Inclusive UX: Centering Marginalized Users at Cal Poly

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Abstract
The focus of human-centered design should be on centering all users in an inclusive manner by considering different design considerations, methods, and practices (Shalamova, 2019). Through this project I will research ways in which UX has pushed certain types of people intentionally or unintentionally to the margins and explore potential solutions as design recommendations for inclusive UX focusing primarily on Cal Poly student technology and resources (Lahlou, 2017). The users I will be focusing on are students of color, students with disabilities, first-generation college students, and disadvantaged students. In the context of virtual learning in the midst of a global pandemic, inclusive UX is necessary for all student success at Cal Poly.

Introduction
The goal of this project is to explore and produce potential solutions through creating design recommendations centering all users in an inclusive manner by considering different design considerations, methods, and practices for inclusive UX focusing primarily on the Cal Poly Portal. The intended users are students of color, students with disabilities, first-generation college students, and disadvantaged students. This project is relevant because of a recent Cal Poly College of Engineering (CENG) COVID-19 Resilience Survey where students voiced concern about the overall disorganization and lack of standardized structure among the interfaces they use and how it causes them stress, anxiety, and to lack in their engagement of virtual education. The focus of human-centered design should be on centering all users in an inclusive manner and the Cal Poly Portal, an essential and necessary interface students must use daily, currently does not exhibit this. In the context of virtual learning in the midst of a global pandemic, inclusive UX is necessary for all student success at Cal Poly and it will allow Cal Poly to improve student technology and resources to be more inclusive, welcoming, and user-friendly.

Background
The main methods that were used for this project are UX research, surveying, interviews, analysis of student data (demographics, frustrations, etc.), analysis of current interfaces, UX design tools to create and develop user interfaces and prototypes, user-testing, and recommendations based on the student data from the Cal Poly College of Engineering (CENG) COVID-19 Resilience Survey responses.

Related Work
I collaborated with Dr. Lizabeth Thompson, Professor, Industrial & Manufacturing Engineering, California Polytechnic State University and Associate Professor Tonatiuh Rodriguez-Nikl P.E., Civil Engineering, California State University, Los Angeles to use the data and research from their 2021 CoNECD presentation of A First Look at Resilience in Both an HSI and a PWI During the COVID-19 Pandemic. This work focuses on investigating the impact to the members of our college community caused by the COVID-19 pandemic disruption within the framework of resilience. This study has several dimensions that can inform a deeper understanding of
resilience and interventions in higher education with an equity lens. The broader study will inquire into resilience over time (via a longitudinal survey), investigate the nature of resilience during the initial shock and ongoing recovery (via interviews), and make comparisons between populations with different ethnic and socioeconomic demographics. The project is based on theories of resilience from both educational and community perspectives and includes consideration of engineering education practices (Thompson & P.E., 2021).

Another related project is “Challenging Student Anxiety Produced by Educational Inequities: Strengths Training Utilizing a Social Justice Perspective for Pre-Transfer Community College Students and their Faculty and Staff Mentors” which is part of a larger collaboration between Allan Hancock College, Cuesta College, California Polytechnic State University (Cal Poly) that is called “Engineering Neighbors: Gaining Access, Growing Engineers” (ENGAGE) and is funded by the National Science Foundation’s Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) Program and focuses on increasing access to and success for community college transfer students in STEM disciplines to meet national and California workforce needs (Lehr, Thompson, & Almeida, 2019).

**System Design**

The main appealing properties of the system, the redesigned Cal Poly Portal, should be the functionality, usability, and overall design. The features and requirements for the redesigned Cal Poly Portal (see Figure 1) were determined based on student responses from the Cal Poly College of Engineering (CENG) COVID-19 Resilience Survey where students voiced concern about the overall disorganization and lack of standardized structure among the interfaces they use and how it causes them stress, anxiety, and to lack in their engagement of virtual education and the UI and accessibility issues that were discovered after my analysis of the current solution: My Cal Poly Portal: Home (see Figure 2).
Figure 1: Affinity Diagram: Connecting COVID Resilience Survey Responses to Features

The above diagram was created using survey responses that detail student pain points related to Learning Management Systems (LMS).
Figure 2: Current Solution Analysis of Cal Poly Portal: Home
The above figure displays the UI and accessibility issues that I discovered after my analysis of the current solution: My Cal Poly Portal: Home.

