Design as an Immersive Vanderbilt Experience (DIVE)

A QEP proposal by
Will Berger, Derek Bruff, Elizabeth Boyd, Dan Fleetwood, Ben Shapiro, Lori Troxel, and Celia Walker

VANDERBILT UNIVERSITY

Table of Contents

Executive Summary

In order to face the challenges that confront our world, Vanderbilt strives to develop future leaders and active citizens with the ability to solve complex problems; teaching students a design method and giving them real problems to solve can accomplish this goal. This proposal outlines a new Vanderbilt program entitled **Design as an Immersive Vanderbilt Experience (DIVE)** that will strengthen students' life-long problem solving skills. DIVE will add value for the student, the university, and the greater community.

Pioneered by David Kelley and the revolutionary product design firm IDEO, human-centered design teaches highly transferable problem-solving skills, with the ultimate goal of advancing the human condition.[1] DIVE will provide a place for faculty to teach the six steps of human-centered design: observation, brainstorming, refining ideas, prototyping, testing, and final implementation[2]. Students will use this iterative process to propose solutions to needs both at Vanderbilt and in the surrounding community. For example, students could design solutions to reduce emergency room wait times or to help nearby residents with transportation issues.

DIVE will consist of a two-part core: 1) a short introduction to human-centered design open to all students, faculty, and staff, and 2) a semester-long immersive experience for a small group of students to engage in an in-depth design process, tackling real, open-ended problems through the use of human-centered design in multidisciplinary teams. The DIVE design immersion experience will ideally be equivalent to a full-semester course-load; however, it could also be implemented across two semesters to provide students with curricular flexibility.

In implementing DIVE, Vanderbilt has the capacity to cultivate creativity, intellectual curiosity, passion for diversity, empathy, and resilience. Students will be encouraged to engage with local schools, business owners, and non-profit organizations. Tangible solutions will be developed that can improve the quality of life for a wider audience, while instilling in students life-long problem solving skills. Further, students will be better prepared for postgraduate life. The National Association of Colleges and Employers conducted a study that found "critical thinking/problem solving" is the most valuable skill in newly hired employees.[3]

In short, DIVE is a winning opportunity for Vanderbilt: not only will DIVE contribute to the university's efforts to be a center for producing innovation and knowledge, but also it will strengthen Vanderbilt's reputation as a leader in the teaching and advancement of innovative thought and creativity across disciplines.

---

[1] IDEO. 2015. The Field Guide to Human-Centered Design. www. ideo.org.

[2] IDEO. 2015. The Field Guide to Human-Centered Design. www. ideo.org.

[3] Adams S. 2015. The College Degrees and Skills Employers Most Want in 2015. *Forbes.*

Motivation and Goals

DIVE will address several critical needs on campus. It will increase cross-campus immersion opportunities, build empathy, strengthen diversity and inclusion, foster resilience, build a creative campus culture, enhance professional development, and provide programs for new spaces.

Increases Immersion Opportunities for Underserved Audiences. The fundamental educational aspirations of *Immersion Vanderbilt*, as outlined in the 2014 Academic Strategic Plan are for all students "to engage, to question, and to forge change." While opportunities for immersive learning are flourishing on campus, the bulk of current immersive options are discipline specific, tying students to their major and excluding those students who want to work across disciplines.

DIVE is distinct in that it will be available to students across the four undergraduate schools, regardless of their major. For example, DIVE will leverage the liberal arts backgrounds of A&S students (only 60% of whom are estimated to currently participate in immersion experiences) to think critically to solve problems, while teaching design skills less inherent to their fields of study. In addition, students and faculty mentors from a variety of disciplines will work together closely and collaboratively, furthering not only the Immersion Vanderbilt initiative, but also supporting the tenets of cross-disciplinary teaching and learning, as highlighted in the Academic Strategic Plan.

Builds Empathy and Strengthens Diversity and Inclusion. An inherent and intentional byproduct of DIVE is that students will develop the capacity to listen to and understand different perspectives. Through an exposure to diverse viewpoints and beliefs, DIVE students will build empathy and help create a more tolerant campus culture.

Fosters Resilience and a Creative Community. By helping students to become producers of knowledge and equipping them with the tools to connect theory to practice and solve real-world problems, DIVE helps foster resilience. During the design process, students will learn that the first solution is not always the best solution. As they learn to fail, start over, and revise, they will develop the confidence to be creative. By applying this creative confidence to situations outside of DIVE, they will help build a more creative and resilient campus community.

