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Using an Experience Design Approach to Curriculum Creation

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Abstract
In this paper, we present the approach we took to the development of a new undergraduate major in human-centered design and development. The paper's contributions are twofold: first, we illustrate how we adapted the user-centered design process and used it to help us create the vision, conceptual framework, and new curriculum. We hope that this process, lead by the development of a *vision persona*, can help other groups as they work to create new programs. Second, we present the vision and curriculum framework of the new major, which we offer as a step towards growing UX education in the US.

Introduction
Although the field of user-centered system design and its theoretical foundations have been established, some would argue[1], almost half a century ago, the profession has only taken off much more recently. In fact, user-centered design or user experience design (UX) is one of the fastest growing professions in the US right now[2]. UX requires an interdisciplinary combination of skills ranging from psychology and anthropology to graphic design, computer science and engineering, and as such, employers have had a difficult time filling positions[3,4], since many typical graduates of computer science, engineering, or psychology lack an important portion of the skills required to engage in user-centered design. In fact, potential employees with the needed mix of interdisciplinary skills are so hard to find that industry professionals have deemed them "unicorns[3]." The UX unicorn is defined as "Mythical user experience designer with an advanced and adaptive skill range. Outstanding skills in graphic design, rapid prototyping, front end development, user testing, technical specifications, marketing and branding[5]."

Traditionally, user-centered design has been taught mostly in graduate programs focused on human-computer interaction (HCI). A graduate program complements undergraduate education in ways that enable students to gain the variety of interdisciplinary skills required in UX. At the undergraduate level, HCI is most commonly offered as a minor, following the recommendations of a 1992 ACM report on HCI curricula, which suggested that it would be premature to focus entirely on HCI at the undergraduate level[6]. However, graduate education alone cannot keep up with the demand of the UX profession. As the profession grows, and the market opens more and more opportunities for employment[7,8], the need emerges for undergraduate programs that prepare students for UX professions. Because of its fundamental interdisciplinarity, undergraduate UX education poses a number of unique challenges for traditional undergraduate programs that are often positioned to develop little more than interdisciplinary awareness, in addition to some depth in a chosen area of study.

In this paper, we describe how one program tackled the challenge of creating a UX undergraduate major and present the resulting curriculum structure. Throughout the program's development, we attempted to take a user-centered approach. We explain how

we used or adapted popular concepts and techniques from user-centered design, such as personas, to develop the program and curriculum.

The Approach: User-centered design

User-centered design is a design philosophy and practice that aims to create systems oriented to serve their users' need[9,10]. There are philosophical similarities between learner-centered curriculum design[11] and user-centered design, in that they both focus on the individual and her cognitive processes[12]. User-centered design is, however, more than a philosophy. When applied to human-computer interaction, user-centered design, and the associated new profession of user experience design, employ a process that ensures users' needs, goals, and feedback are taken into account throughout the design process. One core characteristic of the user-centered design process is that it strives to achieve in-depth understanding of users, stakeholders, and their goals. This understanding is often summarized in a user profile or persona and leads to deriving specific design requirements for the new product. Another core characteristic is the iterative integration of user feedback throughout various stages of development, beginning with the early conceptual stages. In this paper, we explain how we adapted techniques from user-centered design to create a learner-centered curriculum.

Step 1: Understanding Clients, Stakeholders, and the Problem

The first step in the user-centered design process requires that we understand the problem, the client, the stakeholders, and the users[13]. In this particular situation, we can think of the higher administrative bodies that approve undergraduate curricula as the clients, since a defining characteristic of clients is that they can grant or withdraw approval for a project and the details of its development. At a major state university, changes in the undergraduate curriculum undergo review and approval from committees at the department, college and university level.

Stakeholders are parties that "have something at stake." They can either influence or can be influenced by the solution being developed, but they are not direct users of the product/service, nor do they have the decision making prerogatives that clients do[14]. In this case, we identified two major groups of stakeholders: the first is external to the university and comprises of potential employers who look for college graduates with specific skill sets. This stakeholder group was represented by an advisory board comprised of industry partners and department alumni. The second stakeholder group is internal to the organization, and is comprised of the faculty and staff members whose work would be in any way influenced by the development of a new major. The types of influences can range from new courses that need to be taught, space and resource allocation, dealing with student enrollment, and so on.

