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Integrating a Human-Centered Design Approach in a Human Trafficking Hackathon

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1 INTRODUCTION

Human trafficking is a global epidemic that results in grave violations of human rights for approximately 24.9 million people worldwide (International Labour Organization [ILO], 2018). According to the United Nations Office on Drugs and Crime (UNODC), human trafficking is:

> The recruitment, transportation, transfer, harboring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation (UNODC, 2018).

The National Academy of Engineering (2005; 2008) states human-centered design is appropriate for addressing Grand Challenges; thus, the fact that human trafficking intersects with multiple UN agencies and sustainable development goals signifies the need for holistic, interdisciplinary approaches to this global epidemic. Human trafficking is a complex problem, that lacks general awareness, and requires innovative solutions "to reduce the vulnerability of victims, increase the risks to traffickers, and lower demand for the goods and services of modern-day slavery" (UNODC, 2009, para 9). Design thinking supports the development of diverse ideas, which are critical for innovation. In this paper, we describe a university-wide event that applied a human-centered design approach to the problem of human trafficking.

1.1 Human-Centered Design Approach

"Design thinking reflects the complex processes of inquiry and learning that designers perform in a systems context, making decisions as they proceed, often working collaboratively on teams in a social process, and 'speaking' several languages with each other (and to themselves)" (Dym et al., 2005, p.104). Design thinking supports the development of diverse ideas which are critical for innovation (Vande, 2007). Research has suggested that design thinking not only helps students learn core subjects through application, but it also promotes the development of social skills (Staw, 2006; Goldman, 2002) and encourages students' metacognition (Kolodner et al., 2003).

Design thinking has grown significantly over the last 30 years as a way to foster innovation in work environments by balancing a customer focus with employee experimentation (Reilly, 2011). Design thinking is a critical career and college skill set for this new era - central to success in every career (Brown, 2009).

According to Krippendorff (2006), a critical shift is occurring from "technology-centered design" to "human-centered design." Designing products and services that meet the needs of users, sensitive to their expectations and to stakeholder requirements, is critical to innovation and success in today's global community. Brown (2008) encouraged technology and engineering programs to develop the design-thinking skills of their students to prepare them for the marketplace and facilitate their meaningful impact. Vand suggests design-thinking is a creative way of problem-solving (Vande, 2007). In addition, Staw notes that design-thinking is central to the process of developing diverse ideas - central to the process of innovation (2006).

Human-centered design (HCD) actively involves the end users within the design process. The goal of HCD is to ensure that the products are not only usable but also designed to meet the

needs of the end users and stakeholders. In the field of product design, Zhang and Dong (2009) identified several characteristics within human-centered design:

1. The central place of human beings;
2. Understanding people holistically;
3. Multi-disciplinary collaboration;
4. Involving users throughout the design process, and;
5. Making products or services useful, usable, and desirable.

Brown recognized that the human-centered design approach contributed to innovations in engineering design (2008). HCD also assisted students in enhancing skills, such as creativity, practical ingenuity, and communication - all which are essential for the Engineer of 2020 (National Academies Press, 2005). For example, service-learning is a growing pedagogy that provides synergistic opportunities to create a human-centered design experience (Zoltawski et al., 2012). In addition, applying human-centered design to service learning showed promise addressing community needs while engaging students in meaningful problem-solving work (Bringle & Hatcher, 1996). Based on this literature, the authors believed human-centered design could be applied to even the most complex global, social problems - such as human trafficking.

1.2 Human Trafficking

The Global Report on Trafficking in Persons (UNODC, 2016) states that human trafficking includes sexual exploitation, informal labor, child soldiers, forced begging, forced marriage, selling children, removal of organs, and forced labor. This crime has created a global marketplace; $150 billion industry in the United States; $99 billion from commercial sexual exploitation and $51 billion forced economic exploitation (ILO, 2014). For the Americas, on average, 56% of detected victims were trafficked for sexual exploitation and 28% were trafficked for forced labor (UNODC, 2016). There are also clear regional differences with regard to the gender and sex of detected victims. For North America, 81% of detected victims are adults, compared to Central America, where the majority of detected victims are children (62%). For Central America, the Caribbean and South America, girls are more likely to be the victims of trafficking since sexual exploitation is the most frequently detected from there (UNODC, 2016). Overall, the forms of exploitation are labor-based, primarily for sex and informal or forced “sweat and toil” in industry, depending upon country (ILAB, 2018).