Enhances Professional Development. Students will conclude their immersive experience with DIVE having produced a portfolio of work-product, as well as the capacity to describe the learning outcomes of their experience. Human-centered design is an approach to problem solving that is not currently taught at Vanderbilt, and yet businesses and organizations increasingly value this type of thinking and application. The DIVE Program

will allow students to enter the workforce in a variety of disciplines and utilize this design process.

Provides Engaging Programs for New Spaces. The demand for the DIVE Program is wide-ranging. For example, in December 2015, the School of Engineering hosted a makerspace workshop, attended by students, faculty, staff, community members, business and nonprofit leaders, and regional and national experts on makerspaces. Considerable enthusiasm for physical spaces that promote design is also evidenced by the School of Engineering's decision to build the new Innovation Center. DIVE will provide immediate programming for new design spaces in the Innovation Center and across campus. In addition, DIVE has the potential to engage numerous campus partners, such as the Curb Center, campus initiatives and organizations centered on entrepreneurship, the School of Engineering, and the Managerial Studies Program.

Program Overview

DIVE draws from curricula and various human-centered design and maker initiatives in university and professional settings, as well as current, local, and unique design expertise within the Vanderbilt and Nashville communities. The program consists of two primary learning experiences for students:

1. *Introduction to Design Thinking*. Offered both as a one-credit, semester-long course and as a non-credit, two-day "boot camp," *Introduction to Design Thinking* will engage a broad range of students in the principles and practices of design thinking.

2. *Design Immersion Experience*. In this one- or two- semester intensive experience, a smaller set of students will be selected from the *Introduction to Design Thinking* class to engage in an immersive design process. These students will tackle real, open-ended problems through the use of human-centered design multidisciplinary teams.

The entire DIVE program is portrayed in Figure A1 in the appendix and summarized here. The *Introduction to Design Thinking* students along with the Vanderbilt and Nashville community will propose project ideas. Next, students in the *Design Immersion Experience* will select projects with the assistance of DIVE faculty and staff mentors. These mentors along with additional specialized faculty and peers will provide expertise as needed for the immersion students as they use the human-centered design process to create solutions. A "going public" phase in which participating students share potential solutions with authentic audiences will conclude the experience.

Introduction to Design Thinking. Design thinking is applicable across a wide variety of contexts and careers; therefore, DIVE will feature an *Introduction to Design Thinking* experience available to hundreds of students, faculty, and staff across campus each year.

This introduction will help students understand the potential of design thinking and how design thinking is used to address different kinds of problems. It will engage students from the start in collaborative design work to begin to foster their "creative confidence" as designers, as well as shed light on the importance and challenges of collaborative design.

Introduction to Design Thinking will be offered in two formats:

- As a one-credit, semester-long course, offered in both fall and spring semesters, taught by Vanderbilt faculty, and available to students regardless of school or major; and
- As a no-credit, two-day "boot camp," offered each August (and perhaps at other times), open not only to students, but staff and faculty, as well.

This introduction will be a prerequisite for the *Design Immersion Experience*. Students might take *Introduction to Design Thinking* as a course in the year preceding their immersion experience, or complete the August boot camp in a just-in-time fashion.

Design Immersion Experience. Students interested in a deeper exploration of human-centered design will have the opportunity to participate in the *Design Immersion Experience* -- the heart of DIVE. Participating students (perhaps between 20 and 40 each year) will move through a structured design process, guided by faculty and staff mentors, in which they work in collaborative teams to apply human-centered design to real problems submitted by the campus and city communities. Students will frame problems and identify questions, listen to and understand client needs and perspectives, brainstorm and prototype potential solutions, and grapple with and learn from failure, all while seeking to address real needs in our local communities.

Student teams will be structured to provide diverse perspectives on problems of mutual interest. Participating students will also need to identify when additional perspectives and resources are needed, reaching out to faculty, staff, and other students on campus to consult on team projects. For instance, a project on "food deserts" (low-income neighborhoods without ready access to fresh, healthy, and affordable food) might require early input from faculty who study urban food issues, while a project team that storyboards a mobile app might reach out to the VandyApps student group for assistance in designing a prototype. This will provide a meaningful and practical structure for those with important domain knowledge or technical skills to be involved in the immersion experience.