For an undergraduate program, the users are the students who would enroll in the major. We conceptualized our users as current high school students who would be eligible to apply for admission to the new major, and current undergraduates of our program, especially freshmen, who might be interested in transferring to the new major once it is established.

We formulated the problem we were trying to address with this project as follows: There is an increased market need for graduates with UX skills. Currently, our department graduates a few students every semester who assemble a version of the required skillset due to the choices of elective courses they make. There is an increasing demand among our current students who take the one available undergraduate course on user-centered design for more courses on the topic. The department is faced with slowing application and enrollment rates and needs to create programs and majors to attract more applicants. As a whole, the university is driving towards innovation in undergraduate education, with special emphasis on interdisciplinary and competency-based education. Taken together, these factors create a fertile environment that presents the opportunity to innovate.

Our understanding of the problem emerged from iterative rounds of conversations with our clients, stakeholders, and users. Some conversations were informal, others were department or college-wide meetings, and some involved archiving and analyzing formal and informal student feedback about the one undergraduate-level user-centered design course the department offered in order to understand student needs. As several members of the client and stakeholder groups became convinced that this problem/opportunity needed to be addressed, we proceeded to the initial planning stages.

Step 2: Vision
A persona is a popular concept and technique in user-centered design. A persona is defined as a composite archetype of the user group. It is generated after in-depth research and understanding of the user group and as such, it is a technique for presenting research data in a way that is easy to understand and creates empathy with users[10]. A name and photograph, as well as details about the persona's daily life, are used in a persona description to provide vivid detail and facilitate empathy. The literature emphasizes how important it is for the persona to be based on actual research data rather than stereotypes or opinions[15]. When not enough data is available, a hypothetical or ad-hoc persona is used[16]. In developing the vision and goals for our project, we did not use a persona in the traditional sense. We grounded our decisions in the understanding of the problem, clients, stakeholders and users that emerged from the first step, and adapted the persona concept to create what we introduce as a *vision persona*. With a vision persona, we crafted a description of the ideal graduate of our yet-to-be-envisioned program. We began with the question, where is this graduate one year after graduation? Where does the graduate work? What is the graduate able to do? Because recruitment of women and under-represented minorities in our program is always a priority, just like in many STEM programs in the US, we created a female persona and named her Sarah. The persona description we used is presented in Figure 1.

Meet Sarah.

She graduated last year with a Bachelor's degree in Human Centered Design and Development from XYZ University. She now works as a user experience designer and developer for a top company that develops mobile and wearable computing applications.

Sarah is able to draw upon her deep understanding of human behavior and her strong programming skills to lead multi-disciplinary teams through the user-centered design process in order to create innovative digital products that create seductive user experiences.

Sarah's competitive edge is that she combines an understanding of h**uman-centered computing** with **solid technical competencies**. When she had to demo her idea for a mobile app, she did not show a PowerPoint. She had a working prototype. Sarah is the elusive **UX unicorn**.

 This document proposes a unit within XYZ University that will educate students like Sarah. The proposal is grounded in the discipline of human-computer interaction but extends it to allow for strategic growth in other technology areas that employ user-centered design.

Figure 1: Vision persona

Step 3: Design requirements

The vision persona and our understanding of the problem as summarized by the need for "UX unicorns" lead to the following requirements our new program would have to meet:

First, the program would have to include an interdisciplinary mix of skills from the areas attributed to the "UX unicorn." Figure 2 shows this mix.
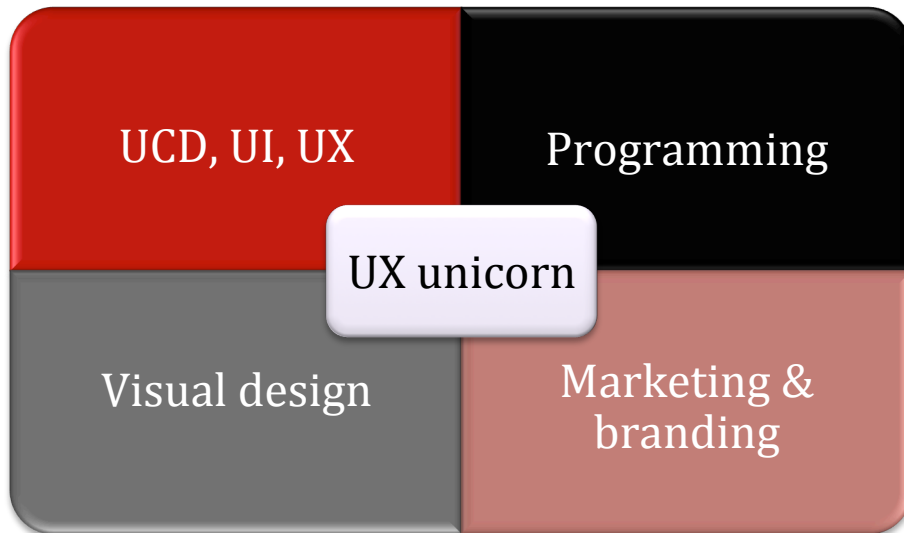

Figure 2: Design requirements: skills

Second, we knew that it would be important for the program to encourage not only immediate skills but also long-term, life-long learning goals such as creativity and continuous learning.

Third, it emerged as important that students engage in hands-on, interdisciplinary learning that is project-based and can replicate work experience. The nature of user-centered design is such that it makes little sense if taught only at the theoretical, process, or principle levels. Moreover, our stakeholders emphasized the importance of collaboration on realistic projects and of a well-rounded student portfolio, which can all be achieved through project-based learning.

Together, these design requirements provided the foundation for our curricular framework, described next.

Step 4: Curricular framework
Consistent with user-centered design philosophy, we conceptualized the "what" before the "how[10]." The "what" here refers to what the product/service should be able to do. As the "what" takes shape, the designer begins to tackle the "how," or the details of how the various goals and tasks can be accomplished. The shift in thinking from design requirements to curricular framework began to bridge the gap between the "what" and the "how" for us. As we listed the major learning goals we wanted the program to accomplish (the "what"), we started brainstorming ways for *how* the program could accomplish these goals through specific pedagogic activities and strategies. Table 1 illustrates this thinking process with regards to the major learning goals. We used a similar process when moving from the skills required of a UX unicorn to how we might able to help students achieved them in a 4-year undergraduate program.

Table 1: Bridging the gap between the "what" and the "how"

LEARNING GOAL (*what*)	LEARNING ACTIVITIES (*how*)
creativity and design	user centered design; brainstorming; creative challenges; project based instruction
teamwork and collaboration	project based instruction; distance collaboration
critical thinking	project-based research; evaluation of design solutions
life-long learning	project-based research; stretching to new platforms; developing habits for staying abreast of new information (e.g. reading professional blogs)
communication skills	technical writing; presentation; reports; data presentation
content mastery and application	project based instruction; reflection; design challenges, design critiques
technical competencies	project based instruction; mentoring; prototyping; internships

Step 5: Feedback
One defining characteristic of the user-centered design process is its iterative nature that relies on repeated feedback and prototyping loops[17]. Having created a conceptualization of our program's "what," we engaged our clients, stakeholders and users in several rounds of formal and informal conversation in order to validate our idea. Industry partners were consulted during the department's regular meetings with the industrial advisory board and were enthusiastic about the concept. They manifested no reservations and expressed that we have captured the skills and the type of individual they looked for when making hiring decisions. The only aspect of our proposal that did not capture the industrial advisory board members' imagination was the idea of competency-based education that would use a badging system instead of traditional grades and GPAs. Student feedback ranged from intrigued to enthusiastic, and our clients endorsed the idea and encouraged us to proceed with the project and do our best so that the program would be available to students as soon as possible. Therefore, we decided that the quickest route to this goal would be to establish a new major within the existing degree program and proceeded to create the detailed curriculum and courses for the new major in Human-centered Design and Development (HCDD).

Step 6: Curriculum
The curriculum discussions struggled to reconcile existing university requirements for coursework and credit hours with innovative pedagogies that would combine interdisciplinary and project-based learning with competency-based education. We soon found that at this stage in our institution's history competency -based education is best integrated informally throughout the curriculum while maintaining the university's course and grading structure.

