read the information on its back. Following this activity, I referred to the cake shop metaphor to explain each one of those financial concepts such as cost, channels, and market segment. The purpose of using a metaphor was to make these concepts more tangible and simplified for students. After understanding the first layer of cards’ content, students were asked to take out the second layer of cards, which were about re-envisioning their design idea through a specific financial lens. First, they were provided with examples and then, they were given different ideation frameworks for each one of the four questions to be completed as homework. In the fifth week, students were split into groups of two to practice additional rounds of ideation in class in order to help them completely understand the methods they had
been taught in the prior class. At the end of this session, they were introduced to the last two layers of cards. They were given a presentation about different ways of creating a pilot plan for their projects. Finally, they were given a smaller version of the tool to document their final business strategies. By week six, students had completed all the tool’s modules and were ready to write a standard business plan to be presented to potential investors and partners identified in the tool’s second layer. Figure 5.1 represents students while going through the second level of the tool.

![Figure 5.1](image)

**5.2 Evaluation Process**

When ID students finished using the tool and completed all its modules over the course of seven weeks, it was time to investigate how application of such method had affected their design process as well as outcome. Thus, all students in the class were asked to evaluate their experience with the tool. The tool was also shared with a group of design educators to get their feedback on its structure and application’s potentials in undergraduate industrial design courses.

In the first step, it was most important to understand how students thought of applying such methods into their design process. Thus, an online survey was prepared and sent out to all students in class to rate the usefulness of the tool in development of their projects. A sample of this survey has been provided in Appendix C.
Students were asked a range of different questions in order to measure how successfully the tool had responded to the four design requirements that were developed at the end of chapter two.

First, it was necessary to measure how much the tool had helped students to gain a general understanding around business aspects of their design. As the survey revealed almost 55% of the students had a very little knowledge, 36% had some, and 9% of students had a lot of knowledge regarding the financial aspects of their designs prior to the application of this tool. However, 73% of students said this tool had helped them a lot to think about business side of their idea and the rest of class stated the tool had fairly helped them to consider these aspects. Thus, when students were asked how much their business knowledge had increased around different aspects, all groups responded positively and there was a 25% increase in business knowledge across all students in class. Even the students who had developed preceding business knowledge through independent research stated that they had learned something new. Interestingly, 91% of all students rated these business aspects as very important factors in their projects.

The next set of questions related to the second design requirement, which was about the tool’s potential for inspiring students with more ideas. 36% of class stated that the tool had inspired them a lot to transform their initial idea, 55% mentioned it had somehow inspired them and 9% of students stated that they had been a little inspired by the tool.

Last, I looked into the third design requirement, which was about teaching design students the basic business vocabulary. 27% of students mentioned the tool was very successful to teach them the basic business vocabulary, and 55% mentioned it was successful and 18% said it was somewhat successful. The overall response was very
positive and none of the students expressed that they have not learned any new business terms throughout application of the tool.

In the second portion of the survey students were asked more questions regarding the format of the tool and how it could be improved in its future iterations. In terms of the tool’s content originality, 73% of class said the material was somewhat new. Some of them were already exposed to the material through elective business courses, independent research, and their co-op experiences.

In terms of the tool’s clarity, almost 55% of the class said that the tool’s material was moderately easy to understand, while 36% of class said the tool’s content was very easy to comprehend and 9% of students expressed difficulty understating the material. Almost half of the class mentioned the tool’s content was relevant to their design projects and the other half mentioned it was somewhat relevant. In terms of tool’s format, 36% of students had found it very engaging, while 45% mentioned it was somewhat engaging and 18% of students had found it a little engaging.

Besides multiple-choice questions, students were also required to provide comments regarding various aspects of their interaction with the tool. One of their positive comments related to the tool’s simple way of making them consider all the business factors involved in their design concepts; as one of the students described “it was like having all the important questions/things to think about right there in front of you”. Going through this process also helped them to see the scope of their projects in terms of who should be involved and what resources are needed. They also mentioned they enjoyed how the tool spurred them to reframe their solution and think about it in a different way and come up with applications around their idea that they would not normally consider. Some of them talked about how useful the trend research phase had been and had
forced them to look into areas that they had not considered before. Although a few students mentioned it was a little challenging to understand how they should prioritize the trends along the axes and suggested using color grids or other visual cues to make it easier to comprehend.

