Systems Design Education in Industrial Design: A Hybrid Approach of Combining ID Studio and UX Design Courses as a Superblock

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Abstract
Traditional Industrial Design (ID) curricula have successfully trained students in fundamental ID skills. However, the increasing complexity of modern industries and technological advancements call for integrating Systems Design and User Experience (UX) principles. This paper introduces the "ID+UX Superblock," a hybrid educational model combining ID Studio and UX Design to better prepare ID students for contemporary challenges. Systems Design education teaches the methodologies and thought processes required to design not just individual products but complete systems within which those products exist. It encourages students to think about how those elements interact within an extensive system, offering a holistic and sustainable approach to problem-solving. For example, designing a smart home involves creating devices and understanding their intercommunication, management, user interaction, and underlying technologies. The Superblock model aims to widen students' skill sets for designing from both macro and micro perspectives. It involves real-world projects requiring a blend of systems thinking, user research, and UX design, enriching the learning experience and training graduates to be more competitive in diverse design roles. This paper discusses the curriculum, pedagogical strategies, and teaching outcomes through case studies, highlighting how the superblock model improves students' proficiency in systems thinking and capability to deliver system-level solutions. These solutions encompass physical and digital products with intuitive user interfaces, showcasing students' enhanced ability to integrate ID and UX principles. The success of this Superblock signifies the potential of interdisciplinary education to produce versatile designers capable of navigating complex design challenges.

Keywords: Industrial Design Education, UX Design Integration, ID+UX Superblock, Systems Design

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Introduction

Product Design's evolution has been marked by its traditional focus on creating physical products optimized for mass production. However, the landscape of product design is shifting dramatically with the onset of the digital era (Verhoef et al., 2021). The surge in the development of digital products has been persistent and profound, leading to the ubiquitous presence of User Experience (UX) Design in our everyday interactions. This rise underscores the increasing importance of UX Design in the design industry, signifying a paradigm shift from purely physical product design to a more integrated approach encompassing digital experiences.

The necessity for Systems Design in ID education becomes evident in this context (Meyer & Norman, 2020). The digital era has not only brought about a proliferation of digital products but has also introduced a heightened complexity in modern industries and technological advancements. We observe an intricate integration of physical and digital products with various platforms and services, catering to increasingly complex user needs. In such an ecosystem, designers are no longer just creators of isolated products but architects of comprehensive systems that provide coherent and intuitive experiences across multiple touchpoints.

It has become essential to equip ID students with the skills to develop comprehensive systems that include UI/UX design for digital products, grounded in the UX Design process. At the University of Houston's ID program, separate courses in ID and UX are offered, each focusing on distinct project scopes and learning outcomes. However, the core of these courses, which is Product Design, is undergoing a transformation as products are increasingly interconnected and designed to function within larger systems (Figure 1).

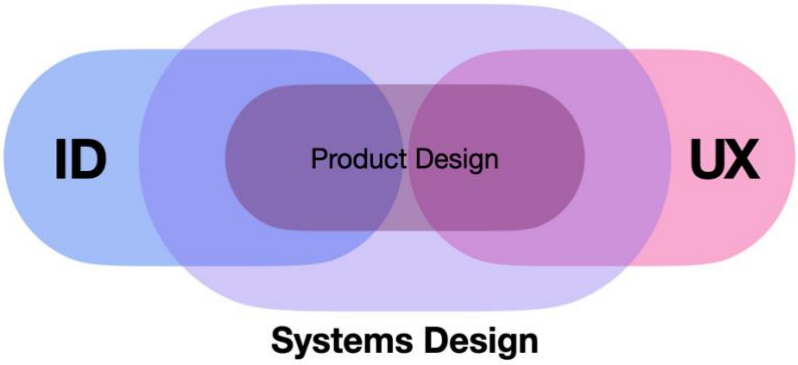

Figure 1. Systems Design in Industrial Design

Integrating ID and UX courses has become a strategic necessity in response to this evolving landscape. The goal is to transcend the traditional boundaries of these disciplines, fostering a comprehensive educational model where students can undertake system-level scale projects. This approach facilitates a deeper understanding of the interconnected nature of modern products and services. It equips students with the diverse skill set required to design and innovate within this complex, system-driven context.