We envisioned the curriculum as an inter-weaving of six different strands, or types of skills, that we derived from the intersection of our design requirements, university requirements, and a consideration of existing university resources. The six different strands are presented in Table 2.

Table 2: Six strands of the HCDD curriculum

Strand	Specific skills
1. Technical skills	Programming, mathematics, physics, science
2. Visual and information design	Graphic design, information visualization, statistics
3. User-centered design	User-centered design process, research and evaluation methods, project management
4. Humanities	Oral and written communication, psychology, design history, technology history
5. Entrepreneurship	Business planning, management and promotion
6. Global conscience	Foreign language and culture, study away, international collaboration

The six strands are integrated throughout the curriculum, and while they occasionally stand alone in one course (e.g. fundamentals of speech communication or intro to psychology), they are often merged into each of the core courses that are critical to the HCDD major. These core courses fall into three categories: Learning studios, Experience studios, and Capstone experience.

We envision the *Learning studios* to be project-based courses where students of relatively the same skill level work collaboratively under a professor's close supervision. The projects are set up so that the students' learning experience meets specific learning outcomes. During their undergraduate tenure, students would take four different learning studios. Each learning studio combines at least three of the six strands: user centered-design, technical skills, visual and information design, with some of the more advanced ones including more, strands. The emphasis on each strand might vary from learning studio to learning studio. For example, the first learning studio will focus more on the user-centered design process and less on technical skills, and the second learning studio is planned to emphasize visual and information design while still incorporating aspects of user-centered design and technical skills. The advantage of this model is that students need not separate the different layers of user experience design into different courses. The integration of multidisciplinary strands into each course is also meant to facilitate naturalistic connections between skills and concepts.

Experience studios are planned to be a student-run UX design consultancy firm. Students from different levels and with different skill sets will collaborate in Experience studios on real-life projects commissioned by external clients. The Experience studios will operate under the tutoring of a clinical faculty who is expected to manage projects and student teams, offer assistance, but not close supervision. Over the course of the 4-year program, a student will take five different experience studios, beginning in the second semester of the freshman year. Projects in the Experience studios will likely not be as tightly structured as those in the Learning studios. They might involve only parts of the user-centered design process – for example, evaluation, or development of only one component rather than an entire system. The Experience studios are meant to provide a setting as close to possible to a real job and to help students graduate with applied working experience. While the program encourages students to secure internships, we believe that a semi-structured, applied project experience that takes place under faculty tutoring will be an excellent complement to internship experience and provide diverse learning opportunities.

We envision the *Capstone experience* to span across two semesters and consist of the planning, development, and evaluation of an entire product, applying the entire user-centered design process and the skills acquired from all the other strands of the curriculum. Fourth-year students will work collaboratively on projects under faculty mentoring. We are also considering opening this capstone course to students from other disciplines, in order to maximize the opportunity for truly interdisciplinary collaboration.

Step 7: Informal evaluation

With the curriculum in place, we are continuously seeking feedback on our ideas as well as securing the necessary approvals. Informal feedback has been enthusiastic, with the Experience studios being the most intriguing and exciting aspect of the new major. As the major will not be offered before Fall of 2016, we do not have formal evaluation data. We hope that enrollment numbers, student success, and industry attention will be useful metrics. At this stage, we could only seek validation of the concept, and that has been encouraging all around.