In general, there are three stages in human trafficking: recruiting, transition, and exploitation (Stickle, Hickman, & White, 2019). Relationships are built as a start of the trafficking process, where traffickers and victims will differ by gender based upon national and cultural norms. In addition, secrecy is important for isolation and transporting victims to a new geographic location for exploitation. The majority of trafficking cases involved more than one country, and 57% of cases involved crossing at least one international border (UNODC, 2016). Overall, while human trafficking is a global epidemic, it occurs within and among communities. To combat the “this doesn’t happen here” response, local context is needed (Stickle et al., 2019). For example, the economic crisis of Venezuela has resulted in a cross-border crisis of 5 million refugees, which encompasses multiple countries, including Colombia, Ecuador, and the rest of the region

(UNODC, 2020). Thus, we focused our Design Innovation Challenge on the Americas: the closely connected countries and markets of North, Central, South America.

1.3 The Grand Challenge

Human trafficking results in a loss of human dignity due to stolen personhood. The challenge of the lack of human dignity due to sex trafficking and forced labor are related to multiple United Nations sustainable development goals of no poverty, zero hunger, good health and well-being, gender equality, decent work and economic growth, and reduced inequality; and is directly noted as well (UNODC, 2015; UN, 2017). Through a Design Innovation Challenge, our goal was to build awareness and identify innovative solutions to this global problem that is happening in our local community. In the United States, Interstate 20 from Atlanta, Georgia to Birmingham, Alabama may be considered the "sex trafficking superhighway" (The Wellhouse, 2015); but Interstate 65 also facilitates the trafficking of victims as it connects Chicago, Illinois to Birmingham, Alabama (Hasnie, 2017; Peters, 2018). In addition, the National Center for Human Trafficking Hotline (NHTH) has reported an increase in calls related to human trafficking in Indiana; in 2019, the NHTH received 327 calls to the hotline, and 157 cases of human trafficking were identified. Of the 157 cases, 72% of cases were sex trafficking, and 25% of the trafficked victims were minors (NHTH, n.d.).

The US Department of State has emphasized that academic institutions are one part of the global community that can help end modern-day slavery. The fact that human trafficking intersects with multiple UN agencies and sustainable development goals signifies the need for holistic, interdisciplinary approaches to this global epidemic. Academic capabilities help address grand challenges, such as human trafficking, at both national and community levels. Furthermore, a design innovation challenge that includes undergraduate and graduate students helps create the next generation of stakeholders and applied researchers in addressing real-world problems of serious importance. Finally, there are opportunities for policy changes; an approach that conceptualizes human trafficking and forced labor as a multi-staged process, spanning geographical boundaries, rather than existing through isolated national policies (Zimmerman, Hossain, & Watts, 2011). We utilized our higher education institution (HEI) and members of the community in a design challenge to bring awareness and identify innovative solutions to fight human trafficking.

2. CASE STUDY

2.1 Human Trafficking Event

Purdue University was celebrating its 150th anniversary. In celebration of the University's sesquicentennial, a year of signature events were organized, per college, to showcase the culmination of 150 years of research and discovery (Purdue University, 2019). The Purdue Polytechnic's mission is "to inspire, educate, and mentor students through learn-by-doing and integrated study…to advance use-inspired research addressing important state and global challenges" (Purdue Polytechnic, 2019, para 1). The goal was to organize an event that highlighted the college's interdisciplinary approach to real-world problems; thus, we organized an

event that we believed would unite a campus and community - regardless of major or expertise. Based on the authors' research areas in informal labor compliance and cyberdeviancy, we focused on the topic of human trafficking.