Most students found in class activities and explorations very useful, particularly students who were from disciplines other than industrial design, such as graphic and communication design. These group activities had helped them better understand how the tool applies to their non-product based concepts. There were a few concerns regarding the shape, folding aspects and physical dimension of the tool as well. Some students suggested a smaller and more transportable version would be more practical and they said a digital tool, which is more editable could be an ideal alternative.

Finally, the class unanimously agreed that these types of methods should be taught to undergraduate industrial design students. In their view, these types of methods could introduce students to the business language and business thinking and help them design for real situations. As they expressed, designing without a base or realistic strength behind it was a fantasy, which would never happen in the real world. Thus, the skills acquired by this tool were not only beneficial for starting a business, but they could easily be applied to the current design process in understanding where one’s solution could go.

Besides all the positive comments, students also stated that these types of methods should not be incorporated in every industrial design class and ID students should have an opportunity to explore freely and without financial constraints sometimes.

Lastly, it was very important to present the tool to design educators who were working in the intersection of business and design in order to get their feedback on the tool’s application for undergraduate industrial design courses. Therefore, the tool was
presented to three distinguished individuals who have spent many years of their career investigating the common grounds between design and business education, Michael Wescott president of Design Management Institute (DMI), Richard Buchanan professor of design management at Weatherhead School of Management at Case Western University, and Kaja Tooming Buchanan professor of Design in Management at Cleveland Institute of Art. The response from these individuals was very positive. In their view, this type of tools could have a great impact on the way design students perceived business and it could also help educators to keep students engaged in the process. They expressed, the playfulness of the tool and the possibilities it provides for ideation around financial constraints would make it an appropriate method to be used in creative design classes. Finally, they commented that such tool makes business concepts more accessible, comprehensible and playful for design students.

In summary, the tool was tested in a seven-week long experiment with undergraduate design students. In every session students first learned about a particular module of the tool through design related examples, situations and metaphors. Then, they had a chance to practice their learning through in-class activities and share their ideas and thoughts with their peers and get their feedback. These interactive sessions helped them better understand the tool’s content and relate it to their design ideas. Finally, students were given worksheets to fill at home and bring to class for further discussion in the following sessions. The main purpose of this activity was to give students more time to reflect on what they had learned in class and refine their thoughts outside of class discussions. After completing the experiment, students filled out an online survey to rate and evaluate their experience with the tool. Overall, their responses were very positive and the majority of the class stated that the tool had successfully delivered its
primary functions in a simple, visual and engaging way. The tool had helped them to see various financial elements that were related to their concepts, learn new business terminologies and create new applications for their ideas that they would not consider otherwise. In the following chapter, it will be concluded how different parts of this research comes together and responds to the two research questions that had been established in the beginning of the project.
Chapter 6: Conclusion

The competitive market landscape, scarcity of materials, and reformation of communication methods have all directly influenced the way products and services are designed, and consequently the role industrial designers play in their organization. Besides knowing the craft, today’s industrial designers need to be strategic problem solvers who can help their organizations sustain in this continuously changing context. Thus, their training needs to encompass many other elements in addition to their core creative programs to prepare them for their future responsibilities.

One key element that significantly helps designers prepare for their new roles is to speak the language of business. Designers should be able to understand the financial ramifications of their creative decisions and envision how their ideas become commercially viable. Although many designers learn this process through years of practice, they could become familiar with business basics through their design education. The current design education system lacks business methods that are made for designers and their creative processes. Simply exposing design students to regular business courses would not solve the problem, yet it may add to the degree of separation between design and business.

This research tried to take advantage of a user-centered design approach in order to design a business method for industrial design students based on the insight that was collected through hours of interviews and observations. This tool was developed in collaboration between business savvy industrial designers and design savvy business people to assist the design community in understanding the business implications of their design driven ventures. This process for ensuring financial consideration has a
more comprehensible, creative and fun approach of integrating business criteria into
design development methodology. The research results showed to be successful in
that design students embraced the material, which they formerly tried to avoid.

Therefore, this process enabled me to respond to my first research question and prove
when business training is designed based on the following approaches, it can be easily
integrated into the undergraduate industrial design curriculum.

1. The tool’s design and development was completely based on the insights
collected from design students and professionals. Therefore, students could
easily understand its content, relate it to their design ideas and apply it in their
working processes. It was tried to format business explanations into simple and
understandable definitions and avoid business jargons. The physical dimension
was also designed in a way to encourage interaction and playfulness to keep
students engaged throughout the process.

