

Developing a Data Dashboard to Support Student Success in a Medical Sciences Baccalaureate Program

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ABSTRACT

Pre-medical students face the challenge of managing rigorous academic and extracurricular demands, which can lead to burnout. Effective tracking and visualization of their activities are crucial in keeping records of student progress. This study aimed to develop and evaluate a user-friendly dashboard tailored for pre-medical student data management. Semi-structured interviews with nine medical sciences baccalaureate program (MSBP) faculty members identified major issues in current data management practices, including standardization and tracking. Using affinity diagramming and Miroboard, five key themes emerged, guiding the creation of an initial dashboard prototype. After iterative critiques and revisions, the final design received positive feedback from the MSBP committee. Limitations include a small sample size and a lack of formal usability testing. Future work will focus on addressing implementation challenges and refining the design based on user feedback.

Index terms: Medical Education, Student Success, Data Dashboard, User-Centered Design, Qualitative Analysis

1 INTRODUCTION

Pre-medical students must balance a rigorous academic schedule with various extracurricular activities including clinical shadowing, research, volunteering, and medical exploration.¹ These activities are critical due to the competitive nature of medical school applications.² Effective tracking and reporting of such data via a data management and visualization tool (data dashboard hereafter) are valuable to keep a record of students' progress and success.³ Previous studies have highlighted the need for user-centered design (UCD) in educational systems, yet few have specifically addressed pre-med students.^{4,5} At the University of Cincinnati (UC), the Medical Sciences Baccalaureate Program (MSBP) is tailored towards undergraduate students pursuing a professional or graduate degree in healthcare fields.⁶ The MSBP faces a growing student population with limited resources, highlighting the need for such a data dashboard. This study aimed to address this gap.

2 METHODS

This study focused on user needs assessment, ideation, and prototyping of the UCD. For needs assessment, the study recruited nine faculty and staff members from the MSBP, who are potential users of the data dashboard. The participants mentored MSBP students and/or provided program support, making their insights vital for designing the data dashboard. Nine participants were selected using purposive and snowball sampling. A semi-structured interview guide was developed based on Kallio et al.'s framework,⁷ which covered six components: Job/Title & Experience, Typical Process, Pain Points, Potential Solutions, Hypothetical Interface Components, and Closing. Each interview session was conducted by two members of the research team, one of which asked questions, and the other documented responses. Each session lasted 30 to 60 minutes. A total of nine interviews were conducted.

Interview recordings were de-identified and qualitatively analyzed to summarize the themes. Specifically, affinity mapping was used to group similar ideas and reveal patterns.⁸ Key insights were organized and categorized using the Miroboard visual workspace (<https://miro.com/>). The identified themes and representative quotes were used to initiate the ideation phase for the dashboard design. Utilizing the affinity diagram of pain points and desired utilities, the research team developed an initial dashboard prototype. The initial prototype then underwent evaluation by an external designer who critiqued the dashboard and provided feedback in three areas 1) Information Architecture, 2) Visualization, and 3) Functionality. The research team refined the prototypes based on one iteration of design critiques, which were considered as the final prototype and presented to the MSBP committee for feedback.

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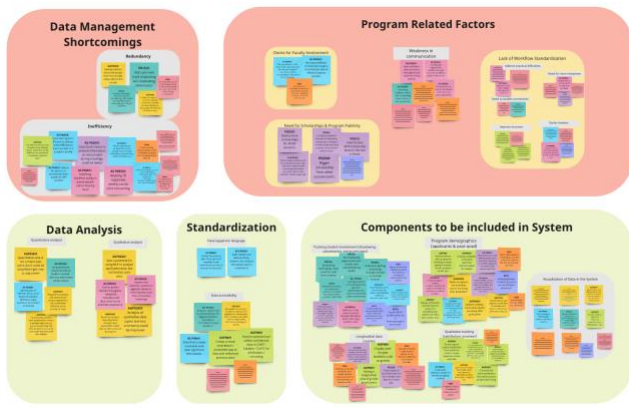


Figure 1: Affinity diagram of organized quotes and themes from MSBP Interviewees. The themes highlighted in red are the pain points, whereas the themes highlighted in green are hypothetical solutions to the pain points.

Table 1. Summary of design critiques and corresponding alterations made to produce the revised prototype.

Critique Area	Designer Comment	Resolution in the Revision
Information Architecture	“Information architecture needs to be re-organized... since demographics entries won’t be edited as frequently as shadowing”	Split demographics and shadowing profiles
	“Simplify navigation low”	Utilize pop-up windows to reduce number of pages visited
	“Choose button placement based on visual flow”	Action buttons placed on the right, as a viewer reads from left to right
Visualization	“Distinguish information based on hierarchy”	Vary font style and size
	“Maintain color tone to create cohesiveness”	Follow same color themes for each cohort, utilizing pastel and muted tones
	“Current gapping settings in the raw data table are creating visual disorder”	Align columns to create organized gapping/
Functionality	“Reduce redundancy in buttons”	Condense search functions to search bar
	“Minimize the number of steps needed to add/edit information”	Utilize pop-up windows to add/edit entries.

3 RESULTS

The affinity mapping generated five themes (**Figure 1**) highlighting the challenges and potential solutions in the MSBP data tracking. Two themes (in red) focused on pain points in Data Management Shortcomings and Program Related Factors. Within the pain points, six sub-groups were identified: Redundancy, Inefficiency, Desire for Faculty Involvement, Weakness in Communication, Lack of Workflow Standardization, and Need for Scholarships & Program Publicity. Three themes (in green) suggested potential solutions including creating a dashboard that could 1) perform Automated Quantitative/Qualitative Data Analysis, 2) provide Standardization in Data /User Accessibility, and 3) include Components for Visual, Longitudinal, and

Intentional Tracking of MSBP student data. The most immediate and broadly mentioned need was the desire to longitudinally track MSBP student demographics along with student’s shadowing experiences.