The recommended features for the improved Cal Poly Portal include:
- **Interactive calendar:**
  - Course links to Canvas
  - Ability to connect/import calendar to Google Calendar or iCal or Outlook
- Notification system
  - Opt in/out email and/or text
  - Deadlines + Dates (registration, money matters, messages to external portals, upcoming courses based on calendar)
  - Click on notification to address it (one-step user path)
- Overview of academic progress
- Simplified and organized layout
  - Grid-like, clean UI
  - Direct links instead of student searching for what they need

The feature I am focusing on redesigning and prototyping is an interactive calendar that will include course links to the Cal Poly LMS Canvas, campus-wide, academic, and financial deadlines tailored to the individual student and the ability for the student to import the calendar to iCal, Outlook, or Google Calendar. The calendar is often the first thing a student sees when they log into the Cal Poly Portal, however, it currently is not clickable, the course names are cut
off, it can only provide a day or week view, and it provides no other functionality. For example, Cal Poly plans on enforcing a COVID-19 Testing Plan in Spring Quarter 2021 where students must get tested twice every week or they will not be in compliance and will get locked out of their portal and other university applications (email, Canvas, etc.). By having a testing reminder with a one-click link to register to schedule a test directly on the calendar, students will be able to stay in compliance by checking one source: the interactive calendar on the home page of the portal.

**Implementation**
The prototype of the desktop experience of the Cal Poly Portal homepage will be designed based on user pain points (student frustrations from COVID-19 Resilience Survey responses and published analysis) and LMS best practices based on my analysis of the current solution and industry standards after a competitive analysis. Figure 3 depicts a map of the design process for this project. User testing was initially conducted on Prototype I which was created and hosted on Figma (shown in Figure 4). After user testing took place and an analysis of the findings was complete based on a user success rate determined by the completion of tasks using the prototype, a second iteration of the prototype was created and hosted on Figma as well (shown in Figure 5 and Figure 6).
Figure 3: System Design
Figure 4: Prototype I with Interactive Calendar in “Week View”

Figure 5: Prototype II with Interactive Calendar in “Today View”

[Link](#) to access Prototype II on Figma.
Testing and Validation
IRB approved user testing on Prototype I and Prototype II was conducted for a total of five student participants for each iteration. The same student participants tested both prototypes. After their initial user testing with the first prototype, they were contacted later to user test the second prototype redesigned based on the initial user testing results. After testing Prototype II, all five student participants were asked to complete an anonymous post-survey in which they selected the date of the user test, self-identified their racial and gender identities, and had an opportunity to share additional comments. Appendix B of the IRB Protocol submitted prior to conducting user testing for this project contains the questions included in this post-survey.

According to Jeff Sauro of MeasuringU and as described by Ellie Martin in the Invision Design blog, five users is ideal for discovering problems in an existing system because the probability of users encountering a usability issue is 31% according to an average problem frequency from several studies. In a Poisson Distribution with a 31% binomial probability, five users in a test group are able to find 85% of the problems. However, as you add more than five users to a test group, you start exhibiting drastic diminishing returns, which means the more people you add, the less you learn (Martin, 2016). Figure 7 is a graphical representation of this concept.
The following is the IRB Protocol including details of how the user testing was conducted. Participants for user testing are Cal Poly students who were recruited via survey and all participants signed an informed consent form. These interviews were recorded. During the user testing, the users were asked to complete the following tasks using the prototype of the redesigned Cal Poly Portal and voice their thought process, feelings, and frustrations as they attempted them:

**Task 1:** Go to the first course of the day in Today, Month, and Week mode and attempt to access the Canvas page  
**Task 2:** View the course, campus, and COVID-19 Testing schedules in Today, Month, and Week mode  
**Task 3:** Add events to calendars in Today, Month, and Week mode

These tasks and the evaluation criteria are further detailed in [Table 1: Task Evaluation Criteria](#).