To develop community awareness, establish research collaborations, and leverage diversity of thought, the authors co-chaired a design innovation challenge to "Fight Human Trafficking in the Americas" (i.e., the Human Trafficking Event). This event was generally understood as a "hackathon." Broadly, hackathons are events in which participants collaborate for a defined period of time to solve problems (Kollwitz & Dinter, 2019; Rhoads, 2020). They assume a variety of forms, originally from computer-based and data science disciplines, in which a challenge is presented and participants develop a proof of concept often in the form of software, hardware, or data visualization (Gama, Gonçalves, & Alessio & 2018; Kollwitz & Dinter, 2019). We increasingly see researchers from a variety of career stages, with diverse backgrounds that in sum, create shareable solutions to problems of common interest, based upon cross-pollination of knowledge (Craddock et al., 2016; Gama et al., 2018; Rhoads, 2020).

However, the problem of human trafficking is interdisciplinary, concerned with the complete system, and interconnects multiple fields and stakeholders. To converge different disciplines of study and levels of knowledge around such a complete problem we applied a human-centered design (HCD) approach - an approach that is familiar within the Purdue Polytechnic.

2.1.1 HCD Approach

Our higher education institution (HEI) has taught design thinking for nearly 10 years to all college freshmen (approximately 10,000 students overall in total). Human-centered design is a required course for each student in the Purdue Polytechnic, regardless of academic program. Administered at the College-level, the TECH 12000 course (Design Thinking in Technology) engages students in critical analysis of real-world problems and global challenges (Purdue Polytechnic Institute, 2019). Students are expected to apply the principles of human centered design, communicate effectively in teams to examine problems from a societal, cultural, and ethical perspective (Purdue Polytechnic Institute, 2019). This course had been offered for approximately 10 years prior to the human trafficking event. The event co-chairs reached out to the TECH 120 faculty to teach human centered design as a workshop, prior to the students organizing themselves to 'hack' the problem at the event.

The Human Trafficking Event immersed participants in human-centered design-thinking strategies through active learning. To set the foundation for our students to engage in design, we provided a 30-minute active introduction. We began with the idea that design is a process that all students are capable of using to develop innovative solutions. We mentioned that it is hard, messy and iterative. We walked the students through two key activities to serve as a model and a primer for their work. First, we focused on developing a Point of View statement. For our program, a Point-Of-View (POV) statement includes three parts (user, need, insight), is one element of the HCD approach is problem definition; this artifact often arises during the define stage and serves as a guideline during the entire design process (Sohaib et al., 2019). Students were provided a few minutes to turn to their teammates and identify potential stakeholders. Students leveraged what they had learned from the presentations earlier, supplemented by google searching, to

quickly create a list of stakeholders. If stuck, we suggested students search for “a day in the life of a human trafficking victim” to illuminate additional stakeholders they may not have considered. Students then picked a stakeholder to potentially be the focus for their design work and wrote a POV statement that included their needs and an insight about the problem from their perspective.

With an initial draft of a POV statement in hand, we next directed students’ attention to a divergent ideation process. We provided guidelines, such as suspend judgment, go for quantity, headline ideas quickly to maintain momentum, and table concerns about details for later discussion. After a few minutes of practicing, we reviewed the two main process-based concepts of POV and ideation and released students to work.

Overall, we described a rationale for design thinking as a way of approaching problems as a foundation. We introduced a point of view and composite character profiling tools to make structured problem statements actionable. The experts and community leaders shared strategies for reviewing and evaluating potential solutions as students conducted literature searches for benchmarking, and later after ideation, to evaluate their ideas. Ideation techniques were introduced to foster the development of creative thinking by providing structure.

Students engaged in low-resolution mockup prototyping as a method of clarifying the solution, communicating, and testing. Prototyping strategies provided valuable insights for iterations and solution evaluation. Students were taught a human-centered design approach where the systems engineering principles of creativity, interconnectedness, and divergence of thought were leveraged towards the complexity of child trafficking and illicit labor (Boy & Narkevicius, 2013). The rubric for judging team submissions was adopted from prior human-centered design thinking coursework taught at our HEI (see Figure 1). The rubric was provided to the students in advance of the Human Trafficking Event via the registration site.

