BUSINESS SENSIBLE DESIGN
EXPLORATORY RESEARCH ON THE IMPORTANCE OF CONSIDERING COST AND PROFIT FOR UNDERGRADUATE INDUSTRIAL DESIGN STUDENTS
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1. INTRODUCTION
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. Therefore, they should be prepared to consider various factors including their idea’s financial feasibility and profitability. Despite industry's new demands of designers, 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. 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 industrial designers ourselves, who had studied and worked under these circumstances, we decided to conduct this research in order to understand the possibility of making business education more integrated into the design process. Our goal was to develop a financial assessment tool, which was specifically created for undergraduate industrial design students who had less than two years of professional work experience. To guide our research and come up with a solution, we took a user-centered design approach, which provided us with contextual user knowledge as well as methods for testing and evaluating our proposed solution.

1.1. 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, our search was limited to the undergraduate industrial design program at the University of Cincinnati, DAAP (College of Design, Architecture, Art, Planning) in Ohio. As professors and Graduate assistance we had full access to students and the studios where they worked. We specifically narrowed down our scope to a group of senior industrial designers who were graduating in less than one year.

1.2. 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. A three-day observation session was held while 36 undergraduate 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 how they responded to financially related questions raised by the audience.

Contextual Interviews: played an instrumental role in different stages of this research. In the preliminary stages, 20 senior and junior industrial design (ID) students were interviewed at DAAP to understand how
they perceived financial factors, such as cost and profit in their design processes. 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. 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 they used to financially evaluate projects and explore whether those methods could be modified for design education.

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 the development of a financial assessment tool. This tool was used as a business awareness tracking system for an undergraduate entrepreneurship design studio with 15 senior ID students. 7 of this 15-week course were 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.

2. DESIGN STUDENTS AND PROFESSIONALS’ PERCEPTION TOWARDS COST & PROFIT

In order to design the right tool, first we 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 us understand what they really wanted to gain from business courses and how they wanted this process to benefit them.

Although they all acknowledged the importance of considering cost and profit in their design process, most design students believed these factors prevented them from freethinking and developing better solutions. Almost all of them referred to their Co-Op experiences and stated that in reality designers have to deal with budgets and profit requirements. However, 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 their attention from customer’s needs to client’s needs and consequently from problem solving to moneymaking, thus, greatly affected their design process. They assumed that considering these factors not only expanded their research phase to find the least expensive materials and manufacturing procedures, but it also squashed their creative thinking phase and forced them to discard many good ideas simply because they did not seem financially viable. Two interesting concerns regarding concepts of cost and profit repeatedly came up during these interviews, which are worth mentioning. 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.

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. 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, they mentioned that their elective business courses did not fulfill any of these areas effectively. They expressed that these courses were either too basic or too complicated with little application in their design courses. As a result, they gradually became disengaged and could remember very little from the courses’ content.

Interviewing professional 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. Their most significant challenge was encouraging investors to fund their projects. Even though online platforms, such as Kickstarter 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.

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. 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 help them establish more realistic goals for each project based on their client's resources, limitations, and financial interests. 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 these financial factors were very important pieces of the process that connected them to their clients and gave them leverage to defend their ideas.

Another core issue discussed with these young professionals was regarding the 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 school. This conversation revealed that most design entrepreneurs and consultants did not have any specific method to financially evaluate their work. Some of them had applied cost analysis to estimate their required initial investment in a few 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.

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 their final outcomes.

3. FRAMING INSIGHTS INTO DESIGN REQUIREMENTS

Further analysis of literature reviews, observation and interview results led to four design requirements for developing a financial assessment tool for undergraduate industrial design (ID) students.

- 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 design professionals revealed that most designers have to integrate cost and profit thinking into their work. Although the degree of this integration may vary based on the type of project, designer’s position or organization, having financial constraints is a reality that cannot be ignored. Thus, the proposed tool should provide an easy to understand business foundation for design students. Students who are interested in knowing more can take part in other specialized elective courses to complement this general knowledge.

- 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.
• 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. Thus, the proposed tool should familiarize students with the common business terminology that is used in product development processes and avoid overwhelming students with business jargon.

• 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 quick and iterative cycles and learn its content for future applications.

4. IDENTIFYING OPPORTUNITIES FOR IMPLEMENTING A FINANCIAL ASSESSMENT TOOL

After understanding designers’ perception towards cost and profit, it was time to explore their working procedures. Here we mapped out their product/service design development journey and identified critical areas for integrating a financial assessment tool.