The following sections of this paper will delve into the specifics of this integration, detailing the structure and pedagogical strategies of the ID+UX Superblock model and illustrating its impact through case studies and teaching outcomes.

Key Component of Systems Design

In an era characterized by rapid technological advancements and the increasing complexity of user needs, integrating Systems Design into the ID+UX Superblock model is essential. Systems Design transcends traditional product design by emphasizing the interdependence and interaction of various components within a broader ecosystem (Buchanan, 2019). This approach is crucial for preparing students to tackle the multifaceted challenges of modern industries, where products are no longer standalone items but integral parts of complex, interconnected systems.

Integrating Systems Design principles into the ID+UX Superblock curriculum ensures that students are proficient in designing individual products and capable of envisioning and crafting comprehensive, user-centric systems. It equips them with a holistic understanding of how products interact within these systems and how they impact the user experience. By embedding these principles in the curriculum, the ID+UX Superblock model aims to nurture a new generation of industrial designers adept at navigating the intricacies of the modern design landscape, where the boundaries between physical and digital products are increasingly blurred. These are key components of Systems Design for ID students to see the larger systems for a broader user experience.

Systems Thinking

At the core of the ID+UX Superblock model lies Systems Thinking, an approach that encourages a comprehensive view of design. This perspective is well-articulated by the notion that "A system is a set of elements that are interconnected in a way that achieves its function" (Meadows, 2015). This definition underlines the essence of Systems Thinking - recognizing and understanding the complex network of relationships and interactions that define a system. Eliel Saarinen, the renowned Finnish-American architect, succinctly captures the spirit of Systems Thinking in his famous quote, "Always design a thing by considering it in its next larger context — a chair in a room, a room in a house, a house in an environment, an environment in a city plan." This perspective resonates deeply with the philosophy of the ID+UX Superblock model. It emphasizes the necessity of viewing a product not in isolation but as a part of a larger ecosystem, understanding how it fits and functions within this broader context. Incorporating Systems Thinking into the ID+UX Superblock curriculum empowers students to see beyond the surface of their designs. It encourages them to consider the broader implications of their work, from the immediate user interaction to the societal and environmental impact. By understanding that every design is part of an interconnected system, students learn to create solutions that are not only innovative and user-centric but also harmonious with the larger system in which they exist.

Real-World Problem Solving

The curriculum is heavily focused on tackling real-world problems, encouraging students to apply Systems Thinking and UX principles to develop practical, effective solutions. This involves understanding user needs, market trends, and technological possibilities, ensuring that the solutions are viable, innovative, socially responsible, and user-centric.

Product Design

The ID+UX Superblock model marks a significant shift in ID education by emphasizing the integration of User Experience (UX) principles with traditional Industrial Design. This blend mandates a holistic view of product development, where the design process does not terminate at the aesthetic and functional stages but extends to consider the user's interaction

with the product in a digital context. In doing so, it challenges students to think beyond the tangible aspects of design and to consider how a product communicates, interacts, and integrates with other elements within a system.

User Experience Principles

User Experience (UX) Principles are integral to the Superblock model, ensuring that every design decision is made with the end-user in mind. Students learn to develop empathy for users, conduct thorough user research, and translate user needs and feedback into intuitive and meaningful product interactions, regardless of the medium.

Technology Integration

In the ID+UX Superblock model, Technology Integration is a critical component, reflecting the design industry's current trends and future direction. Students are equipped with the knowledge and skills to incorporate the latest technologies into their design processes, enabling them to create innovative solutions that are technically feasible and forward-thinking.