Human Trafficking Design Information Challenge Rubric	Performance			
Final presentation - 1 minute video submission via Qualtrics at: www.conf.hei.edu/humantrafficking	None	Weak	Moderate	Strong
Justification				
Introduced Selves & Mentor (if applicable) - Name, Major				
Problem statement framed based upon Point of View- the problem is clearly and objectively identified and defined.				
Need				
Audience - who is your target or stakeholder - who will benefit from your solution?				
Existing Solutions (if any) - Identification of past and current attempts to solve the problem				
Innovation				
Proposed Solution - the proposed solution is well-substantiated and is applicable and relates and relates back to your need and justification.				
OR				
Prototype - a prototype idea that is clearly explained and defined with enough detail and relates back to your need and justification.				
Professionalism				
Attire (business casual or better)				
Video presentation - professional, language, poise, manner				
Tiebreaker - Team diversity				
Team member diversity of background (Major, minor)				

Fig. 1. Human Trafficking Design Information Challenge Rubric

2.2 Schedule of Events

The Human Trafficking Event spanned two days. Beginning at 9:00am, we hosted a free public information session, which included presentations and panel discussions on human trafficking – where attendees learned about the state of human trafficking in the Americas from advocacy programs, policy makers, businesses, and survivors. Academic experts presented three keynote addresses: 1) human trafficking 101: an overview of human trafficking in the Americas, 2) the relationship between poverty economics and human trafficking in Mexico, and 3) human trafficking in Indiana: voice of the survivor, a story of an individual trafficked from Botswana to an American college campus into domestic servitude. A panel discussion was convened between experts from: national and local child advocacy programs, a corporate supply-chain compliance officer, and a former state politician with a focus on human rights. During this open session (9:00am-2:00pm), the attendees included members of the general public, law enforcement from across the state, students, faculty, and staff. The next portion of the event was only open to college students and their student team mentors.

The second half of the event began at 2:00pm; students were introduced to the human-centered design approach by faculty subject matter experts (SMEs) in a talk called: “The ideation process – Developing socio-technical solutions to real-world problems.” Individual students and student teams registered in advance; on-site registration was permitted for students without teams but concluded by 2:30pm. Student teams consisted of three to eight college students, with only one graduate student per team. Teams were encouraged to represent a diversity of major areas of study (see Table 1). Students were encouraged to bring their own electronic devices (e.g., laptops, mobile phones) to assist in their problem-solving. Each student team was paired with experts and community leaders (e.g., faculty, municipal government, law enforcement) to serve as a team mentor. The team mentor was a sounding board for student ideas and helped the students navigate the ideation process.

Over the next 17 hours (2pm-8am), student teams worked throughout the night to develop solution(s) for trafficking. Refreshments and meals were provided for registered participants throughout the event, which was co-sponsored by several university and community/corporate partnerships. Students were provided with space on campus to work throughout the night. Teams were instructed to submit a one-minute video of their potential solution by 8:00am the following day to be considered for the cash prize. The first-place team won a cash prize of $4,000 and second-place received $1,500.

3 EVENT RESULTS

At this event, we had over 300 attendees, including more than 20 law enforcement officers from across the state. Law enforcement received continuing education credit for attending this event due to a local partnership between law enforcement and the cyberforensics program at our HEI. Over 200 students participated in the Design Innovation Challenge, representing over 90 major areas of study, with over 25 teams submitting solutions, with a submission rate of approximately 80 percent. Judging took approximately three hours by a group of SMEs: event keynote speakers, law enforcement, community leaders, event sponsors, and faculty.

Due to the proprietary nature of the team's solutions, details of the teams' ideas are not publicly available. However, both winning solutions focused on disrupting trafficking by improving detection; they identified conditions and circumstances of a trafficking event, incorporated leading-edge video technologies, and focused on the trafficking process. The majority of the video submissions focused on the detection of human trafficking (i.e., identifying victims and traffickers) with only a few video submissions focusing on the prevention of sex or labor trafficking (e.g., prevention through education). Socio-technical solutions included a wide-range of innovative ideas, including biometric analysis, wearable technology, healthcare screening tools, public health measures (e.g., campaigns), mobile technology, and scam detection.

