Enabling Mobility Impaired Students to Succeed Academically Through Online Live Lecture Tool

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Abstract

Students with disabilities in postsecondary education continue to face physical challenges commuting to and from classes despite institutions' attempts to provide adequate accommodations. This is especially the case on campuses with varying topography, as even the slightest change in incline can make commuting on crutches all the more difficult. This paper presents the primary commuting concerns of students with temporary mobility impairments at Cornell University. Previous literature have discussed potential solutions in helping and empowering such students by meeting with university administration to remove specific barriers and reword signages. Through the use of research and design methods of co-design, autoethnography, and non-design, however, the authors found that they could alleviate the commuting needs of such students by allowing them to forego their commute entirely. The authors thus propose implementing a distance-learning platform run entirely by students to relieve individuals' need to commute on hilly campus grounds with their temporary mobility impairment and still ensure their academic success.

Background

It is well recognized that the nature of built environments greatly affects the degree of mobility that individuals with disabilities can have (Clarke et al., 2008). A building designed to be accessible or inclusive, then, should enable all users to utilize its facilities equally and independently. With the introduction and passing of disability-focused policies, including the Americans with Disabilities Act of 1990 (ADA) in the United States, which requires buildings to have at least one entrance with an accessible route from the street, passenger loading zones, public transit stops, and/or public parking areas in order to be considered accessible, the consideration of inclusivity has become of great importance in industrial design (Wu et al., 2004). And yet, Church & Marston argue that ADA's "standards-based" measurement neglects other factors that should be considered when measuring accessibility, including the number of routes available and the values that each accessible route encompasses. Additionally, accessibility can vary greatly among different spatial scales, as "accessibility on a university campus differs from that of accessibility within a city" (2002).

Indeed, despite attempts to provide equal opportunities and accommodations for students with disabilities in postsecondary institutions, these students continue to face many physical challenges on their campuses, some of which are caused by inaccessible transportation to and from school and unavailable ramps or elevators in multi-level school buildings. This results in students' poor attendance and low confidence about their ability to succeed in higher education (Dowrick et al., 2005). The utilization of participatory action research and design has initiated changes within a university to rid certain physical barriers and change signages that have reinforced negative stereotypes about individuals with disabilities (Agarwal et al., 2015), but other factors like hilly topography continue to affect the commuting needs of students with disabilities. In fact, a research study conducted at the Chinese University of Hong Kong found that the topography of an individual's surroundings can greatly influence his or her perception of how accessible an environment is. Through the combination of walking diaries and Likert scale questionnaires, Sun et al. concluded that walking pedestrians view public open spaces as accessible but hilly sidewalks as barriers to their commute; while the former encourages positive physical, mental, and social outcomes, the latter causes negative sentiments due to distorted awareness (2015).

Evidently, the issue of empowering students with mobility disabilities in higher education has yet to be resolved. As such, this paper aims to showcase and address the commuting needs of students on hilly campuses by presenting findings from a co-design session, an autoethnography session, several user interviews, and a non-design session at Cornell University, an institution whose landscape is defined by its varying topography (Rakow, n.d.). We chose these research and design methods because they have been proven in previous literature to be beneficial for learning more about the specific context of a design space and stimulating discussion for potential new design ideas. Specifically, co-design, or the collective creativity shared by two or more people across the design process, is useful because it allows multiple stakeholders to be involved in the brainstorming of possible solutions for the problem space (Sanders & Stapper, 2008). We decided against using participatory design, a form of co-design that Agarwal et al. used, because we wanted to focus less on the politics

Figure 1: *Co-design session at Cornell Health.*

Figure 2: *Autoethnography session on Cornell campus. Researcher collapsed in exhaustion.*

between the stakeholders and more on the ideation of design solutions (Kensing & Blomberg, 1998). Additionally, autoethnography is useful because it allows us to better understand our users' experiences and thus attain empathy for our users (O'Kane, Rogers & Blandford, 2014), which Agarwal et al. found to be very important in making students with disabilities feel empowered (2015). And finally, we used non-design to consider low-tech and no-tech solutions (Baumer & Silberman, 2011) because our findings from both the co-design session and the autoethnography session proved the need for such solutions.