Interdisciplinary Collaboration

The model fosters Interdisciplinary Collaboration, recognizing that modern design challenges often require expertise from various fields. Students are encouraged to work in diverse teams, communicate effectively across disciplines, and leverage collective knowledge to devise comprehensive solutions that are well-informed and multifaceted.

Sustainable Design

Sustainable Design principles are embedded throughout the curriculum to ensure that students consider the environmental impact of their designs. This approach not only involves the use of eco-friendly materials and processes but also encourages students to think about the lifecycle of products, aiming for solutions that are sustainable in the long term.

ID+UX Superblock Model

At the University of Houston, the Industrial Design program recognizes the evolving landscape of design education and the need for an integrated approach to meet the industry's contemporary demands. A pioneering step in this direction is introducing the ID+UX Superblock model. This innovative educational framework is presented at the pivotal stage of the students' journey—during the first semester of their junior year, where they engage in 'Juniors ID Studio' and 'Introduction to UX Design' (Figure 2). By combining those two courses and creating a building block with the key components of the Systems Design, this Superblock model for our ID curriculum was developed (Figure 3).

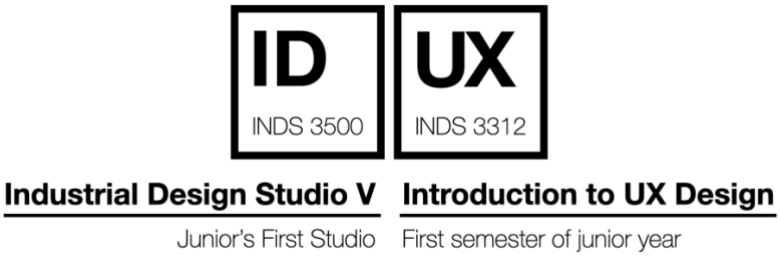

Figure 2. ID Studio and UX Design course in junior year at the University of Houston

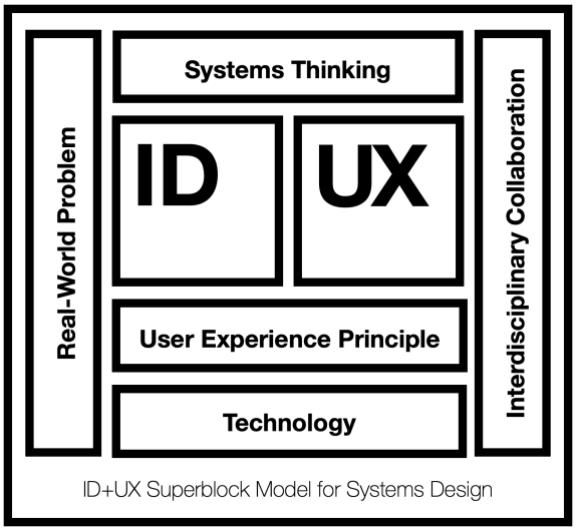

Figure 3. ID+UX Superblock Model for Systems Design

The ID+UX Superblock model is crafted to bridge the gap between traditional Industrial Design and the dynamic field of User Experience Design. It is designed to equip ID students with a comprehensive skill set encompassing product design, UX design, and UI design. This integration facilitates a holistic learning experience with additional building blocks: the key component of Systems Design, enabling students to explore real-world problems with advanced technology through user experience principles.

This combined course immerses students in a learning environment that encourages them to think beyond isolated products. They are trained to envision and design systems that optimize user experiences, leveraging their product and UX/UI knowledge. This approach ensures that their solutions are technologically feasible, relevant to market trends, empathetic to user needs, and environmentally sustainable.

By fostering an understanding of the interconnected nature of products, services, and user experiences, the ID+UX Superblock model aims to cultivate a new generation of designers. These designers are proficient in their craft and visionary in their approach, capable of addressing the complex, system-level challenges of the modern design landscape.