Given the important role of metacognition in learning, immersion students will reflect in writing on their experiences as they move through the design process, likely on a blog open to the campus community. Not only will this prompt students to examine their own learning, it will also foster peer-to-peer learning as students read and respond to each other's reflections. At the end of the immersion experience, students will again reflect in writing, this time looking back on what they learned as novice designers and how they

contributed to their team projects. These reflections will provide faculty an insight into individual student learning, complementing the assessment of final group portfolios.

Ideally, the Design Immersion Experience will be a one-semester, intensive experience, similar to study abroad or an internship in that students will not take any courses outside the immersion experience. If this structure were not feasible, a two-semester structure, similar to senior design at the School of Engineering, would be possible. The colleges and schools of the participating students will determine course credit for the immersion experience.

Project Proposal Process. A project proposal process will serve as the foundation for collaborative design projects in the *Design Immersion Experience*. The process will be open to, and hopes to elicit participation from, not only the Vanderbilt community but also the broader Nashville community. The goal is to collect a variety of potential problems that lead to projects that are daring, feasible, and applicable to relevant communities.

In particular, participants in the *Introduction to Design Thinking* offerings will be asked to identify potential problems to which they could apply design thinking but are beyond the scope of the introductory experience. The ability to recognize a problem and advocate for its value is an important component of design thinking and, indeed, our students' future as global citizens.

Problems submitted by the Vanderbilt and Nashville communities and the *Introduction to Design Thinking* participants will be distilled by immersion students and mentors into a set of projects. These projects will serve as the foundation for the work of the immersion students.

Mentors and Consultants. Faculty will be involved in DIVE in a number of ways.

- Introduction to Design Thinking - Each offering of this one-credit course or two-day "boot camp," will be led by at least one faculty member with expertise in design thinking. The introduction will typically be co-taught by another faculty member, a staff member, or even an advanced student with appropriate expertise.

- Design Facilitators - The immersion experience itself will be facilitated by at least one faculty member, again with expertise in design thinking, and typically co-facilitated by another faculty member (perhaps from a very different discipline) or a staff member. These facilitators will be responsible for guiding students through the design process.

- Design Consultants - Faculty will also be involved on a per-project basis as consultants, offering domain knowledge or technical skills needed by project teams. This structure will involve a broader array of faculty who may not have expertise in

human-centered design, but can offer meaningful mentorship to students working on particular projects. As noted above, staff and students will also play this role as appropriate

Going Public. The *Design Immersion Experience* will finish with a showcase of student projects, similar to (but smaller in scope than) Senior Design Day in the School of Engineering. The showcase will be open to the campus, and members of the campus and Nashville communities involved in or affected by the student projects will be invited to attend and participate.

In cases where student designs have considerable merit, projects will move from design to implementation, given sufficient student interest and the necessary campus or community resources, with consultation and assistance from the Vanderbilt Center for Technology Transfer and Commercialization as appropriate. Implementation beyond prototype won't be required as part of the immersion experience, but will be supported as much as possible as part of Vanderbilt's mission to empower students to engage, question, and forge change.

Outcomes

Student Learning Outcomes. As recently quoted in the *New York Times*, design experts believe that "design thinking can help everyone form the kind of lifelong habits that solve problems, achieve goals and help make our lives better.[4]" By leveraging design principles in a research university, DIVE will equip students with skills and mindsets that prepare them to make a difference in the world.

Human-centered Design Process. Students will fully comprehend and successfully apply the human-centered design process to identify and solve meaningful problems. Students will understand the iterative process of human-centered design, move effectively from making concrete observations to thinking in the abstract, think critically about complex challenges, and create out-of-the-box problem solutions.[5]

Creative Confidence. Students will exhibit the creative confidence to tackle open-ended or ill-defined problems. Students will learn to trust their creative instincts by following the tenet that everyone has the capacity to be creative. Creative confidence will afford students with the resiliency to fail, start over, revise, create, and apply solutions in an iterative and dynamic manner.[6]

Listening and Empathy. Students will better hear, understand, and value the perspectives of others. They will broaden their network of colleagues on campus and in the Nashville

[4] Parker-Pope, T. 2016. 'Design Thinking' for a Better You. *New York Times*.
[5] IDEO. 2015. The Field Guide to Human-Centered Design. www.ideo.org.
[6] IDEO. 2015. The Field Guide to Human-Centered Design. www. ideo.org.

community. In practice, "others" refers to the clients and users of the design solutions produced by participating students; however, this learning outcome will be applicable to any number of situations, disciplines, and scenarios throughout the course of a student's life. Tara Parker-Pope, a recent op-ed contributor to the *New York Times* noted that "developing empathy for [herself] was truly a breakthrough made possible by design thinking."[7]

Multidisciplinary Team Building & Refined Communication Skills. Students and faculty will work in diverse, interdisciplinary teams, sharing their perspectives to consider problems from multiple viewpoints. Students will learn the value of collaboration, how to communicate effectively with members of a diverse group, and the tools to successfully navigate the challenges inherent to teamwork.