Methods & Findings

We recruited all of our student participants by sending out recruitment messages in the various listservs and chat groups we were in. Specifically, we asked for anyone who has previously been or is currently mobility challenged due to a leg injury on Cornell University's campus to participate in our research project. All of the participants who expressed interest were previously temporarily disabled and used crutches to accommodate their commuting needs; none of them were chronically disabled or used wheelchairs for their commute.

Co-Design

The first user research and design method we conducted was the co-design session. We recruited three male students who previously injured their legs on campus and were in contact with two female employees in Student Disability Services (SDS) to participate in the co-design session. All four researchers and designers were present as well, with two facilitating and two note-taking.

In the beginning of the session, we explained what our study was about, gave a brief overview of what the co-design was going to encompass, and asked everyone to go around and introduce themselves. Specifically, we asked the students to briefly reflect on their experiences when they were temporarily disabled and asked the SDS representatives to give an overview of the services and accommodations they currently provide. We also set some ground rules to remind everyone to withhold judgment, be receptive, build on the ideas of others, and think quantity instead of quality.

Then, we facilitated two index card activities, one asking everyone to write down all of the factors they felt were important in this problem space and another asking everyone to write down all of the possible solutions they felt would address the issues brought up. The intent behind these activities was to encourage both the university employees and the students to work together to group similar ideas later on. For the second index card activity in particular, we encouraged them to think of any and all ideas, regardless of feasibility.

From the co-design session, we found that a lot of the challenges that students with mobility impairments at Cornell University have faced while commuting pertained to poor signages in buildings for finding accessible entrances and elevators, unfavorable travel conditions like heavy snow and uneven terrain, delays in CULift services, lack of accessible parking spaces near certain buildings, and lack of off-campus transportation services for medical needs outside of university resources. To address these concerns, the students and SDS representatives proposed solutions such as expanding CULift services, building more elevators, implementing mandatory academic

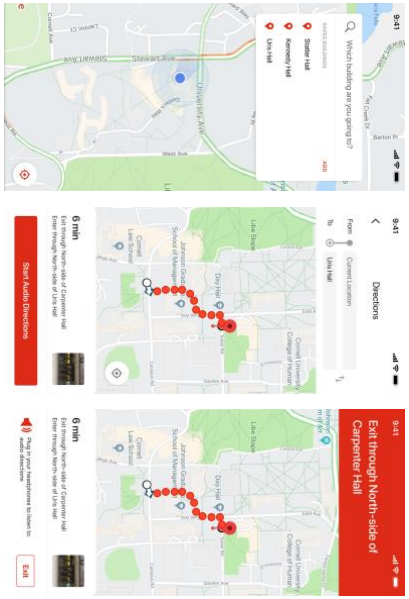

Figure 3: *Initial prototype: Home Screen > Route Preview Screen > Audio Direction Screen*

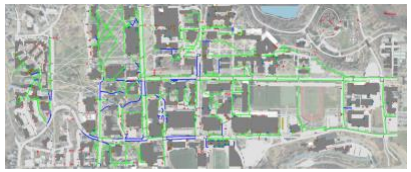

Figure 4: *Cornell's accessibility map.*

accommodations across all departments, and creating a magic flying carpet.

Interview with Student Disability Services (SDS) Representatives

Following the co-design session, we then interviewed the two representatives of SDS to let them express any additional thoughts that they had but weren't able to share during the session due to the limited amount of time we had with all of our participants. Specifically, we asked about the challenges that they face on their end and the ways in which they measure the efficacy of their services. In response, they said that their main challenge is acting in the intersection of helping students and abiding by university and state policies. They also expressed how difficult it is for them to increase their services to fully accommodate students' needs because there is no central office that will oversee the implementation process and there are too many administrative procedures out of their control.

Autoethnography

Following the interview with SDS, we conducted an autoethnography session as our second user research and design method. We initially considered using walking diary studies because we thought it would help us better understand the real-time nuances that currently mobility-impaired students experience that the students in the co-design session might not have thought or talked about when reflecting on their past experiences. However, because some of our peers told us during our design critique session that we might get similar insight regardless, we chose to use autoethnography instead to better empathize with our users.

For the autoethnography session, then, one researcher borrowed a pair of crutches and used them to walk to and from the academic buildings of her classes. Another researcher walked alongside her to take notes.