Systems Design Framework

These two courses are combined with a project incorporating product design, including physical and digital products and system solutions focusing on UI/UX design. The UX Design course has one project in this framework, while the ID Studio has two projects. One is for simple product design, while the other is for a system design that overlaps with both ID and UX. As the process of the superblock course shown in Figure 4, in the first half of the semester, the UX Design course focused on conducting research for the system design project, while the students worked on a separate project in the ID Studio, which was designing a chair. In the second half of the semester, the physical and digital product design phases of the system design project occur simultaneously. This combined superblock model course allows junior students to work on a physical product design: Project 1 and a system design project: Project 2.

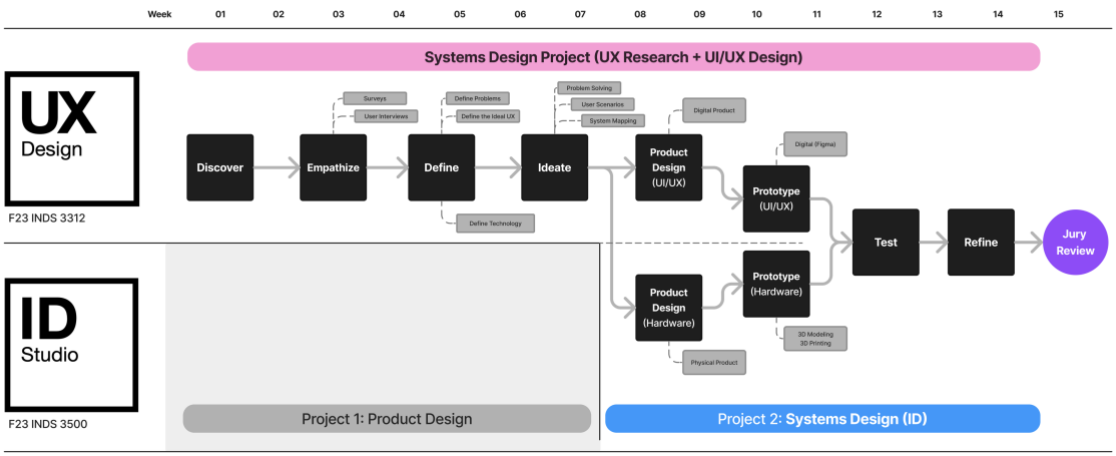

Figure 4. Systems Design Framework and Process

Case Studies

As part of their system design project, the students were given a challenge to create products that solve everyday problems using advanced technology. The project in the ID+UX Superblock course involves both research and design phases for physical and digital products. The students are expected to consider the latest technology integration to enhance the design solution and provide an ideal user experience for the identified issues. This section introduces the design challenge that students are working on, followed by two case studies from the course.

Design Challenge

- Identify a critical issue at home or work based on individual interests and research discoveries.
- Conduct focused research on specific human needs, define the ideal experience, develop concepts, and test the designs.
- Explore design opportunities for products they largely control in size, functionality, and testing.
- Study and apply the latest technology trends to design concepts to enhance the user experience.
- Create a system with physical and digital products to solve daily issues with the ideal user experience and human factors.
- Functionally creative and practical while aesthetically pleasing as an offering to the target user segments.

Case Study 1: ENERA – A System for Healthcare Monitoring

This project aims to improve the connection between patients and healthcare providers, creating a positive snowball effect. In the UX class, insights from the user interviews highlighted critical gaps in healthcare. During an interview, someone shared their experience of facing chronic AFib, which made them nervous about the episodes that come with it. They expressed a strong desire to take control of their condition and better manage it. This highlighted the challenges of managing atrial fibrillation and led to the direction of this project, which aims to bridge UX Design and ID Studio.