Community Outcomes. DIVE supports town-gown relationships and provides a vehicle for students to connect with community issues and work together to solve problems. The community will benefit from the talent and creativity of Vanderbilt students. In time, the university will form a network of corporations and not-for-profits who know to reach out to DIVE for help and guidance.

Institutional Outcomes. As referenced above, DIVE will advance *Immersion Vanderbilt*, foster cross-disciplinary teaching and learning, increase campus tolerance and inclusivity, significantly contribute to student learning, and nurture university-community relationships. Given that many of our peers and aspirational peers, including Stanford, Yale, Harvard, Northwestern, and the Massachusetts Institute of Technology (MIT), to name a few, offer programs similar to the DIVE program, DIVE will increase the university's visibility among our peers and potential student applicants.

DIVE will also position the new Innovation Center as a place not only for producing innovation, but as a center for the *teaching and learning* of innovation. By partnering with DIVE, the Innovation Center will become a space where high quality research and innovation will work seamlessly together through interdisciplinary student teamwork.

DIVE will provide additional avenues to centralize many existing but fragmented innovation initiatives at Vanderbilt and with the burgeoning entrepreneurial and innovation oriented Nashville community. For example, it will provide resources (e.g. faculty, course credit, tools) that will greatly strengthen and work well with existing student groups such as Design for America (DFA) and initiatives such as the Curb Scholars Program.

[7] Parker-Pope, T. 2016. 'Design Thinking' for a Better You. *New York Times*.

DIVE will contribute to efforts to enhance the undergraduate experience and attract a new generation of students who desire to engage in design development with others to create physical, virtual, or social innovations that are changing how we live and work.

Student Experience

Detailed in Table A1 in the Appendix is a complete sample design process that follows a human-centered design methodology. DIVE will teach each of these steps through independent, faculty-led case studies, before having students tackle final projects; i.e. a "Deep DIVE" approach.

Assessment

Outcomes for DIVE are outlined above at the student, institution, and community levels. We propose that initial assessment efforts for the program focus on student learning goals. Following are three high-priority learning goals, chosen for their relevance to human-centered design and their potential to be met through an immersive experience. Suggestions for assessment are provided for each goal. Actual assessment procedures and instruments will be developed in conjunction with the Vanderbilt Institutional Research Group and the Vanderbilt Center for Teaching.

1. Design Process - Do participating students understand common human-centered design processes? Are they able to apply those processes to solve design problems? We suggest a content analysis of student reflective statements, written during and after the design experience, using a rubric focusing on student knowledge of and ability to apply human-centered design processes. See the Reflective Assessment Rubric developed by Goldman and colleagues[8] for potential rubric material.

2. Creative Confidence - Are participating students more willing to tackle open-ended or ill-defined design problems? We suggest the use of a pre- and post-experience survey instrument designed to assess creative confidence, perhaps based on Hanauer and Dolan's Project Ownership Survey[9] and/or Carberry and colleagues' Engineering Design Self-Efficacy Survey[10].

3. Listening and Empathy - Are participating students better able to hear, understand, and value the perspectives of others? Here, "others" refers to the clients and users of

[8] Goldman, S., et al. (2012). Assessing d.learning: Capturing the journey of becoming a design thinker. In Plattner, H., et al. (eds.) *Design thinking research: Measuring performance in context*. Springer-Verlag.
[9] Hanauer, D., & Dolan, E. (2014). The Project Ownership Survey: Measuring differences in scientific inquiry experiences. *CBE Life Sciences Education*, 13, 149-158.
[10] Carberry, A., Lee, H., & Ohland, M. (2010). Measuring engineering design self-efficacy. *Journal of Engineering Education*, 99(1), 71-79.

the design solutions produced by participating students. We suggest the use of a pre- and post-experience survey designed to assess empathy in the design context, perhaps based on the five hierarchical categories of student understanding of "users" identified through qualitative research by Zoltowski and colleagues[11].