**Table 1: Tasks and Evaluation Criteria**

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Criteria</th>
</tr>
</thead>
</table>

![Figure 7: Number of Test Users vs. Usability Problems Found](image)
<table>
<thead>
<tr>
<th><strong>Task 1: Go to the first course of the day in Today, Month, and Week mode and attempt to access the Canvas page</strong></th>
<th><strong>User</strong></th>
</tr>
</thead>
</table>
| | ● is able to navigate the different modes of the interactive calendar.  
● can find and access course information.  
● can go to Canvas and back to Portal.  
● complete task at ease without needing assistance. |

<table>
<thead>
<tr>
<th><strong>Task 2: View the course, campus, and COVID-19 Testing schedules in Today, Month, and Week mode</strong></th>
<th><strong>User</strong></th>
</tr>
</thead>
</table>
| | ● is able to navigate the different modes of the interactive calendar.  
● can add and remove different schedules.  
● can access COVID-19 information.  
● complete task at ease without needing assistance. |

<table>
<thead>
<tr>
<th><strong>Task 3: Add events to calendars in Today, Month, and Week mode</strong></th>
<th><strong>User</strong></th>
</tr>
</thead>
</table>
| | ● is able to navigate the different modes of the interactive calendar.  
● can add and remove events.  
● complete task at ease without needing assistance. |

The outcomes of the user testing of Prototype I led to the design considerations behind Prototype II. The evaluation criteria for Prototype I and II of the redesigned Cal Poly Portal was determined based on a usability evaluation after user testing. The criteria is focused on user success rate and the following usability metrics: effectiveness, efficiency, satisfaction, freedom from risk, and context coverage. A user success rate of 100% means that every user was able to complete every task successfully. The following questions were considered in the usability evaluation as well as feedback from users during user testing:

- How long will it take the user to accomplish X task?
- How many users fail to accomplish X task?
- How many users get frustrated along the user journey?

User expectations and impressions questions:

- What are you thinking as you look at this?
- What is your (first) impression of this feature?
- What do you think this feature does or will do?
- Where do you start?
- When and where do you think someone would use this feature?
● What do you expect to gain from using this feature?
● What would keep you from using this feature?
● Do you feel this feature is similar to another one?
● Do you trust this feature?
● You [started to shake your head] when I showed you the interface, what caused this reaction?

General task-driven feedback questions:
● How would you go about performing [task]?
● What do you expect to happen if you did this [task]?
● What alternative method would you use to perform [task]?
● Was anything surprising or did not perform as expected?
● Was the interface easy to understand?
● What was the easiest task to accomplish?
● What was the hardest task to accomplish?

Table 2: Prototype I User Findings

<table>
<thead>
<tr>
<th>Task</th>
<th>User 1</th>
<th>User 2</th>
<th>User 3</th>
<th>User 4</th>
<th>User 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
</tr>
<tr>
<td>2</td>
<td>Partial Success: Could not view in Month mode</td>
<td>Success</td>
<td>Partial Success: Could not view in Month mode</td>
<td>Partial Success: Could not view in Month mode</td>
<td>Success</td>
</tr>
<tr>
<td>3</td>
<td>Partial Success: Could not add event in Week or Month mode</td>
<td>Partial Success: Could not view in Month mode</td>
<td>Success</td>
<td>Fail</td>
<td>Success</td>
</tr>
</tbody>
</table>

Table 2 is based on the Tasks and Evaluation Criteria outlined in Table 1. As shown above, 5/5 users successfully completed Task 1 using Prototype I, 2/5 users successfully completed Task 2 using Prototype I, and 2/5 users successfully completed Task 3 using Prototype I. Only the fifth user was able to complete all three tasks using Prototype I successfully. The fourth user failed to complete Task 3 and could not partially complete the task during the interview as they were confused on how to interact with the interface to add events and eventually needed assistance to understand how to do so. Overall, while testing Prototype I users wished that the calendar feature
was more intuitive and similar to Outlook as they were used to how that calendar worked. All users displayed excitement and approval of the feature and voiced that it would alleviate their accumulated stress from virtual learning and the COVID-19 pandemic’s impacts on their educational experience as the Cal Poly Portal is a place they must navigate to daily to access their courses and know what is going on at school.