From this autoethnography session, the researcher was able to personally experience the challenges of commuting around the university's campus while using crutches. She expressed that while she knew it was going to be difficult, she did not realize how tiring and painful the commute actually was. She had to take breaks several times in her commute to catch her breath and relieve the constant pressure under her arms and in her "uninjured" foot. She also realized first-hand how even slight changes in incline could affect her already difficult travel and how challenging stairs were. In fact, because she took up the entire staircase while walking up a set of stairs, another student had to wait on the side for her to pass before he could walk down himself.

Brainstorming & Design Solution

Non-Design

Because we realized how difficult commuting on crutches is, let alone on uneven terrain, we knew that we wanted to consider no-tech and low-tech design solutions first. In particular, we knew that students with crutches would not be able to take out their phones while commuting to check, for instance, the most accessible route to their classes. As such, one idea that we pondered over for a long time was painting sidewalks a different color (ie. orange) so that students on crutches could easily know which paths are the most accessible to their destination, which generally include paths with few stairs, flat pavement, etc. We really liked this idea because it would also resolve the issue of poor signage by directing students to the most accessible entrances. However, because the paint

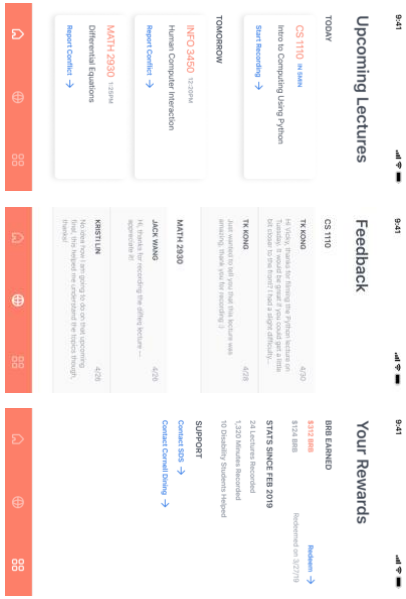

Figure 5: *Final prototype (Student Recording): Home Screen > Feedback Screen > Rewards Screen*

would not let users know in advance if a certain path would lead them all the way to their desired destination or to another location on campus entirely, we knew this was not feasible.

Initial Design Solution and Prototype

We then largely considered creating an audio-based mobile app that would give students audio directions to their desired destinations through the most accessible route. This resolves the feasibility issue mentioned above because students would not have to take out their phones during their commute as they could simply listen to the directions through their earphones or headphones. This also largely addresses the financial burden that SDS might face because students can simply download the mobile app on their phones. Ultimately, then, students would simply enter their destinations, start the audio guide, and go off on their way. Additionally, because it will build upon the accessibility map that Cornell currently provides, the mobile app can be implemented fairly quickly.

Unfortunately, we received feedback that this idea wasn't particularly innovative because it greatly resembles Google Maps. Wishing to open up to more creative solutions, we returned back to the drawing board.

User Interviews

As we reviewed our data and brainstormed some more, we realized that the commuting needs of our users could potentially be alleviated if they could forego commuting entirely. As such, we recruited three more female students who were previously temporarily injured on campus and asked them about the reasons behind commuting while on crutches. All of them said that they primarily needed to commute to attend class because certain classes did not have materials online for them to catch up on lectures. They also said that while they had meetings for certain student organizations that they were part of as well, their club members generally either allowed them to video-call in or caught them up in follow-up emails or instant messages about what happened during the meetings and what needed to be done for the week. As such, we reasoned that the commuting needs of our users could be alleviated if their academic needs could be fulfilled in ways other than commuting to class.

Additional Background Research

To make sure our final design solution was innovative, we decided to gather some more background research. We found that currently, people who experience physical challenges like students with mobility disabilities use web-based instruction to succeed academically (Fitchen et al., 2009). Web-based instruction, otherwise known as distance education, is learning that occurs in a different physical space from teaching and thus requires specially designed instruction, methods, and arrangement to account for communication by electronics and other technology. A lot of higher education institutions are actively involved in providing such distance learning programs (Benson et al., 2004) because of the large audience they reach (Radford, 2011), amongst many other benefits. And yet, as the definition of web-based instruction implies, a lot of drawbacks to implementing this also exist, because classrooms must have the appropriate hardware and software programs to allow for such an option, which institutions would have to financially accommodate for, and both faculty members and students would need to have the time and motivation to learn the necessary technology (Lei & Gupta, 2010).