The first-place team were all undergraduate students, representing a variety of majors: applied statistics, chemistry, chemical engineering, and computer and information technology, finance, and general management. The second-place team also represented diverse fields of study, which included both undergraduate and graduate students from biomedical engineering, and exploratory studies. The judges reasoned that due to the overall quality of team submissions, determining the top two winning times was difficult. In fact, the judges decided to award a third place team to recognize their innovative solution - although no cash prize was awarded, this third team was recognized as a runner-up for the design innovation challenge. This third-place team also represented a wide-range of majors, anthropology, law & society, political science, public health, and sociology & developmental family sciences, and all students were undergraduate. The winning teams were mentored, respectively, by a HEI faculty member, the Chief of Campus Police, and a local trauma nurse.

4 DISCUSSION

Human dignity is a fundamental right and human trafficking robs the individual of their freedom, prosperity, and justice. This global problem is systemic in countries and local communities around the world. At our Human Trafficking Event, we leveraged diversity of thought by marshalling our academic community (faculty, student, staff) and local community leaders to increase the public's awareness on the problem of sex and labor trafficking. In addition, we applied the methodology of human-centered design with a focus on prevention, detection, and intervention to a significant societal problem - human trafficking. While previous hackathons utilize existing datasets, this was a novel approach in that no data was formally provided to the student teams. In fact, SMEs that conducted prior human trafficking hackathons noted the wider variety of solutions presented at this event. This observation suggests that the human-centered design approach was successful in facilitating innovation. In addition, the diversity of majors and student team mentors were important in the variety of socio-technical solutions developed by the student teams.

Innovation has increasingly been viewed as a process that can be managed, and improved, like other business functions (Kollwitz & Dinter, 2019). Organizations emphasize outside knowledge and understand that innovation is a collaborative, interdisciplinary process (Kollwitz & Dinter, 2019; Steen, Manschott, & De Koning, 2011). A hackathon brings together both concepts of interdisciplinary collaboration and innovation. We adopted the idea that hackathons can support innovation of new ideas (Kollwitz & Dinter, 2019), but we understood that a student's focus on presented datasets may limit creativity and innovation (Varghese, 2018). Therefore, our

challenge was based upon a centralized theme – fighting human trafficking in the Americas – rather than data-centric (see Kollwitz & Dinter, 2019).

For future human-centered design events, we provide the following recommendations. First, this event was labor intensive and took time to organize due to the complexity of the topic. A successful event needs invested stakeholders and partners, to support the development of the event, as well as experts with different perspectives (e.g., poverty economics vs. supply chain compliance) that break down myths (e.g., crossing boarders is required for it to be human trafficking) and encourage out-of-the-box thinking. The inclusion of stakeholders also helps mitigate the study of human trafficking specifically, as a common challenge for researchers in this field is a lack of empirical evidence or data due to the illicit nature of the human trafficking process. Key stakeholders may have access to resources and/or data, and future partnerships may be created and solidified through such collaborations as a "hackathon" or design innovation challenge. Finally, most student solutions from the Human Trafficking Event were reactive rather than proactive or preventative. Thus, we would recommend the incorporation of methods that encourage a focus on prevention, in a more holistic manner, such as the engineering technique known as failure modes effects analysis (Liu, Liu, & Liu, 2013).

4.1 Conclusion

Overall, the end result of this design innovation challenge were socio-technical solutions that focused on prevention and detection of sex and labor trafficking in the Americas. This challenge not only valued the final output (i.e., innovative solutions), but a focus was put on human interaction (Kollwitz & Dinter, 2019) by encouraging diversity within the student teams. The event united a community, engaging an interdisciplinary research group of a wider community of faculty to work together, and supported the development of the next generation of applied researchers and activists. Future events addressing global challenges may yield similar results, leveraging interdisciplinary collaborations and innovative solutions that bridge diversity of thought. We also believe human-centered design is a scalable approach to tackling grand challenges. Future design innovation challenges could include multiple HEIs as a rich source of diversity in thought for developing socio-technical solutions to global challenges.

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