<table>
<thead>
<tr>
<th>Task</th>
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<th>User 4</th>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
</tr>
<tr>
<td>2</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
</tr>
<tr>
<td>3</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
<td>Success</td>
</tr>
</tbody>
</table>

Table 3: Prototype II User Findings

Table 3 is based on the Tasks and Evaluation Criteria outlined in Table 1. As shown above, all five users were able to complete all three tasks successfully indicating a user success rate of 100% for Prototype II. The main issue with Prototype I was that it was not intuitive or similar enough to Outlook’s design and functionality. Because Prototype II was designed with that in mind, the student participants were able to complete the tasks with ease and all voiced that this feature would improve their virtual learning experience immensely because the calendar now contained all the links, deadlines, and schedules they needed to be a successful Cal Poly student. The calendar even had an option to add events and customize it to the students’ specific need which two of the users who self-identified as Asian (shown in Figure 9) specifically mentioned would be useful for adding student organization events such as cultural club meetings.
Figure 8: User Self-identified Demographics - College

This graph depicts which college each of the five student participants are a part of. Three students belonged to the College of Engineering, two belonged to the College of Liberal Arts, and one belonged to the College of Business.
This graph depicts how the five student participants self-identified. It is important to note that four out of the five student participants self-identified as people of color which is one of the target demographics for this project that aligns with the results of the COVID-19 Resilience Survey responses and analysis.
This graph depicts how the five student participants self-identified. It is important to note that three out of the five student participants self-identified as female which is one of the target demographics for this project that aligns with the results of the COVID-19 Resilience Survey responses and analysis.

**Future Work**

Extensions of this project could be pursued by Cal Poly ITS to implement the design recommendations suggested based on the UX research and testing findings. This could hopefully lead to an increase in student success, improve retention and morale which could be measured by additional surveys in the future.

As every student participant mentioned they already use Outlook or Google Calendar to alleviate the stresses and to account for the current calendar causes, it is recommended that Cal Poly ITS implement replacing the current calendar shown on the homepage of the Cal Poly Portal with an integrated Outlook or Google Calendar. Cal Poly students already have Outlook accounts provided to them so this would be a matter of creating a default widget to show students their Outlook calendars on the homepage rather than navigate to that app from the sidebar.

Another recommendation which would provide Cal Poly ITS more ownership of the interactive calendar feature would be to make improvements to the current calendar by using an API or
A database containing all important campus dates and populate the calendar based on the student-specific data (getting more data contained in Student Center).

**Conclusions**

Overall, upon an analysis of the self-identification of the student participants and the analysis of their interaction with the final prototype, it is apparent that the interactive calendar feature on the My Cal Poly Portal is imperative for student success at Cal Poly by means of student experience. Each of the five users during the user interviews that were conducted mentioned how virtual learning and COVID-19 has negatively impacted their student experience. The rush to online course delivery in response to COVID-19 revealed limitations of commercially available learning management systems, specifically the Cal Poly Portal. The current Portal is limited in functionality and poorly supports student needs. In addition, the effectiveness of the portal as a whole is not well understood, particularly for specific marginalized student populations who may be disproportionately impacted by the pandemic. To address these issues, the Cal Poly Portal calendar feature should be redesigned to include direct course links, academic calendar and registar dates, and allow students to add events which would overall lead to it being a more culturally responsive and trauma-informed system. This could hopefully lead to an increase in student success, improve retention and morale which could be measured by additional surveys in the future.

**References**


Lehr, J., Dr., Thompson, L., & Dr., Almeida, D., Dr. (2019, March 23). Challenging Student Anxiety Produced by Educational Inequities: Strengths Training Utilizing a Social Justice Perspective for Pre-Transfer Community College Students and their Faculty and Staff Mentors. Retrieved January 3, 2021, from https://www.westmont.edu/sites/default/files/users/user551/Almeida%20et%20al.pdf