Based on these pain points, the initial mock-ups of the system were created and refined by the designers’ critiques. **Table 1** shows the critiques provided by designers and how the research team incorporated the feedback into the final prototype. In response to designer feedback, we reorganized the information architecture by splitting demographics and shadowing profiles, using pop-up windows to simplify navigation, and optimizing button placement. For visualization, we improved hierarchy with varied fonts and maintained consistent color schemes. As noted in the critique, “current gapping settings in the raw data table are creating visual disorder,” which we resolved by aligning the columns for a cleaner look. We also streamlined functionality by consolidating search features and minimizing steps to edit entries.

As shown in **Figures 2a**, the final mock-up included a landing page for quick snapshot of shadowing and demographic information along with tabs to navigate to the “Dashboard” of shadowing instances and a “Students” page. Each graphic can be exported as PDF or directed to identify raw data relating to that graphic, using the top left buttons next to each visualization. Additionally, the user can explore the raw data table either on this page with a limited view or be directed to the “Raw Shadowing Data” page (**Figure 2b**). The “Raw Shadowing Data” page tracks all information relating to student’s shadowing encounter, including shadowing date, location, department, student badging status, provider name, and duration. Users can edit, add, and delete entries by clicking the top buttons or icons on the left of each row. Due to space constraints, the initial prototype and the remaining component of the final prototypes are not shown.

The final design of the dashboard addressed the pain points identified in **Figure 1**. Specifically, tracking shadowing across cohorts over time, number of shadowing opportunities available to students each month, breakdown of shadowing facilities, and shadowing involvement by cohort addressed the pain point of inefficiency faced by the program due to manual tracking via excel for each student individually. The automated analysis and visualizations in these panels resolved redundancy by consolidating raw data and analysis in a single location rather than managing separate excel sheets to track each of these objectives as the program had done in the past. Additionally, the ability to download each figure or view raw data pertaining to the figure (top right 2 icons respectively, in each panel) enabled ease in sharing data with other faculty members transforming prior weaknesses in communication, faculty involvement and workflow. The longitudinal tracking panel was also a key aspect of the visualization, as it addressed the critical need to analyze trends over time to better support the program’s students. The chart types were selected based on the variable types (e.g. time and counts) and the analysis goals (e.g., cohort and breakdown).

The final mock-ups of the dashboard were presented in June 2024 to the MSBP Committee, who provided overall positive feedback.

The committee's comments demonstrated strong support for the proposed design and intention to begin pursuing the dashboard's implementation. The committee suggested two future directions: 1) expand the dashboard to track medical student data, keeping a focus on monitoring student progression and identifying areas for additional support, and 2) start a conversation with the university's Honors Program on the main campus, which has developed a data-tracking system for honors student experiences, to seek potential synergy.

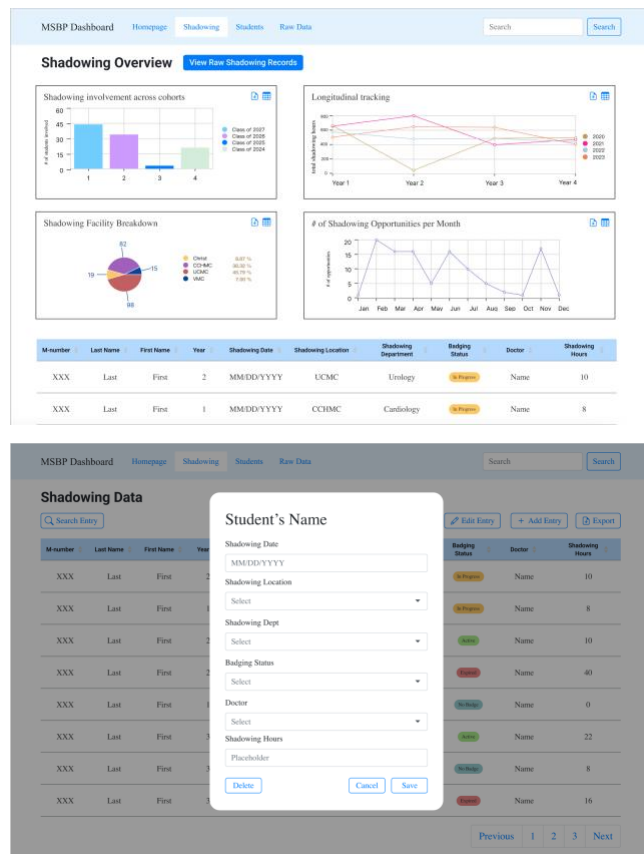


Figure 2. Final Prototypes of the a) Shadowing Landing Page b) Raw Shadowing Data page with Pop-Up Window

4 DISCUSSION

This study developed a data dashboard for tracking pre-medical student data following the UCD principles. Semi-structured interviews collected qualitative data from nine potential users, and the affinity mapping identified five major themes. The themes informed the interactive design of the final prototype, which received positive feedback from the MSBP committee. This study is limited due to the single institution/program setting, small sample size, lack of student-centered design, and no formal usability testing. Future work involved exploring the synergy between this homegrown tool and existing tools on campus, conducting thorough usability testing with MSBP staff and students, and refining the design based on student preferences.

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