Resources

Physical Space. The Innovation Center, the Curb Center, and the College Halls will form a geographic *Creative Triangle*, as each one of these will house one aspect of DIVE. DIVE will have dedicated space for ideation in the College Halls. Here, DIVE students will meet, discuss, draw, brainstorm, and write. This space will be available 24/7 for the students. The Innovation Center will serve as the primary makerspace for DIVE. The Curb Center will serve as the primary resource for creative thinking. The director of DIVE will reside in one of these three locations. Because the *Creative Triangle* forms a perimeter around all of the undergraduate schools, it will communicate that creativity and design are integral and inclusive parts of the campus culture. A showcase area in the center of campus will be dedicated to displaying the work of DIVE students so that prospective and current students, parents, and faculty can view DIVE projects. The showcase area will be visible from the exterior to facilitate serendipitous viewings. Other campus facilities that will complement DIVE are the Physics Machine Shop, the Art Studios, and Engineering Labs.

Campus Connections:

- Design for America
- Vanderbilt Mobile Applications Team
- Vanderbilt Entrepreneurship Group
- Project Pyramid Global Projects Team
- Vanderbilt Social Enterprise Club
- Engineering World Health
- Engineers Without Borders
- Vanderbilt Innovation and Entrepreneurship Society
- Vanderbilt Energy Association

Community Involvement Potential:

- Metro School students such as MLK, Hume Fogg, and Nashville School of the Arts
- Charter schools such as the STEM Academy
- Fort Houston
- Metro Arts Commission

[11] Zoltowski, C., Oakes, W., & Cardella, M. (2012). Students' ways of experiencing human-centered design. *Journal of Engineering Education*, 101(1), 28-59.

- The Edgehill Neighbors
- Martha O'Bryan Center
- Belcourt Theater
- The Vanderbilt Office of Neighbor Relations

Budget. The following items will require financial resources:

- Human Capital: DIVE Director, Faculty Mentors, Lab Supervisors
- Space: Dedicated creative space, Administrative Office(s), Innovation Center, Engineering Labs
- Transportation: Vehicles to meet with community partners
- Materials: Paper, pens, metals, wood, plastic, safety glasses, masks, gloves, paint, etc.
- Hardware and software: Computers with design and drawing software

APPENDIX

Figure A1: Map of Design as an Immersive Vanderbilt Experience.