Discussion: Curriculum Development

A question that arises is where an experience design approach to curriculum creation 'fits' within the traditional paradigms of curriculum development. In its basic form, curriculum development has historically followed a top-down, 'bigger-to-smaller' hierarchal process. It begins with deciding the topics that fit within a given academic major, perhaps (or specialization, minor, etc.). These are usually broken out as sub areas called courses, with related topical content. Within the course, then, content is further broken down into modules or lessons. Finally, related and supporting structures are applied to the lesson to provide teaching artifacts, assessment instruments, etc. However, instructional design experts have shown over time that more organized and scientific approaches to curriculum development can be much more effective. These approaches often begin with analysis of learning needs, development of learning objectives, assessment instruments, etc. prior to, or concurrent with, instructional content development. All of which should be followed with multiple levels of evaluation to ensure objectives are met (see Figures 3 and 4).
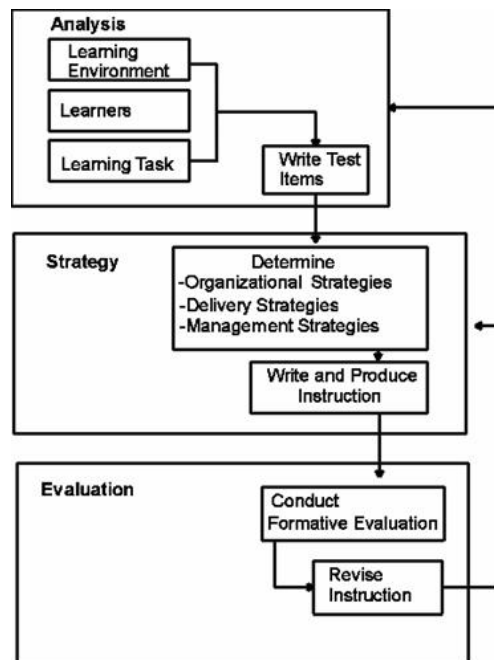

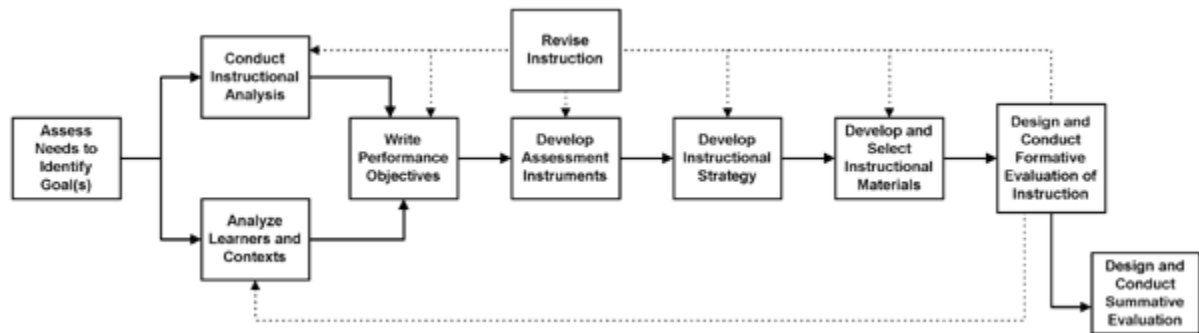Figure 3. Curriculum Development Model[18] (p. 7)

Figure 4. Systems Approach Model for Instructional Design[19] (p. 2-3)

As Smith & Ragan[18] note:

> Novice designers commonly assume that there is one "best" way to sequence content or organize learning experiences within courses or larger instructional scopes, and that this best sequence will be obvious to the designer once all of the learning goals are identified. On the contrary, many organization alternatives exist, many of which are not intuitively obvious. Finding the best curriculum organization should be the result of the designer's problem solving as he takes under consideration salient attributes of goals, learners, and context. (p. 302)

Within the last few decades, increasing attention has been applied to the question of curriculum development processes, resulting in many exciting changes in educational structures, methodologies, and techniques. Phrases such as 'problem-based learning,' 'flipped classrooms,' and 'competency-based assessment' are becoming much more common, resulting in novel and excitingly effective learning environments. We feel that an experience design approach to curriculum creation is an innovative attempt to leverage these developments that is consistent with the instructional design literature, while proposing specific process innovations such as a *vision persona*.

Conclusion
In this paper, we present the approach we took to the development of a new undergraduate major in human-centered design and development. The paper's contributions are twofold: first, we illustrate how we adapted the user-centered design process and used it to help us create the vision, conceptual framework, and new curriculum. We hope that this process, lead by the development of a *vision persona*, can help other groups as they work to create new programs. Second, we present the vision and curriculum framework of the new major, which we offer as a step towards growing UX education in the US. Further work is needed to create solutions for integrating competency-based education models into this curriculum and to understand how such models interact with existing administrative structures.

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