To better understand the daily impact of AFib, this research began by improving its management for everyday life. This included gaining insight into the chronic condition, identifying the target user group, and evaluating current solutions. Continuous monitoring of AFib vitals can enable early detection and better symptom management, resulting in improved patient outcomes. A proposed solution integrates telehealth, IoT, and UI/UX on digital interfaces. The ENERA system includes wearable devices and an app for continuous monitoring and feedback. (Figure 5)

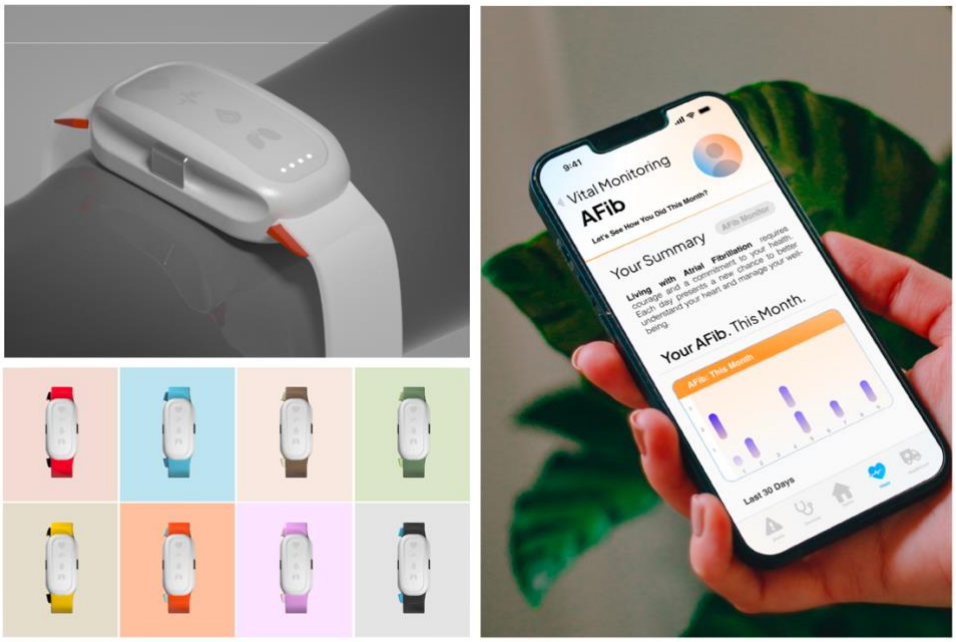

Figure 5. Physical and Digital Product of the ENERA System (Srivats Srinivasan, 2023)

The connection between UX and wearables is crucial in creating a coherent user flow system. The ENERA app employs various sensors to measure vital signs, including ECG, heart rate, respiratory rate, and oxygen saturation. By collecting this data from a wearable device, the app establishes a timeline, identifying when episodes occurred and which ones were abnormal. This provides a better understanding of the user's health status.

Case Study 2: Personal Pick – A System for Online Grocery Shopping Experience

One student found that online grocery shopping can be challenging when it comes to ensuring the quality of produce, and there is often no way to specify individual preferences and ensure the quality of each item. To address these issues, this project aims to enhance the online grocery shopping experience in three key ways:

1. Optimizing the process of picking and packing online orders by employees at the store.
2. Implementing AI learning to continuously improve the online shopping experience based on repeated buying behaviors.
3. Incorporating customer preferences and product conditions at the grocery store to provide customers with more detailed information and options.

Augmented Reality (AR) technology was proposed to be integrated into the hardware product used by employees to enhance their picking experience. AR glasses use a combination of optical technologies such as cameras and spatial mapping, along with non-optical

technologies like GPS tracking and projection, to provide visual guidance to the user, direct them to the correct location, and accurately highlight the object needed for selection. Therefore, the student designed the AR glasses with consideration to weight distribution, adjustability of the glasses, and hygiene issues. (Figure 6)

Figure 6. AR Glasses for Employees at Grocery Stores (Peggy Thai, 2023)

The deliverables are AR glasses for employees, a mobile app for customers to order groceries based on their preferences, and quality assurance. (Figure 7)

Figure 7. Personal Pick: System for Online Grocery Shopping Experience (Peggy Thai, 2023)