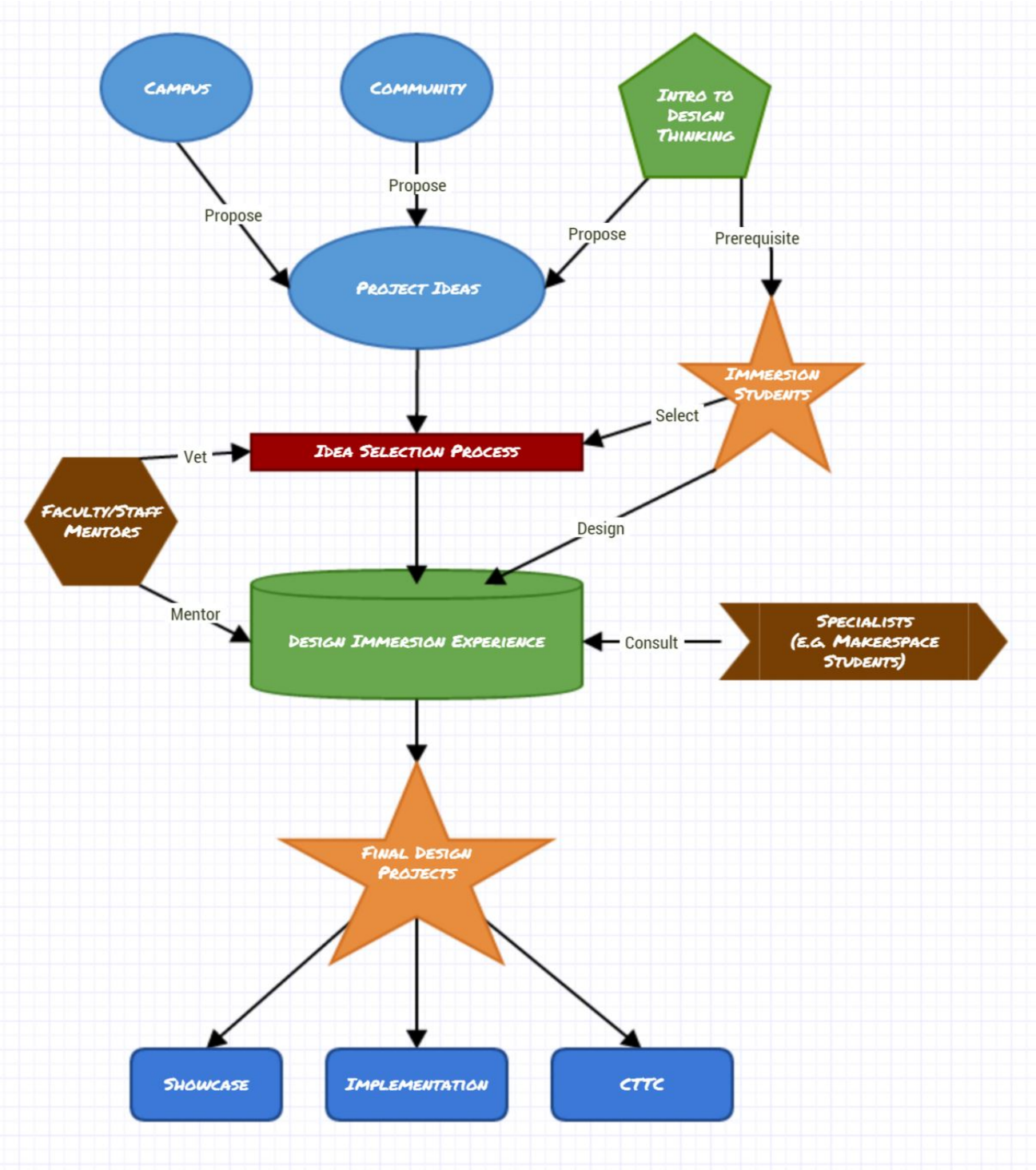

Table A1. Sample Student Design Immersion Experience.

Process	Description	Problem: Redesign Bus Riding Experience for Nashville MTA
Research and observation	· Faculty introduces community sourced problem · Students research the problem and discuss · Students visit problem site, speak to "experts", observe habits, and build empathy for the user (human-centered design)	Students research and discuss Nashville's public bus system. Safety emerges as an immediate concern, followed by missing stops, long wait times, uncomfortable seats, cleanliness, traffic, boredom, and confusing routes. The students ride the bus and speak to "experts" – daily commuters and bus operators, learning that passengers care most about three things: where, when, and how – where to go to catch a bus, when the bus will arrive, and which routes to take. Bus drivers care most about the safety of the passengers, disruptions and distractions, and running on time. Students learn that Nashville MTA has a trip planning feature online, yet few passengers know it exists.
Brainstorming	· Encourage wild ideas · One conversation at a time · "Defer judgment" – don't block others ideas · Build on the ideas of others · Quantity over quality	Students suggest ideas that range from practical to wacky, such as: · Developing an app that tracks the busses · UV lights that sanitize the bus at the end of the day · Seats that can be hidden into the walls to optimize space · Wheels that can turn 360° for better parking · A play space for kids · Velcro pants that stick to Velcro seats for safety · Heated bus stops · Buttons (on the bus & at stops) that alert the driver to stop · Advertisements for Nashville's MTA trip planner
Refining Ideas	· Democratic selection process · Most faculty direction · Choose a few, feasible ideas	Students vote on collected ideas. Building an app initially seemed ideal, but one student observed that most commuters do not use smart phones, making an app of little use. Instead, she suggests passengers communicate with and find the bus via SMS text. The faculty instructor intervenes to help focus the group by suggesting they combine elements of the most feasible ideas.
Prototyping	· Build prototype if required in makerspace · Develop minimum viable products (MVP's) to test in the field	Students split up into teams to build three different designs: 1. An ad campaign for Nashville's MTA trip planner 2. A button activated, bus stop heat lamp that doubles as a method for alerting the bus driver that a passenger is waiting 3. A SMS text system that tracks bus movement and arrival times
Testing	· Students bring prototypes to end-users and seek feedback	While passengers seem excited about all three ideas, they find the MTA trip planner ads and the ETA text system to be most useful.
Finalizing a Design	· Use feedback to finalize a design and implement it in the real world	Students finish the ETA text system and include a link to the trip planner with each SMS response so smartphone users can access the trip planner via phone, and non-smartphone users can access the planner from a home desktop.