We began by researching Industrial Design’s most common development processes. Studying “How do you design?” (Dubberly 2005) introduced us 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 us build a generic design process that was relevant to both design students and young design professionals. This linear process consisted of the following eight phases: Identifying, Understanding, Synthesis, Conceptualization, Selection, Evaluation, Realizing, and Delivery. Although the order and length of each phase may vary in an actual design project, we decided to keep this process linear with equal phases to help us organize the methods we later examined.

Creating this process provided us with an overview of the actions designers take in each phase of their design process. Subsequently, we began to study what types of tools and methods they 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, we also looked into cross-disciplinary methods, which were developed by business and design hybrids in order 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.

Comparing the found methods across these three areas led to several very important insights. For designers, there were two methodology concentration peaks 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 the 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. Ultimately, these comparisons not only provided an overview of the available methods in three different disciplines and their structures, they also enabled us to identify three opportunity areas for introducing a financial assessment tool into the design process:

- 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, define strategies for reaching those goals, and overcoming constraints that may arise throughout the process. By optimizing this phase, students would become more informed about their process 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.

5. DEVELOPING, TESTING AND EVALUATION OF A FINANCIAL ASSESSMENT TOOL

5.1 TOOL’S EVOLVEMENT PROCESS

With the design requirement at hand, we looked into the methods we had collected in the last phase in order to find tools to be modified for ID students. In this quest, two frameworks were found: “Big picture” (Nordheilm 2006) from Marketing Strategy, and “Business Model Canvas” (Osterwalder and Pigneur 2010), from Business Design Hybrids. These two frameworks had the following characteristics that made them appropriate for application in the design process:

- They both created a visual overview of the entire product/service business 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 objective that the “Business Model Canvas” did not emphasize.

Although both of these frameworks were effective in broadening their 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.

5.2 TOOL’S STRUCTURE
Based on the pros and cons of these two frameworks and also the principles discussed previously, 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 framework was actualized as a paper prototype that would function as a playful game. This game consists of three complimentary layers. Each layer includes four main questions that ID students need to respond to in order to move to the next layer. The first layer is designed in a way that conceals the other two layers. 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. The first layer’s questions help ID students to gain a general understanding of the context they are designing for. They have to analyze current trends and organize them based on their impact and likeliness to occur. The matrix used in this layer has been borrowed from the STEEP (Social, Technological, Environmental, Economic) Analysis (Fraser 2012) and modified for this game.

As students complete this layer, they can unfold the prototype and move to the second layer’s questions. These questions help students assess their core strength and weaknesses. Through completing this layer, students can clarify what skills, resources and partners they need and what kind of benefits they should create to compete in their current landscape. Finally, students can move 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. The top layer of this stack provides a simple explanation of a particular financial concept. The next layer gives students methods and tips about ideating with those financial forces. The third layer requires students to evaluate their ideas and design a pilot experiment to test their assumptions. And the last layer asks students to refine their exploration results and report their final plans.

5.3 TESTING THE TOOL

This framework was used as a structure of the first half of a semester long entrepreneurship design studio at DAAP, University of Cincinnati. 15 senior industrial design students who were planning to pursue their ideas after graduation participated in this course. 15 paper prototypes were built and distributed to students for utilization throughout the first seven weeks. Every week, one layer was introduced to students and practiced using a team format. Later, students were given worksheets to further refine their ideas as homework and received feedback the following week. At the process’s end they 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.

5.4 EVALUATING THE TOOL

When ID students finished using the tool, 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. Students were asked a range of different questions in an online survey to measure how successfully the tool had responded to the four design requirements that were developed in previous sections. First, it was necessary to measure how much the tool had helped students 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 of their concept, all groups responded positively. 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, we 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. 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 see the scope of what they were trying to do 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 how it had forced them to look into areas that they had not considered before.

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 could be applied to their non-product based concepts.

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.

Lastly, it was very important to present the tool to design educators who were working in the intersection of business and design and 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 from different design institutions. The response from these experts was very positive. In their view, these types 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 tools make business concepts more accessible, comprehensible and playful for design students.

CONCLUSION
The competitive market landscape, scarcity of materials, and reformation of communication technologies 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, industrial designers need to be strategic problem solvers who can help their organizations thrive in this continuously changing context. Thus, their training needs to encompass many other elements in addition to their core creative programs. 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 aspects of their design ideas and envision how their concepts 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 ramifications 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. Our results proved to be successful in that design students embraced the material, which they had formerly tried to avoid.
Reflecting on the entire research process, it can be concluded that the following four approaches helped prove when business training is designed for creative mindsets and processes, it can be easily integrated into the undergraduate industrial design curriculum and assist students to understand what it takes to commercialize their ideas.

- 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 jargon. The physical dimension was also designed in a way to encourage interaction and playfulness to keep students engaged throughout the process.

- 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 design 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.

- 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.

- 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 was going to be realized and reach their target users.

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