2. The tool’s content was taught through tangible and familiar examples or exciting
metaphors. These examples extremely helped students comprehend complex
and abstract business concepts. It also gave them a reference of how they can
apply the tool to transform their initial ideas. Particularly, giving them examples
of how thinking about a specific business aspect has led to a more innovative
and creative solution cracked their bias towards business thinking and how it
limits creativity. It also encouraged them to at least give it a try and experiment
with it to see whether their ideas can be improved.

3. The tool gave students new techniques to ideate around their design concepts.
This helped them see the tool as an enabler rather than a limiting force.
Therefore, they were encouraged to envision possibilities that they would not consider otherwise.

4. The tool’s application was centered on a design idea rather than pure financial considerations. Thus, instead of talking about how students can increase profit margins or reduce cost in an isolated way and away from a design project, they were asked to take a holistic approach and see their design concepts in a larger business context. This approach helped students to constantly evaluate their concepts against what they were learning from the tool and refine them accordingly. Although, they did not come up with solid financial numbers at the end of this process, they had developed a clear understanding of how their idea is going to be realized and reach their target users.

To respond to the second research question regarding the necessity of these types of business training for design students, the tool was presented to many different stakeholders including students, educators, professional designers and employers. Although each group responded to this question from a different perspective, they all agreed that these types of trainings are significantly important for design students and would help them easily transit from an academic setting to their future professional careers and become more effective members in their organizations.

In a world that is increasingly becoming entrepreneurial, further research, investigation, and relevant documentation in this area is needed. This thesis served, as a starting point for the development of business methods that are developed to cater to designers and their particular working processes. However, the research and design of the financial assessment tool can be further investigated and refined.
In next steps, a similar study can be conducted in various design schools in order to understand and analyze students’ perceptions towards business training across different learning environments. In addition, the tool can be refined through co-creation sessions with students and educators who have applied it in their design studios. In doing so, the tool will be evolved to something that is more appropriate for both design students as well as design educators. In addition to an educational version, the possibility of modifying the tool for other applications, such as a consulting version can be investigated through further research and user evaluation. Finally, the tool can be transformed into a digital version that is easily accessible for any design student across the globe. This digital tool would ultimately enable students to take their designs beyond aesthetic considerations and turn them into real offerings that can have a positive impact in their target users’ lives.
Bibliography


Appendices:

Appendix A: Interview Questions
Appendix A.1 Students’ Interview Questions:

1. Read and compare the two, Highlight opportunities for innovation, Choose one that you would like to work on and explain why

Design Brief 1:

SmithCo is recently expanding their head office in Detroit Michigan and they are planning to add a small auditorium to their facility for company’s meetings and community events. This future auditorium will be remarkably compact, with narrow concrete risers and can accommodate almost 150 seats. As one of the leaders in furniture industry, SmithCo aims to take advantage of this opportunity and bring the state of the art design into its home office and showcase its capabilities to guests and people from community. In order to reach this goal, your company has been commissioned by SmithCo to design the next generation of foldable seats for this public space within the next 14 months. The seating should visually complement the space and create something both elegant and technically creative that conveys the company’s innovation oriented legacy.

Design Brief 2:

Virco, a medium sized furniture company specialized in school equipment in South Carolina, is trying to develop a line of utilitarian armed-chairs for primary schools. One of the main players in this industry is Steelcase that produces high quality educational furniture, however, because of their high price points many public institutions cannot afford their products. This presented an opportunity for Virco to enter the education market with a product that could immediately make an impact on seating arrangements with lower prices and same quality as Steelcase products. Now, Virco is partnered with your company to find the right platform for improving the classroom experience through redesign of tablet-arm desks. Virco requires your company to create a series of utilitarian furniture concepts and a finalized prototype that should:

- Be engineered and manufactured by Virco’s current technical capabilities
- Be ready to reach the market within the next schools’ purchasing cycle in 9 months
- Reduce the cost of each unit from $290.00 to $178.00 to meet public institutions’ purchasing budget
- Create a minimum 40% net profit about $72.00 per unit in order to remain a profitable line in Virco’s portfolio
- Enable institutions to save money by making spaces more flexible and accommodating for varied uses.