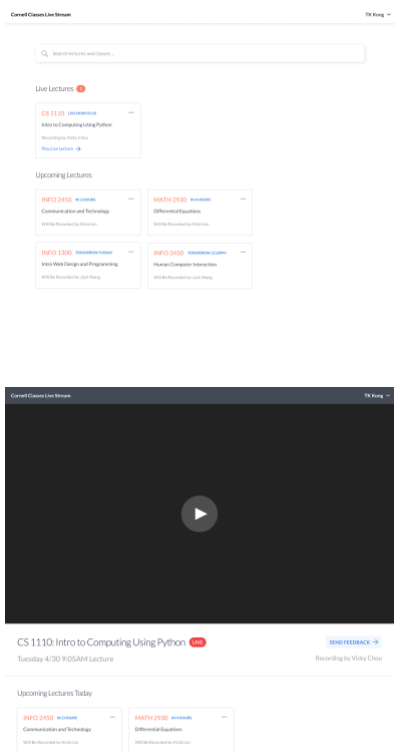

Figure 6: *Final prototype (Student Viewing): Home Screen > Video Screen*

Final Design Solution and Prototype

With these drawbacks in mind, we decided that our final design solution should build upon existing web-based instruction but resolve some of its outstanding issues. Our design solution, then, is an online platform that allows students without mobility impairments to attend their regular classes and stream lectures for students with mobility impairments. This alleviates the financial burden on schools for having to purchase extra equipment and teach faculty how to record lectures and relieves students with mobility impairments the need to physically commute to class. Still, these students are responsible for following along with the lecture at the same time that it is occurring because the videos will not be available once the live stream ends. This is to prevent students with access to these videos, as diagnosed and approved by the Student Disabilities Services, from potentially having unfair advantages for having resources that other students don't. The students with disabilities can also contact the students recording the lectures to give feedback on the videos so that the videos would be as accommodating as they can be. The incentive for students to volunteer and record these lectures well, then, is the ability to earn money for food on campus. At Cornell University, where many cafes struggle with food waste despite the prevalence of students skipping meals to save money (Gonzalez, Shin & Weiss, 2019), this comes in the form of Big Red Bucks or meal swipes for dining halls. We believe that our design solution, then, counters a lot of existing problems within the university and can be modified for other postsecondary institutions as well.

Discussion

We began our project thinking that we would make it easier for students with temporary mobility impairments to travel on hilly campuses, and we held onto this assumption through most of our user research and design methods and brainstorming sessions; even as we debated over the originality and feasibility of various design solutions, as many of our ideas were either already in the market or too impractical or expensive to implement, we wondered how we would alleviate our users' negative experiences with commuting on crutches on uneven terrain. And yet, the challenge of innovation in our initial design solution was what prompted us to really think about our users' needs and realize that the problem space we should be tackling is not the actual commute of our users but the purpose behind their commute. The unexpected gap in the design that we ultimately came up with and the problem space that we initially wanted to intervene, then, shows us both the importance of going into a project without a potential solution in mind and the value of reviewing and reflecting over and over again the information that our users provide to us.

Conclusion

Students with disabilities in postsecondary education continue to face physical challenges commuting to and from classes despite institutions' attempts to provide adequate accommodations. This is especially the case on campuses with varying topography, as even the slightest change in incline can make commuting on crutches all the more difficult. The need to commute on such campuses, however, can be entirely alleviated if the purpose behind commuting can be relieved in some way. Through the use of various user research and

design methods, then, we found that students with temporary mobility impairments need to commute on crutches largely because they need to attend class. Consequently, we designed a distance-learning platform run entirely by students so that students with mobility disabilities can choose to watch live streams of lectures at home without requiring the university administration to purchase extra equipment or requiring the teaching staff to learn new technologies. We believe our design solution can therefore resolve not only the commuting needs of students with temporary mobility impairments but some of the concerns with existing distance-learning platforms as well.

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