In this case study, a simulation was presented to demonstrate how AR glasses work and how users interact with the digital interface. The simulation focused on picking experience for employees with a specific order, where the preference was given to the ripeness of bananas. (Figure 8)

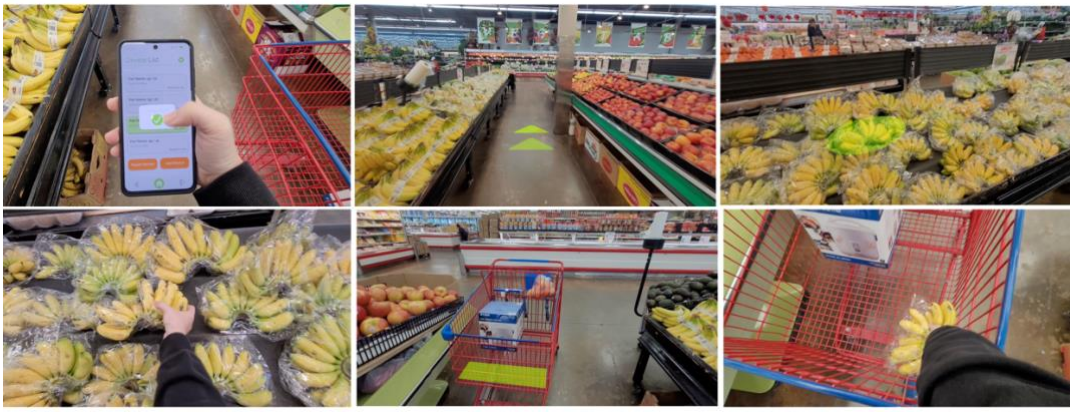

Figure 8. Simulation for Optimal Picking Experience with AR Glasses (Peggy Thai, 2023)

Conclusion: Discussions and Future Works

The "ID+UX Superblock" model marks a significant advance in the realm of industrial design education, strategically addressing the gap between traditional Industrial Design (ID) and User Experience (UX) Design to align with the needs of today's rapidly evolving design landscape. By integrating Systems Design and UX principles into the ID curriculum, the Superblock model demonstrates a profound potential to enrich students' design capabilities, preparing them for the multifaceted challenges of contemporary design.

The case studies presented within this research offer compelling evidence of the model's effectiveness in fostering a holistic design approach. These studies illustrate how students, by focusing on a holistic user experience within a single system-level scale project, can identify opportunities to resolve issues and create a cohesive system of products. Such projects not only showcase students' proficiency in form-giving and user interface design but also highlight their adeptness in the overall design of complex systems, reflecting a comprehensive understanding of both the macro and micro aspects of design.

The implications of adopting the Superblock model extend beyond the immediate enhancement of students' technical skills. It cultivates a dynamic skill set, empowering students with the ability to think critically and creatively about the interconnected nature of products, services, and user experiences. This approach ensures that graduates are capable of innovating within their respective fields and are prepared to contribute meaningful, sustainable solutions to the global community.

However, implementing such an integrated curriculum presents its own challenges, including the need for substantial faculty coordination, technology resources, and industry engagement. Despite these hurdles, the benefits of the Superblock model, as evidenced by the success of the case studies, underscore the importance of continuing to explore and refine this educational approach. Addressing the logistical and pedagogical limitations will be crucial in further developing and scaling the model to meet a broader range of design challenges and opportunities.

In conclusion, the "ID+UX Superblock" model signifies a vital evolution in industrial design education, emphasizing the need for a more comprehensive, integrated approach to prepare designers for the complexities of the current and future design landscape. The model's success in fostering a new generation of designers proficient in designing holistic, user-centric solutions across a spectrum of complex systems holds promise for the continued

advancement of design education. As we move forward, it is essential to build on this foundation, expanding the scope and adaptability of the Superblock model to ensure that it remains relevant and effective in equipping designers to navigate and shape the ever-changing design environment.

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