2. What are the most creative projects you have worked on? Why?
3. What are your main challenges during Co-op?
4. What do you think, when you are given a project that is confined with cost and profitability?
5. When you are designing a project on your own, where do you put cost and profitability in your priority list?
6. How do you think considering these factors affect the way you work?
7. What do you think it takes to turn an idea to a market success?
8. What do you think designers need to know about business?
9. Have you ever taken any business electives? Can you please explain why you have or why you haven’t?
10. How do you think school could better prepare you for your Co-op?

Appendix A.2 Design Startups Interview questions:
1. What were your biggest challenges starting out a business on your own?
2. What do you think would be helpful to know before starting your business?
3. What do you think school could teach you to facilitate this process?
4. How does your design process differ from your process at school? What factors do you consider now that you didn't consider then?
5. What are your criteria for choosing to work on a project?
6. What kind of methods do you use to measure cost and profit of a project you agree to work on?
7. How important are they for you to run your practice?

Appendix A.3 Business Strategists, Design Thinkers’ interview questions:
1. Do you think in order to succeed in innovation process, designers should be able to evaluate and communicate the economic benefits of their ideas?
2. What do you think clients expect to see? Do they need a business evaluation or just an innovative idea?
3. How do you direct projects in a way to have the right balance of creativity and business viability? Is there any specific guideline or method you use to help your design team measure the financial benefits of their proposals from different aspects?
4. In your opinion, how could we include business evaluation in the design process without constraining creativity?
5. What are the key factors that you consider in a design proposal, from the business standpoint?
6. From your experience, which one of these factors designers mostly fail to address?
7. Is there any reference, article, website that you recommend regarding my topic?

Appendix B: Studied methods

Appendix B.1 Studied Design Methods
· Artifact Interviews (Kumar, 2012)
· Behavioral Prototype (Kumar, 2012)
· Bodystorm (IDEO.org, 2011)
· Brainstorm (IDEO.org, 2011)
· Buzz Report (Kumar, 2012)
· Cluster and prioritize insights (Kumar, 2012)
· Concept methaphors (Fraser, 2012)
· Concept Prototype (Kumar, 2012)
· Concept Scenarios (Kumar, 2012)
· Contextual interviews (Schneider & Stickdorn, 2010)
· Contextual Research Plan (Kumar, 2012)
· Customer Co-Creation (Schneider & Stickdorn, 2010)
· Design Requirement Soul/Heart/ Body (Kruzeniski, 2010)
· Experience Simulation (Kumar, 2012)
· Field Observation (Fraser, 2012)
· Five Whys (Schneider & Stickdorn, 2010)
· Focus Groups (Visocky O’Grady & Visocky O’Grady, 2006)
· Group ideation sessions (Kumar, 2012)
· Inspiration in New places (IDEO.org, 2011)
· Interview/ Observation Database (Kumar, 2012)
· Min mapping (Fraser, 2012)
· Online surveys (Visocky O’Grady & Visocky O’Grady, 2006)
· Participatory design (IDEO.org, 2011)
· Persona (Fraser, 2012)
· Photo Interviews (Fraser, 2012)
· POEM (People/ Objects/ Environments/Messages) (Kumar, 2012)
· Popular Media Scan (Kumar, 2012)
· Project Brief (Fraser, 2012)
· Pugh Chart (Cagan & Vogel, 2012)
· Role Play (Fraser, 2012)
· Scenario Development (Schneider & Stickdorn, 2010)
· SET Factor Analysis (Cagan & Vogel, 2012)
· Sketch (Kumar, 2012)
· Solution Diagraming (Kumar, 2012)
· Solution Enactment (Schneider & Stickdorn, 2010)
· Solution Prototype (Is Like/Feels Like/ Looks Like) (Zenios, 2010)
· Solution Storyboard (Kumar, 2012)
· Storyboards (Fraser, 2012)
· Storytelling (IDEO.org, 2011)
· Task Analysis (Cagan & Vogel, 2012)
· Task Flow (Cagan & Vogel, 2012)
· User Journey (Fraser, 2012)
· Value Opportunity Analysis (VOA) (Cagan & Vogel, 2012)
· Video Ethnography (Visocky O’Grady & Visocky O’Grady, 2006)
· Visual Lifestyle Collage (Visocky O’Grady & Visocky O’Grady, 2006)

Appendix B.2 Studied Design Management and Business Strategy Methods
· Archetype map (Liedtka & Ogilvie, 2011)
- Assumption Testing (Liedtka & Ogilvie, 2011)
- Asymmetric Clustering Matrix (Kumar, 2012)
- Big Picture (Nordhielm, 2006)
- Capability requirement (Fraser, 2012)
- Competencies plan (Kumar, 2012)
- Competitor/Complementor map (Kumar, 2012)
- Competitors Activity Systems (Fraser, 2012)
- Concept Matrix (Kumar, 2012)
- Customer lifecycle map (Schneider & Stickdorn, 2010)
- ERAF Systems Diagram (Kumar, 2012)
- Eras Map (Kumar, 2012)
- Experience Mapping (Fraser, 2012)
- Financial Profile (Kumar, 2012)
- Financial sensitivity analysis (Fraser, 2012)
- Implementation plan (Kumar, 2012)
- Innovation Evolution Map (Kumar, 2012)
- Key facts (Kumar, 2012)
- Learning Launch (Liedtka & Ogilvie, 2011)
- Morphological Synthesis (Kumar, 2012)
- Napkin Pitch (Liedtka & Ogilvie, 2011)
- Need mining Analysis (Fraser, 2012)
- Offering Activity, culture mapping (Kumar, 2012)
- Opportunity Map (Cagan & Vogel, 2012)
- Pilot Development and testing (Liedtka & Ogilvie, 2011)
- Platform plan (Kumar, 2012)
- Porter 5 Forces (Kumar, 2012)
- Prescriptive Value Web (Kumar, 2012)
- Reciprocity (Fraser, 2012)
- Semantic Profile (Kumar, 2012)
- SIT (systematic Inventive Thinking) (SIT Method, 1996)
- Solution Roadmap (Kumar, 2012)
- Stakeholder Mapping (Fraser, 2012)
- STEEP Analysis (Fraser, 2012)
- Strategy Roadmap (Kumar, 2012)
- SWOT (Osterwalder & Pigneur, 2010)
- The Proposition inspiration (Fraser, 2012)
- Trend From... To Exploration (Kumar, 2012)
- Trend Matrix (Kumar, 2012)
- Value Chain analysis (Liedtka & Ogilvie, 2011)
- Value exchange map for all stakeholders (Fraser, 2012)
- Value Hypothesis (Kumar, 2012)

Appendix B.3 Studied Design Thinking Methods
- Business Model Canvas (Osterwalder & Pigneur, 2010)
- Business model prototype (IDEO.org, 2011)
- Capability Checklist (IDEO.org, 2011)
- D3 Matrix (Mrazek, et al., 2008)
- Evaluate outcome with stakeholders (IDEO.org, 2011)
Appendix C: Students’ Evaluation Questionnaire

1. How much did you know about business aspects of your idea before taking this class and using this tool?

<table>
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2. How much did this tool help you to think about business sides of your idea?

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3. How important do you think these business aspects are for your idea?

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4. How do you describe your business plans before taking this class?

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5. How much do you think this tool inspired you to transform your initial idea?

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6. How successful do you think this tool was to familiarize you with basic business vocabulary?

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7. How much do you think you have learned about the business around your idea after using this tool?

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8. How much of the tool’s content was new to you?

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If the material wasn’t new, where had you learned about these business related issues?

9. How easy was the tool’s content to understand?

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<td></td>
</tr>
</tbody>
</table>

10. How relevant the tool’s content was to your design project?

<table>
<thead>
<tr>
<th>Totally Irrelevant</th>
<th>a Little Relevant</th>
<th>Somewhat Relevant</th>
<th>Relevant</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
**11. How engaging was the tool’s format?**

<table>
<thead>
<tr>
<th>None</th>
<th>Little</th>
<th>Somewhat</th>
<th>A Lot</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**12. Which part of the tool was the most insightful?**

**13. Which part of the tool was the most confusing?**

**14. What do you think was missing in this tool that could be added to the next versions?**

**15. Which part of the tool was redundant or irrelevant that could be eliminated in the next versions?**

**16. How do you rate your overall learning from the tool?**

<table>
<thead>
<tr>
<th>None</th>
<th>Little</th>
<th>Some</th>
<th>A Lot</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**17. What do you think about training industrial design students with these type of methods?**

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Please explain your reasons:
