Design and Development of an Intelligent Moderator Dashboard for an Online Support Community for Aging-Related Experiences

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Abstract

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Medical conditions and other experiences related to aging can be challenging to manage for older adults and their caregivers. Virtual Online Communities for Aging Life Experiences (VOCALE) is an online community-based digital health intervention that aims to encourage problem-solving skills amongst older adults and caregivers through participation in weekly discussions. The VOCALE intervention is overseen by trained members of the VOCALE research team, known as “moderators”, whose responsibilities include monitoring the discussion platform and responding to the needs of participants. However, there are still unmet needs amongst VOCALE moderators, such as a desire to facilitate the intervention more effectively while also gaining a deeper understanding of how well participants are engaging with the study.

This thesis project proposes a preliminary design for an intelligent moderator dashboard, which is a tool that can assist VOCALE moderators with their study-related duties and provide insights about participant engagement with the VOCALE intervention. To inform the design of this tool, a series of user-centered design activities, such as workshops and interviews, were conducted with current and former VOCALE moderators. Leveraging a combination of inductive coding and thematic analysis, the major themes extracted from these sessions were then used to inform the proceeding phase of the iterative design process. The final output of this project was a prototype for a proposed moderator dashboard design, alongside recommendations for further development.

Beyond its primary purpose of providing a framework for a dashboard that can be used for future iterations of the VOCALE intervention, this work illuminates key insights about the operation of VOCALE itself, identifying the needs of various stakeholders while also highlighting areas in which the VOCALE intervention could be improved. Furthermore, the work from this project contributes to a broader understanding of how to design tools to aid with the management of online health-related discussion-based communities, with consideration placed on how individual user needs interact with overarching objectives to inform the experience of those who moderate online digital health interventions.

ACKNOWLEDGEMENTS

Well, we made it. It has certainly been less than a straightforward path, but I sure am delighted that we have gotten here. I would like to start by providing my deepest gratitude to the chair of my thesis committee, mentor, and research advisor since I started my graduate school journey, Dr. Annie T. Chen. Without her invaluable guidance, and her willingness to let me explore, I do not think I would be the burgeoning professional that I am today. I would also like to thank Dr. Oleg Zaslavsky, my second thesis committee member. Thank you for providing your insight as I steered the dashboard project to where it is today. It has been a pleasure to work as part of the VOCALE team, and I am excited to see where the intervention goes next!

I would also like to thank all members of the VOCALE research team, both present and past, with special thanks to the VOCALE moderators who dialogued with me about their experiences. I would also like to give a shoutout to Jasmine Kaneshiro and Andrew Teng, who were integral to familiarizing me with VOCALE in general, as well as Pallavi Bagchi, who helped put the entire dashboard project into motion in the first place.

I would like to thank all of my colleagues, faculty, and staff in the Biomedical Informatics and Medical Education department at UW Medicine, with a special thanks to all of the friends I have made at BIME and beyond, and all of the people I have crossed paths with as a result of my work with Dr. Chen. Thank you for your continued patience, welcomed support, and for acting as people I can look up to. (And thank you for laughing at all of my jokes.) I would also like to thank Dr. Bonnie Lau and Dr. Talat Jabeen from LAND Lab for giving me the opportunity to explore additional research paths. Lastly, I would like to thank my parents and the friends I have carried with me from outside of my time in Seattle. Thank you for the much-needed reprieves, laughs, and unexpected trips to the arcade on random Thursday afternoons.

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1. INTRODUCTION AND BACKGROUND

1.1 Virtual Online Communities for Aging Life Experiences (VOCALE)

Aging-related life experiences can be difficult to navigate for both older adults and caregivers of older adults. The people involved in these situations may feel frustration from having to manage declining health symptoms or isolation from peers due to the complexities of their experiences. Online communities centered around health-related issues have the potential to provide informational, social, and therapeutic support for individuals struggling with aging-related challenges (Hopwood et al., 2018; Howe et al., 2020; Siriaraya et al., 2014).

Virtual Online Communities for Aging Life Experiences (VOCALE) is an online community-based digital health intervention that encourages older adults and their caregivers to learn and use problem-solving skills and engage in the discussion of health management strategies. The VOCALE program is an 8-week-long moderated discussion that is currently conducted through the forum platform Discourse, though two previous rounds took place using a Facebook group that was hidden from public discoverability (Chen, Chu, et al., 2021; Chen, Ge, et al., 2021; Teng et al., 2019). Participants are encouraged to share their experiences by responding to weekly discussion prompts and replying to responses from other study participants. Figure 1 below illustrates the current layout of the VOCALE discussion platform interface, with images of an example discussion board and an example discussion thread.

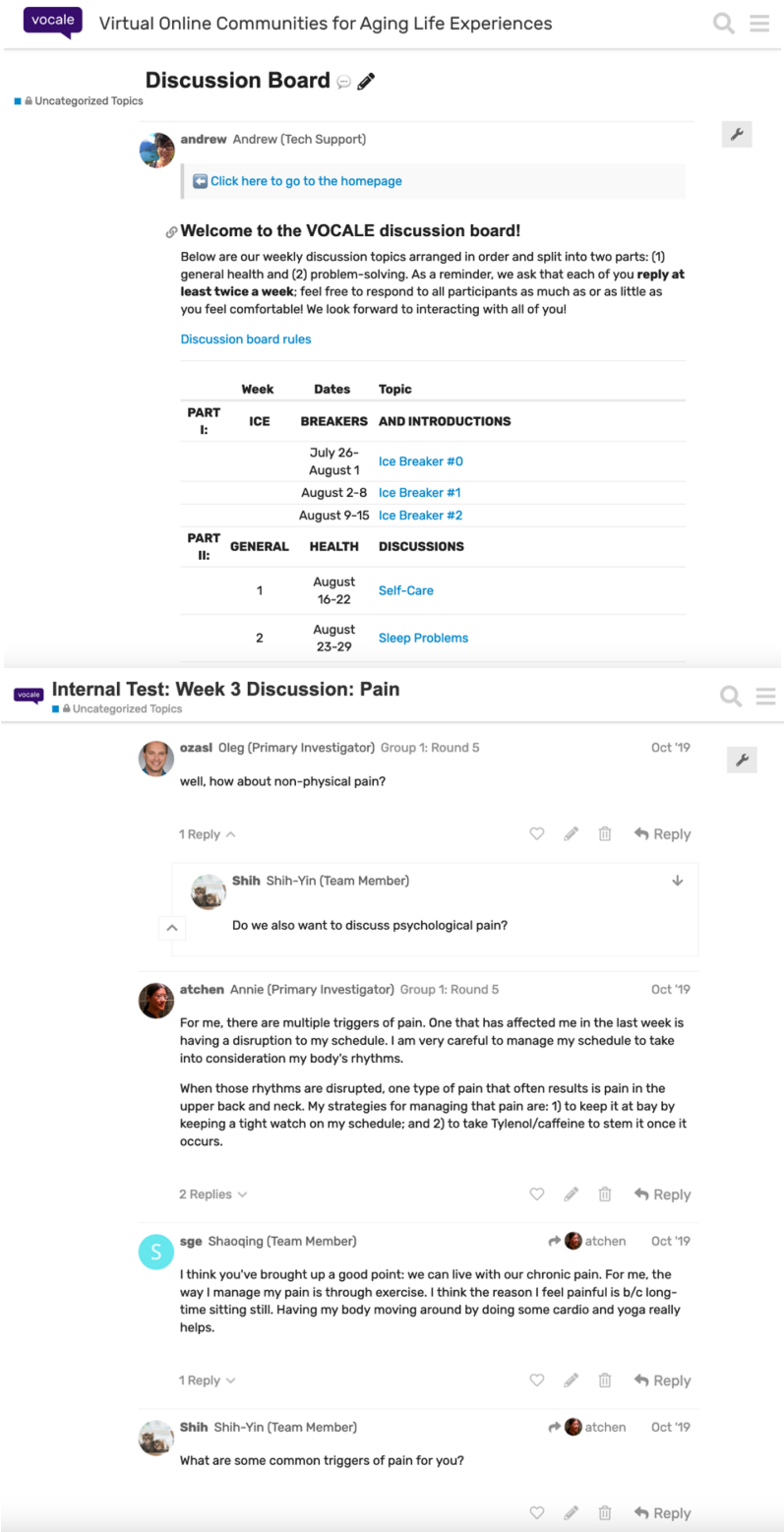

Figure 1. Images of the VOCALE discussion platform interface. The top figure shows a discussion board containing links to each week's discussion topic page. The bottom figure shows a thread of user replies written in response to a discussion prompt. All users featured in these interface images are current or former members of the VOCALE study team.

The VOCALE discussion platform is facilitated by trained study personnel, hereafter referred to as "moderators", whose responsibilities include regularly monitoring the platform, providing affirmations to participants for participating in the discussion, asking follow-up questions to participants to encourage further engagement, addressing participant queries, and ensuring that participants are posting at least twice a week on the platform (Chen, Chu, et al., 2021; Chen, Ge, et al., 2021; Teng et al., 2019, Zaslavsky et al., 2022).

Previous rounds of VOCALE were conducted with 1-2 moderators overseeing discussion groups with a target recruitment size of 10-15 participants (Chen, Chu, et al., 2021; Chen, Ge, et al., 2021; Teng et al., 2019, Zaslavsky et al., 2022). Despite the relatively small sample sizes for each round, preliminary discussions with VOCALE moderators revealed that certain tasks related to moderation were challenging to perform, largely owing to the substantial volume of participant data being generated throughout the course of the study, as well as functional limitations with the platforms being used. Furthermore, moderators and study personnel expressed a desire to learn more about how participants are engaging with the study through the use of analytics, not only to improve the experience of the intervention for participants, but to also make improvements to VOCALE as a whole.

The focus of this thesis project was to propose and evaluate a preliminary design for an "intelligent" moderator dashboard for the VOCALE intervention by conducting a series of user-centered design activities. User-centered design is a framework that puts usability goals and user characteristics at the forefront of the development process (Corry et al., 1997). Particularly within the context of human-computer interfaces, this may include understanding users' context of use, requirements, workflows, and desires from the system. The culmination of this work resulted in the creation of a prototype for a hypothetical VOCALE moderator dashboard and a

series of recommendations for future development of the moderator dashboard. Furthermore, this work can provide a broader evaluation of how similar dashboard tools can contribute to the effective management of online community-based digital health interventions.

The ultimate goal of this work was to propose an interface design that could assist moderators with performing their VOCALE duties by streamlining key tasks and directing attention to important pieces of information. In order to better understand the needs and requirements of such an interface, two phases of user-centered design activities were conducted with current and former VOCALE moderators. The first phase consisted of three workshop sessions, where participants reviewed dashboard design mockups that were developed based on previous interview and workshop findings (addressed in Section 1.2) and participated in other generative activities that contributed insights to the development of the moderator dashboard. The second phase consisted of five individual task-based interviews with current and former VOCALE moderators, where participants explored a preliminary interactive dashboard prototype, simulated the completion of moderation tasks using a think-aloud protocol, and evaluated the overall usability of the proposed design.

The following sections provide more information on how VOCALE is conducted from a moderation standpoint through reviewing the previous work that was done to inform the design of the moderator dashboard before the project reached the stages of development documented in this thesis. Then, a preliminary idea for what an intelligent moderator dashboard system would look like for the VOCALE intervention is introduced. Lastly, an overview of extant literature relating to the moderation of online communities, the use of dashboard interfaces in healthcare settings, and the implementation of user-centered design methodologies is presented.

1.2 VOCALE Moderation Procedures and Needs: A Review of Previous Findings

When approaching any design task, the first step is to understand users' typical experiences with the current system. This can involve engaging key stakeholders in outlining current workflows, identifying existing issues, and understanding current procedures that are taken to address these issues or situations (Johnson et al., 2005; Butz & Kruger, 2006; Lyles et al., 2016; Kashfi, 2010). As such, prior to the current stage of development, a series of user-centered design activities were conducted by a previous member of the VOCALE study team, Pallavi Bagchi, who led the design component of the moderator dashboard development. Conducted in May and June of 2022, these consisted of a series of six individual interviews with current and former VOCALE moderators, followed by a co-creation workshop that was attended by three current and former VOCALE moderators. Because the findings from these sessions were used to inform the work that is outlined in this thesis, it is important to summarize these findings for context.

At a high level, a VOCALE moderator's role can be summarized as to maintain participant engagement with the intervention by regularly monitoring the discussion platform, validating and responding to participants, and encouraging further interactions with the intervention. Tables 1 and 2 explain the major findings from the user-centered design sessions conducted by Pallavi Bagchi. These findings represent the conclusions that were derived by both Pallavi and I after independently reviewing the data collected from the interviews and the co-creation workshop.

Table 1. Major findings from individual moderator interviews (May-June 2022)

Finding:	**Details:**
Key themes from individual interviews:	● Enhancing participant engagement ● Tracking participant details ● Managing protocol ● Monitoring posts ● Assisting participants ● Correcting behavior
Goals for moderation: *What are the core objectives of moderation?*	● Maintaining engagement ○ Encouraging discussion between participants ○ Asking follow-up questions ○ Redirecting focus back to discussion topics ○ Connecting participants to each other through discussion ○ Maintaining a safe environment ■ Validating, encouraging, and welcoming participants ■ Monitoring potential harmful content ● Maintaining retention rate and reducing participant attrition rate ● Resolving participant questions and issues ● Ensuring participants are practicing the problem-solving skills that are being introduced through the intervention
Tasks for moderation: *What are the tasks that need to be accomplished for moderation?*	● Log-in to VOCALE platform and check for new posts written by participants ● Acknowledge posts from participants and provide validation for responding on the discussion board ● Respond to participant emails and questions ● Track participation details as required by study procedures ● Send reminder emails to participants if they did not meet the posting requirement ● Assign trophies & badges based on participation metrics ● Add instructional content to help participants practice problem-solving skills

Protocols for moderation: *What are the guiding principles that need to be followed for moderation?*	● Check the VOCALE platform multiple times a day to monitor participant postings ● Track user participation, as per the study protocol ● Address issues as soon as possible, or by directing it to the appropriate person for assistance ● Make training guides for participants and moderators ● Establish expectations for moderation beforehand
Pain points: *What causes issues, stress, or frustration with the current moderation system?*	● High volume of (new) participant posts that need to be addressed by moderators ● Low participant engagement ○ Lack of expressivity in participant posts ○ Lack of direct interactions between participants ● Needing to come up with "thoughtful" responses to participants that do not sound repetitive ● Technical issues ○ Participants' technical literacy ○ Discourse platform's structural and functional limitations ● How to quantify or measure "engagement"

Table 2. Major findings from co-creation workshop (June 2022)

Theme Addressed:	**Definition of Theme:**	**Actions to Support Theme:**	**Data Needed to Support Actions:**
Managing Protocol	Ensuring that all the tasks/protocols of the study are completed on time	- Tracking if tasks and moderator activities are completed as per protocol - Having a shared and well-organized repository of data - Encouraging engagement within participants to post	Data related to Moderation Activities: ● Date, time, and regularity of sending out weekly discussion topics ● Number of reminders sent out to participants and the time the reminders are sent out ● Whether or not technical support is needed and whether the support is provided in a timely manner

		regularly and on time	Data related to Study Participant Activities: ● Participant log-in activities ● Participants' journeys through the VOCALE intervention ● Trends in posts and replies ● Problem Solving Inventory responses and data ● Participant incentives and compensation ● Participant completion of other training activities
Monitoring Posts	Monitoring new posts from participants, reading participant posts, and responding to participant posts	- Logging in to the Discourse platform to check for new participant posts - Reviewing participant posts and replies to ensure the "twice-a-week" quota for posts has been met - Identifying content in participant posts that may require further action - Replying to all participant posts	Data related to Tracking Post Details: ● Identify posts that need action from moderators due to a lack of replies ● Average number of replies per post ● Flagged keywords in posts Data related to Moderation Activities: ● Identify posts that are unread by moderators ● Identify if the moderator has replied to the participant post Data related to Study Participant Activities: ● Amount of content generated by the participants of the study (posts, word count, replies) ● How participants respond to reminders to post

			• Participant incentives and compensation Desired Indicators for Participant Activities: • Indicator for participant posts that have not been responded to by a moderator • Notification for when a participant has posted • Summary of all participants who have new posts • Notification for when participant needs technical support or other assistance

1.3 The VOCALE Intelligent Moderator Dashboard

To better assist with the tasks and actions introduced in the previous section, the VOCALE moderator dashboard is conceptualized as an intelligent monitoring system that can analyze participant data in real-time and provides feedback to study personnel in the form of indicators, visualizations, insights, and other desired formats. VOCALE moderators can then use this information to adjust their moderation behaviors to better suit the needs of participants, with the goal of making the VOCALE intervention more efficacious and subsequently improving study outcomes.

Throughout an 8-week session of the VOCALE intervention, an important form of generated data are the written posts made to the discussion board from study participants. These posts may be written in response to the weekly discussion topic, addressed to other study participants, or even addressed to the moderators themselves. Other metrics, both quantitative and qualitative, can be derived from the data collected through the Discourse platform, such as trends in a participant's engagement with the study or content analysis of a participant's

postings. The presentation of this information through a dashboard interface can be leveraged to highlight items that require moderator attention to ensure the intervention is running smoothly. These can include new postings from participants, participant queries or requests for technical support, or other potential issues that would warrant further moderator action. Figure 2 proposes a schematic for information flow between VOCALE participants and moderators through the existing study platform, with an additional provision of information coming from the moderator dashboard as it monitors the study platform.

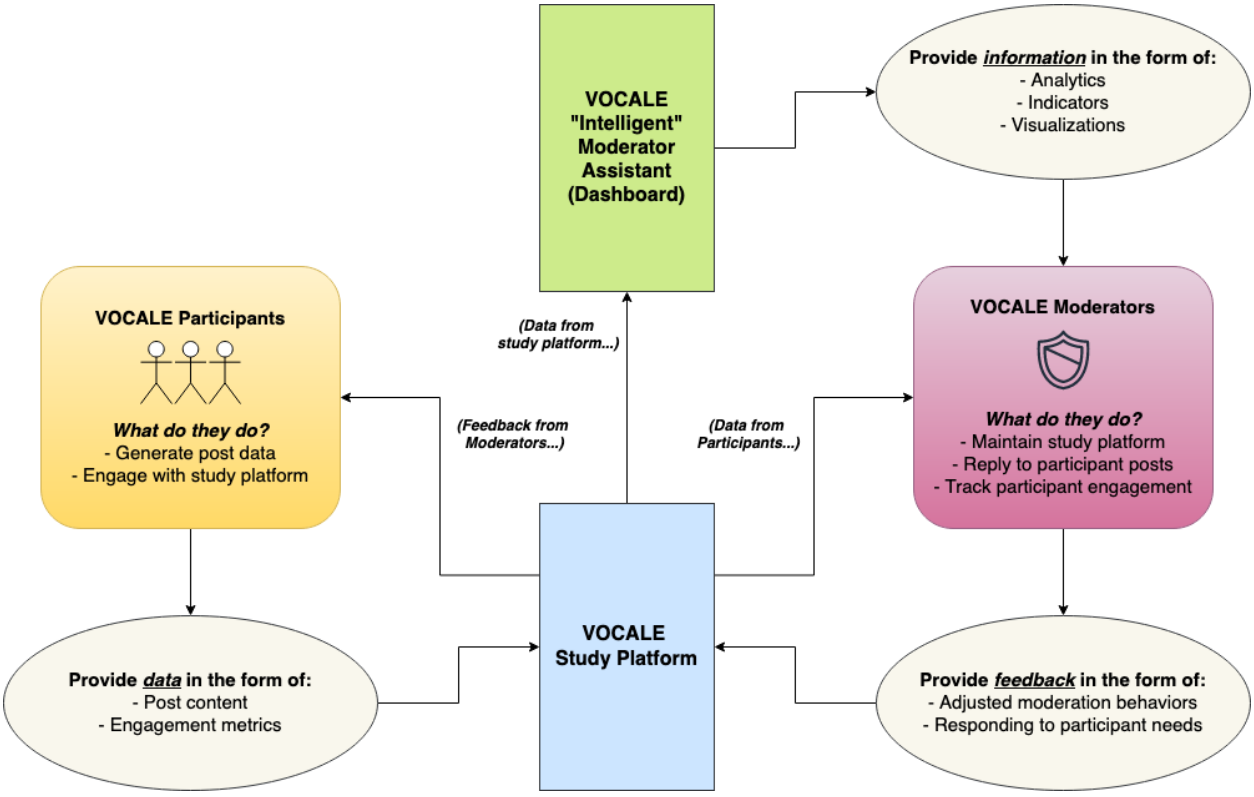

Figure 2. Schematic of information flow between VOCALE participants and moderators through the study platform and the moderator dashboard assistant.

By streamlining certain processes and communicating relevant information in a timely manner, the moderator dashboard is meant to enhance the VOCALE moderation experience. An example of an area in which the moderator dashboard could provide assistance is with the reviewing of new posts written to the discussion platform by participants. A major limitation of

the current workflow is that moderators have to manually scroll through each discussion thread to find new posts from participants to check whether participants are meeting the weekly posting requirement. If the dashboard is able to automatically collect new posts written to the platform and provide this information to moderators, this can reduce the amount of time and effort moderators have to spend on potentially redundant assessment work. In this way, the moderator dashboard aims to reduce the cognitive and task load on moderators as they facilitate the VOCALE intervention.

In a future stage of development, it is believed that a *true* intelligent monitoring system would be able to incorporate advanced features, such as real-time statistical data analysis, natural language processing, and machine learning techniques, in order to more effectively predict user trends and improve study outcomes. This proposed system could then be deployed as an independent application to be used within other online community-based digital health interventions. However, the scope of this thesis work focuses on identifying key features and functions for a moderator dashboard designed to support the VOCALE intervention, and less on the practical integration and implementation of the advanced features outlined above.

1.4 Literature Review

1.4.1 The Role of Moderation in Online Support Communities

Previous literature has illuminated the diverse and important roles that moderators play in maintaining safe, productive environments for the exchange of ideas and information within online support communities. Smedley and Coulson (2017)'s thematic analysis on messages posted in discussion forums for various health conditions, including arthritis, Crohn's disease, depression, and diabetes, revealed that moderators naturally perform a combination of supportive

tasks, such as providing information to and encouraging engagement from forum members, and administrative tasks, such as acting on counterproductive or harmful forum content and ensuring that users are following the rules of the platform. Consequently, forum members tended to view moderators in a positive light, often relaying to moderators how much their support and efforts were appreciated. In another study from Huh et al. (2016), which explored user reactions to the unannounced departure of staff moderators from WebMD communities due to administrative changes, community members expressed that the moderators played a fundamental role in providing informational and pragmatic support, with some members even feeling a sense personal loss without the presence of the moderators. Furthermore, the lack of moderators made people feel less safe interacting in these online communities. These findings suggest that the relationship and interactions between moderators and participants is crucial to maintaining the informational and emotional value found within health-related online support communities.

However, the role of moderation is not without its challenges. Deng et al. (2023) conducted qualitative interviews with moderators of an international digital mental health platform and discovered that the moderators frequently face challenges such as having to address to challenging contented posted by users, having to deal with users who break or misunderstand platform rules, and struggling to elicit engagement from other members in the community. A similar-interview based study with moderators of forms centered around suicide prevention practices and mental health improvement strategies revealed several sources of moderation-related stress, including having a large number of tasks that need to be completed in order to maintain the discussion platform, feeling constrained by their roles as moderators when requested to give forms of peer support that they are not permitted to give, and needing to balance the needs of individual users with the overarching needs and safety of the community

(Perry et al., 2022). These challenges are similar to those previously expressed by VOCALE moderators, as they are also tasked with needing to provide support to community members while also ensuring that the discussion platform and broader intervention is running smoothly. Thus, with the understanding that moderators are essential to the maintenance of these online community spaces, it becomes evident that strategies to enhance moderators' experiences with the task of moderation should be provided.

Previous work has demonstrated potential aids to moderators of online support communities in the form of computerized solutions. One study evaluated the utility of employing a trained binary text classifier on a WebMD community for diabetes to identify which discussion threads require moderator attention, which ultimately presented a potential low-cost solution to assist moderators with their supportive duties (Huh et al., 2013). Another study that employed a machine learning "triage" system designed to prioritize individual forum messages based on the level of crisis presented significantly reduced the amount of time it took for moderators to address concerning content (Milne et al., 2019). These findings suggest that, while a valuable component of moderation involves the building of personalized, human-to-human rapport with community members, the introduction of computerized tools can help to lower the burden on moderators and help discussion spaces operate more efficiently and safely.

1.4.2 Dashboards, Interfaces, and Visualization Principles in Healthcare Settings

According to Dowding et al. (2015), there are two main types of dashboards that help with monitoring performance within healthcare spaces: clinical dashboards, which provide feedback on patient outcomes to enable timely decision making, and quality dashboards, which provide performance metrics at a unit or organizational level. Their review of how clinical and quality dashboards are used within clinical settings revealed several interesting findings. Firstly,

many of the studies that the researchers reviewed mentioned dashboards that employed some version of color-coding to communicate information to users, often using a "traffic light" approach, where "red" indicates that action is required by the individual; this finding suggests that universally-understandable visual design choices are crucial to quality interface design. However, beyond that, there was variation in the visualizations and information formats that the healthcare dashboards employed to convey information, which Dowding et al. noted may have an effect on clinicians' decision-making processes.

Nevertheless, healthcare dashboards can act as a powerful leverage point due to their potential to provide salient information and data-driven messaging to stakeholders in a quick and effective way. Ghazisaeidi et al. (2015) provided several considerations for designing healthcare performance dashboards, emphasizing the importance of balancing visual complexity and information utility, including functional and visual features that support the demands of the users within the environment, and considering how different users might process information based on their cognitive or analytical skill level. For example, certain information formats may lend themselves better to illustrating certain types of data: Ghazisaeidi et al. highlights that graphs are better at communicating relationships, while tables are better at conveying specific values. Furthermore, depending on the situation, one information format may be favored over the other, and it is encouraged that a level of dynamic interactivity or flexibility of data presentation be maintained within an effective dashboard.

Other studies have noted the strengths of incorporating external representations, designing around memory domains, and using visual highlighting within interfaces to help prioritize user attention, reduce cognitive load, and aid decision making (Brown et al., 2019). Moreover, dashboards should be designed in a way that is congruent with a target user's natural

cognitive workflow. Huang et al. (2022)'s work on user perception of a COVID-19 data visualization dashboard revealed that users preferred interface layouts that supported their own individual reading flows and preferences for arrangement of information by assigned importance. This work implies that, while general best-practices for interface design continue to exist, individual preferences might still prevail amongst a diverse user population, and these preferences may have an influence on how users perceive and interact with an interface.

Consequently, dashboards or interfaces that are cumbersome to use in terms of layout, navigation, and interpretability can lead to declines in user productivity and functionality. Studies evaluating the usability of electronic health record (EHR) layouts have shown that a lack of standardized EHR design practices can lead to increased time spent trying to complete basic tasks and increased chances of error when completing those tasks (Ratwani et al., 2018; Zheng et al., 2009). Interface designs that are not well suited to actual user behaviors can lead to negative effects on people and stakeholders beyond the immediate users of an interface. One study that examined the difference that using paper charts versus EHRs had on patient-physician interactions found that physicians who used EHRs spent significantly less time looking at patients and more time gazing at the EHR, potentially due to the amount of information provided in the EHR leading to a greater difficulty in finding key clinical information (Asan et al., 2014). These reduced human-to-human interactions, brought upon by poor interface design, can negatively affect patients' perceptions of quality of care. In more serious situations, the cognitive overload and increased time to complete procedures due to inadequately-designed healthcare interfaces can lead to detriments in patient outcomes. These findings combined emphasize the importance of designing systems that are not only informational, but also intuitive to navigate, as

any extra time or effort spent trying to acclimate to a suboptimal system is time that is taken away from being able to address other outstanding needs.

1.4.3 User-Centered Design Methodology Within Healthcare Contexts

There have been several studies that have leveraged user-centered design frameworks when developing healthcare-related information systems and interfaces. One such study is from Butz and Kruger (2006), where the aim was to design a mobile frontend for a hospital information system. The researchers employed a methodology of involving key stakeholders early on in the process, asking doctors and nurses to describe their workflow, concretizing these steps into information units, developing an interface to support associated actions, and then asking for user feedback to iteratively improve the design. This led to the target user base feeling involved in the creation of the tool, which ultimately led to users having a more positive attitude toward the system and helped to mitigate feelings of resistance toward the integration of novel technologies. Similarly, Kashfi (2010) employed a user-centered designed methodology when designing a clinical decision support system (CDSS). The research team began by defining users and contexts of use for the CDSS, identifying tasks related to the objectives that clinicians are trying to meet with the system, then incorporating stakeholders in the iterative design of a domain concept model to guide the creation of the graphical user interface (GUI), before developing low-fidelity and high-fidelity system prototypes for user testing. Lastly, Lyles et al. (2016)'s work to create a tablet-based tool to help prioritize discussion topics for patient visits emphasized the importance of working closely with stakeholder groups throughout the design process. Using methods such as interviews, focus groups, and group design sessions, the researchers were ultimately able to deliver a tool that was easy to use and better able to meet patient and provider needs. Taken all together, this work demonstrates key user-centered design

concepts such as iterative design, concept modeling, and consistent user involvement and evaluation. These ideas can be considered as critical when designing for healthcare settings, where there are often many people and factors involved in patient outcomes and many complex tasks that need to be accomplished. User-centered design can help build solutions to meet the needs of these information-loaded and fast-paced environments.

Johnson et al. (2005) proposed a framework for redesigning healthcare interfaces by identifying key components of user-centered design methodology. In one part, they describe incorporating different types of analysis as a part of the interface design process: user analysis, environmental analysis, task analysis, representational analysis, and functional analysis. User analysis requires understanding the needs and characteristics of the users who will be using the interface, while environmental analysis focuses on the settings in which the system will be used. Task analysis is an iterative process centered around understanding user objectives and how a system can enable users to reach said objectives, and can involve methods such as surveys, interviews, and observational studies. Representational analysis focuses on the way that information is displayed to facilitate the completion of tasks, primarily with the goal of reducing cognitive load on the user. Lastly, functional analysis examines the relationships and interactions between the users and the system, and how information flow within the user-system domain can help meet user goals and needs. Beyond these analyses, Johnson et al. also recommends various methods for evaluating user interfaces. These can include cognitive walkthroughs, which can demonstrate whether an interface is intuitive enough to support the completion of tasks, as well as help to identify problems with an interface's design that can impede the user experience. Additionally, they also mention implementing small-scale usability studies, which can involve using think-aloud protocols and observational methods. These can help illuminate differences

between users' and designers' mental models of a system, and can provide a better understanding of users' cognitive processes when interacting with an interface. When these methods were applied in a case study to improve the design of a pedigree-tracking program for conducting genetics research, users reported higher satisfaction with the redesign of the application (Johnson et al., 2005).

As demonstrated, many other design and evaluation studies have utilized the user-centered design methods identified in this framework. Cole et al. (2022) leveraged a combination of qualitative and quantitative methods to inform the design of a healthcare tool to support decision-making for hematologic malignancies. The qualitative aspect included think-aloud sessions and semi-structured interviews with participants to be used in affinity mapping and thematic analysis, while the quantitative aspect included validated assessments such as the Post-Study System Usability Questionnaire (PSSUQ) to evaluate prototype usability. Another study that sought to design a healthcare quality improvement dashboard employed a similar combination of interviews, think-aloud prototype evaluations, and co-design activities (Elshehaly et al., 2021). These co-design activities included a "Story Generation" activity, which was a version of task analysis that asked participants to define the importance of tasks, describe how tasks are currently performed, and identify what information is needed to support the completion of tasks. Another co-design activity used in this study was a "Task Sequencing" activity, which asked participants to sequence tasks in order of completion and map them back to a dashboard layout that can provide information to aid with addressing these tasks.

In sum, the work presented in this section illustrates the fundamental and commonly-utilized components of user-centered design methodology, as well as the importance of user-centered design in building powerful solutions that can help meet user needs. By performing a

careful analysis of requirements and making iterative improvements based on ongoing user evaluations, user-centered design can help ensure that a system is functioning to meet the expectations and workflows of actual users. In particular, the work documented in this thesis pulls from various methodologies outlined previously, such as Johnson et al. (2005)'s definitions of user analysis and task analysis, as well as Cole et al. (2022)'s mixed methodologies of semi-structured interviews, think-aloud methods, and quantitative measures. In addition, certain aspects of Elshehaly et al. (2021)'s co-design activities inspired the design process for the moderator dashboard, specifically with regard to mapping tasks back to potential dashboard features and evaluating the information required to support the completion of tasks. These ideas are further expanded upon in the Methods section of this paper.

2. METHODS

The methods section of this thesis is divided into two sections, which represent the two different phases of dashboard development and user-centered design sessions. The activities that took place in each of these phases is outlined in Figure 3 below.

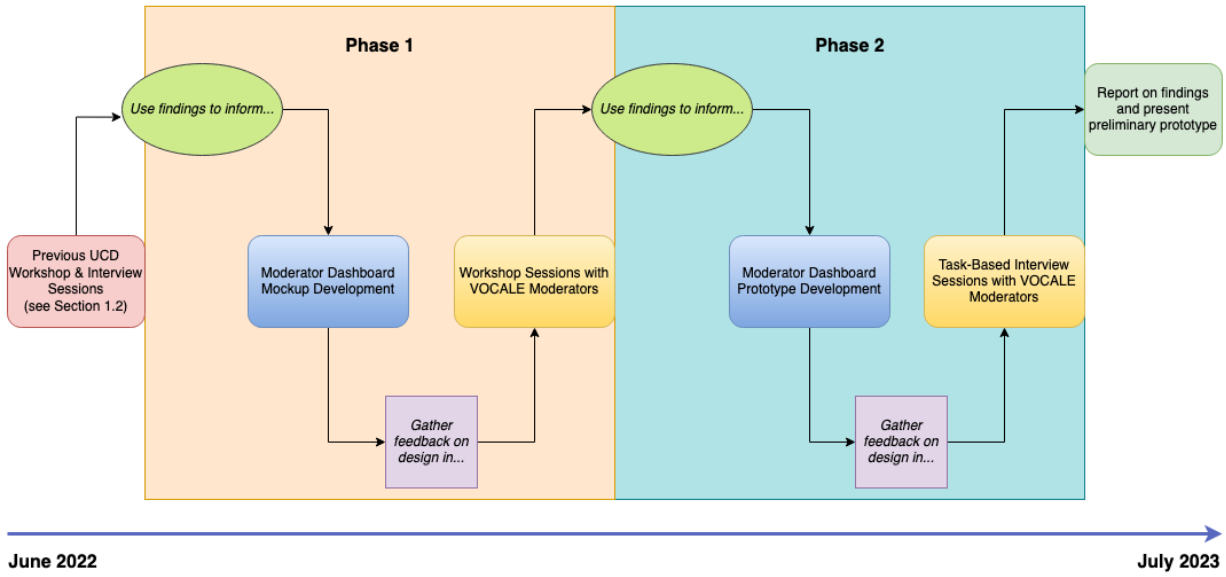

Figure 3. Outline of activities for Phase 1 and Phase 2 of moderator dashboard development.

In the following sections, I describe the process of developing the mockups and question guide for the workshop sessions. Afterward, I describe the procedure for the development of the interactive dashboard prototype and interview protocol for the task-based interviews.

2.1 "Phase 1": Collaborative Workshop Sessions

2.1.1 Mockup Development

In contrast to the previous user-centered design activities described in Section 1.2, which were focused on learning about the needs and experiences of moderating the VOCALE intervention, a primary goal of the proceeding user-centered design sessions was to provide moderators with something concrete to provide feedback on, such as visual representations of a

potential dashboard system. This would give moderators the opportunity to articulate their desires from an ideal system, as well as consider potential formats and layouts for previously requested data and features, rather than continuing to generate ideas without having a sense of how to arrange the information in a usable or meaningful way. Additionally, the insights gathered from the reviewing of wireframes or prototypes can then be used to identify problems with the design that need to be revised in the following versions (Corry et al., 1997).

In particular, the individual interview data described in Section 1.2 informed the creation of three user personas, which represented potential use cases and contexts for interactions with the VOCALE intervention and the moderator dashboard. The creation and integration of user personas into the development process is crucial, as it centers the design process around the needs of its target users, rather than potentially creating solutions that are too disconnected from the people who would actually use the system being proposed (Miaskiewicz & Kozar, 2011). These user personas for VOCALE moderators are summarized in Table 3.

Table 3. Preliminary user personas for the moderator dashboard

Moderator Type:	**Details:**
"Basic"	**Summary of user persona:** ● May have more limited interactions with the formative/developmental aspects of the study ● Being a moderator may not be a central priority in terms of responsibilities they have in life (i.e. job, school, career, etc.). This is not to imply that they are an inadequate moderator – rather that this mindset can influence how they interact with the system and how they go about completing tasks **Behaviors & actions:** ● Likely a secondary moderator ● May only check Discourse once a day ● May not respond to participant queries right away ● May set aside or schedule a certain amount of time for VOCALE

	● May push issues or action items to a later time or the next day, if not viewed as urgent ● May keep communication with other co-moderator(s) and study team to a minimum, or communicate less frequently **Sources of frustration:** ● When there is a lot of new posts from participants to acknowledge ● When a participant asks them a question that they do not know the answer to
"Protocol-driven"	**Summary of user persona:** ● May have a better sense of the study's aims and overarching objectives, and may have more interactions with the formative/development aspects of the study ● Value having a clear, agreed-upon protocol that aligns with the goals of the study, and are motivated to follow said protocol in order to drive the study forward **Behaviors & actions:** ● May be a primary moderator or secondary moderator ● May check Discourse multiple times a day ● Likely responds to participant queries immediately ● Likes to resolve action items as they arise (i.e. if an issue comes up when they are doing something else, they may take care of it right away, rather than postponing to another time) ● May communicate more frequently with other co-moderator(s) and study team to ensure everything is on track and tasks are being completed **Sources of frustration:** ● When the protocol is not being followed ● When the protocol is not clearly defined (i.e. timing of posts, definition of measures, etc.) ● When co-moderators' moderation style is inconsistent with their own moderation style ● When there is a lot of new posts from participants to acknowledge ● When engagement from participants is lower than desired

“Deeply-involved”	**Summary of user persona:** ● Likely involved with more aspects of VOCALE other than just moderating Discourse, which may include data analysis, technical support, formative research & study development, etc. ● Likely has a deep understanding of the study’s aims, objectives, and the steps needed to reach those objectives ● Likely understands how moderation (and, in turn, being a good moderator) fits in toward achieving the study’s broader goals ● May have more knowledge about how to resolve issues that may arise ● May be more experienced as a moderator **Behaviors & actions:** ● Likely a primary moderator ● May check Discourse multiple times a day ● Likely responds to participant queries sooner rather than later ● Likely knows how to resolve action items quickly and efficiently ● Likely communicates frequently with other co-moderator(s) and study team to ensure everything is on track and tasks are being completed **Sources of frustration:** ● When there is a lot of new posts from participants to acknowledge ● When there is a lot of participant details that need to be tracked ● When engagement from participants is lower than desired ● When participants express frustration with something related to the study, and they do not know how to best respond in a way that mitigates that frustration ● When they, as a moderator, can only respond in a certain way due to the constraints of the moderator role ● Being more involved/invested in the study might lead to feelings of being overwhelmed out of wanting the study to be successful

After developing these user personas, a concrete list of core tasks for moderation was created and mapped back to potential dashboard features, a process reminiscent of Elshehaly et al. (2021)’s task-centered co-design activities. These tasks were derived from the findings of the

individual interviews and the co-creation workshop, as described in Section 1.2. It should be noted that this set of tasks may not represent all desired features or use cases for the dashboard, but rather acted as a starting point for the design of key dashboard components. These tasks, their definitions, the hypothetical dashboard features that would facilitate the execution of these tasks, and the data needed to support these dashboard features are summarized in Table 4.

Table 4. Task and variable breakdown for development of dashboard mockups

Task:	**Details:**
Post discussion topic of the week on Mondays	● **Definition:** Ensure that the discussion topic for the week is visible to study participants at the beginning of the week ● **Dashboard feature to support task:** Task checklist ● **Key data needed:** Check if discussion topic post exists ● **Workflow:** Dashboard checks if discussion topic post exists → Mark as done in task checklist
Check platform at least once a day to acknowledge new posts from participants	● **Definition:** Like and reply to new posts from participants ● **Dashboard feature to support task:** Notifications panel ● **Key data needed:** Check for new posts since the last data pull ● **Workflow:** Dashboard notifies moderator that there is a new post → Moderator acknowledges post in Discourse → Mark the post the as "reviewed" in notifications panel
Track participation details	● **Definition:** Check to see if a participant is completing their participation requirements (i.e. posting twice a week – one response to discussion topic post ("post"), one response to another study participant ("reply")) ● **Dashboard feature to support task:** Participation tracker ● **Key data needed:** Check to see if (2) user posts exist for that week, one "post" and one "reply" ● **Workflow:** Dashboard participation tracker automatically updates the following: ○ If "post" exists → Mark as completed in tracker ○ If "reply" exists → Mark as completed in tracker

	○ If the post and/or reply is late or not found → Indicate with color coding or other visual cues
Send mid-week reminder email to selected participants	● **Definition:** Send mid-week reminder email to participants who did not post twice that week ● **Dashboard feature to support task:** Participation tracker ● **Key data needed:** Check to see if (2) user posts exist for that week by a certain date and/or time ● **Workflow:** If a certain type of post does not exist yet, or if 2 posts do not exist yet: ○ Show prompt to send reminder email in that participant's tracker row → Example email template is provided to moderator→ Moderator opens external email client to send reminder email to participant → Mark "reminder email" item as completed
Assign badges based on participation metrics[1]	● **Definition:** Assign badges to participant based on meeting certain participation milestones ● **Dashboard feature to support task:** Individual participant view, Participant "action item" badges ● **Key data needed:** Retrieve posts made by users for a given week and analyze content within post ● **Workflow:** Moderator sees "assign badge" action item → Moderator assigns badges in Discourse → Mark "assign badge" item as completed
Respond to participant questions	● **Definition:** Respond to questions or issues from participants ● **Dashboard feature to support task:** Notifications panel, Requests inbox ● **Key data needed:** Check for new posts since the last data pull, or check for posts with certain "query flag" words ● **Workflow:** Dashboard notifies moderator that there is a participant request or question → Moderator addresses query in Discourse → Mark participant query as addressed

1. After further discussion with VOCALE moderators and study team personnel, it was determined that the assignment of badges would not be utilized in future rounds of VOCALE. Dashboard functions for badge assignment were featured in the Phase 1 mockups, but were removed in the Phase 2 interactive prototype.

Based on this organization of tasks, a series of 12 different mockup panels were developed, which represent 12 different views of a preliminary moderator dashboard and its featured components. These mockups can be organized into five groups, of which are outlined further in Table 5.

Table 5. Mockup summary and categories

Mockup category:	**Details:**
Main View	Represents the central, "main" view of the dashboard ● 6 components, each of which expands to their own section of the dashboard: Task Checklist, Notifications Panel, Participant List, Participation Tracker, Analytics & Visualizations, Activity Log
Popovers	Represents expanded menus that would appear over existing components of the dashboard to provide more information ● Task Checklist Popover ● Notifications Popover ● Participant List Popover
Participation Tracker	Represents a feature that would automatically check whether participants are meeting the posting requirements for the study
Individual Participant View	Represents a view that would show all posts made by a single participant and all posts addressed to a given participant in Discourse
Activity Log	Represents a feature that would log and display all actions made by users within the dashboard

All dashboard mockups for this phase of development were created using diagrams.net (formerly known as draw.io), an open-source web application that allows users to create diagrams. Two examples of the 12 mockups created for this phase of development are shown below in Figure 4. The rest of the mockup images are included in the appendix.

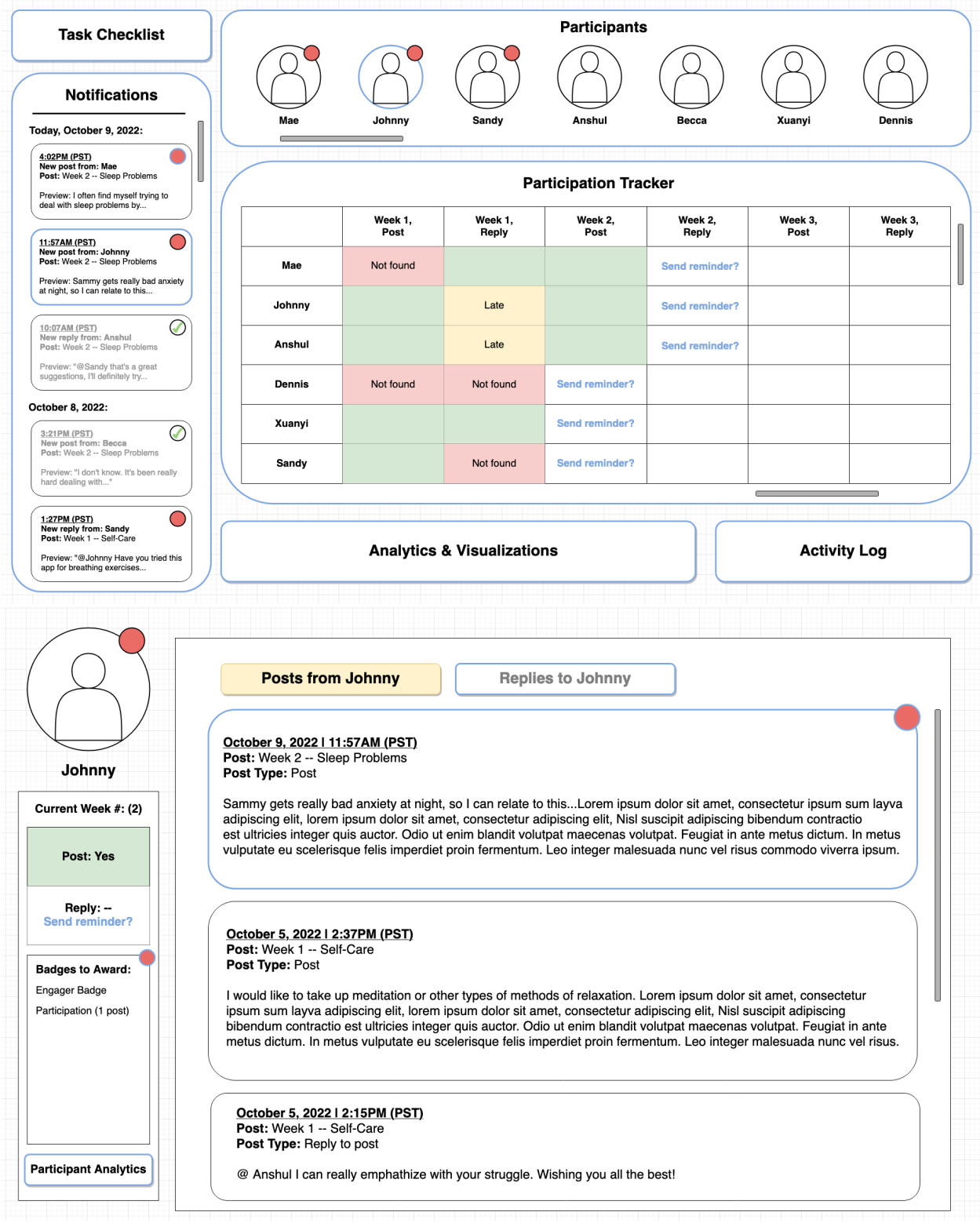

Figure 4. The dashboard mockups for the "Main View", which showcases the six main components of the preliminary dashboard layout, and the "Individual Participant View", which contains all of the postings and action items related to a specific participant. Items outlined in blue represent "clickable"/interactive features of the dashboard.

Because these mockups depict static representations of interactive dashboard features, blue outlining was used to represent the parts of the dashboard that a user would be able to interact with in a functioning dashboard prototype. This may include buttons, checklist items, and hyperlinks that would connect directly to content found on the Discourse platform. Once the mockups were completed, they were exported as images to be used in the development of the collaborative workshop materials.

2.1.2 Workshop Development and Revisions

To facilitate the review of the dashboard mockups, as well as provide more refinement on the variables and visualizations needed within an ideal dashboard, a collaborative workshop protocol was developed. This workshop was divided into two major sections, of which are summarized below. The full workshop question guide can be found in the appendix.

- **Section 1: Mockup Exploration –** Moderators are led through a guided review of all 12 mockup panels, grouped into the 5 categories outlined previously. After being briefed on the features captured in the mockup panels, moderators are allowed to leave comments and annotations on the mockup images using click-and-drag "sticky notes". Moderators are then asked to have a focus-group discussion regarding the mockups. An example of the virtual environment that facilitated this activity is provided in Figure 5.
- **Section 2: Variable Sorting and Mapping –** In the June 2022 VOCALE Co-Creation workshop, moderators completed an activity where they brainstormed data variables and information that they would want to be tracked in the moderator dashboard. For the current workshop, these previously-identified variables were turned into cards that moderators were asked to sort in terms of importance and map back to potential dashboard features. After having a chance to complete the activity individually,

moderators are then asked to do a "group" version of the same activity, working together to come to a best-fit consensus to sort the same set of cards in terms of importance. An example of the virtual environment that facilitated this activity is provided in Figure 5.

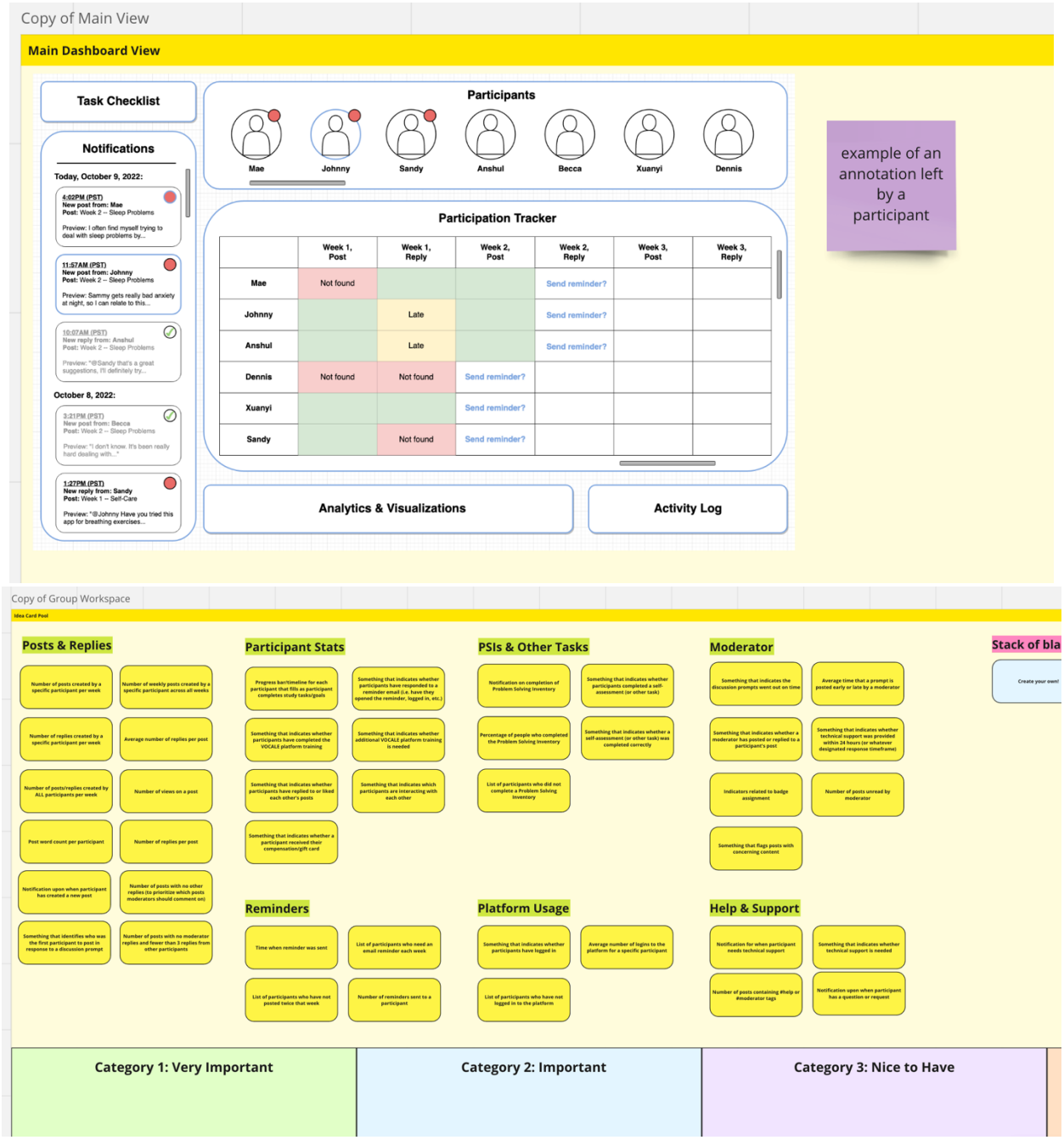

Figure 5. A sample of the workspace environments that were used in the Collaborative Workshops. The top figure shows an example sticky-note annotation left on the "Main View" dashboard mockup. The bottom figure shows the collection of cards used in the variable sorting and mapping activity.

The workshop materials and activities were created using Miro, an online collaborative whiteboard tool. The 12 mockup images were imported into Miro, and individual and collaborative workspaces were created for participants. Workshop sessions were 90-120 minutes in length and conducted over Zoom. A recording of each workshop was taken after receiving verbal consent from the participants in attendance. The workshop materials, which included the Miro boards and the question guide, were reviewed by current VOCALE study team members before the workshop sessions took place.

Due to technical challenges that were observed in the first workshop session, minor changes to the workshop structure and protocol were made between the first workshop session and the subsequent two sessions that took place. These involved increasing the time allocated to certain activities and revising the Miro board content to improve the functionality and navigability of the whiteboard. No changes to the content of the workshop activities were made.

2.1.3 Workshop Participants and Recruitment

All workshop participants were either current or former members of the VOCALE study team, and all participants had moderated at least one of the previous four rounds of the VOCALE intervention. Participants were recruited via email and asked to provide times in which they would be available to attend a 90-120-minute workshop session, and the sessions were scheduled from there. Because all participants were considered collaborators on this study, an IRB application was not necessary to conduct this research.

2.1.4 Workshop Data Analysis

To prepare for analysis, the written sticky-note annotations were exported from the Miro board and transcribed in a Microsoft Word document (.doc). The interview recordings were auto-

transcribed in Microsoft Word Online (Microsoft 365), and resultant transcripts were manually reviewed to correct any errors.

The sticky-note annotations were first analyzed using an affinity-mapping technique, where similar ideas are grouped together into categories and labeled (Lepley, 1998). The categories used for this exercise were “Likes”, “Dislikes”, and “Suggestions”, as these broadly represented the question prompts that were given to the participants as part of the workshop protocol. After identifying relevant quotations from the workshop transcripts, specific transcript excerpts were matched with the participant’s written annotations if they were in regard to the same topic. Once all of the data had been paired together, thematic analysis was performed by first using open coding in Dedoose to identify topics of interest within the data, then defining themes for each of these topics as they relate to moderators’ preferences and the design’s potential areas for improvement. Themes were defined based on whether there appeared to be commonalities across transcripts that were of significance to moderators’ experiences, and the ones presented here represented the most frequently occurring or most interesting ideas. (Braun & Clarke, 2006; Vaismoradi et al., 2013; Jowett et al., 2012).

Data from the variable sorting and mapping activity was analyzed by reviewing each moderator’s sorting of the variable cards to identify patterns in the moderators’ evaluation of the importance of certain types of information. The card sorting data was also paired with excerpts from the workshop session transcripts to gain an understanding of how moderators viewed different types of information in the context of their own workflows, as well as how they would use participant data to inform the decisions they would make and actions they would take during the course of the intervention.

2.2 "Phase 2": Individual Task-Based Interviews

2.2.1 Interactive Prototype Development

Once the workshop sessions were conducted and the findings were reviewed, the next phase of development was to create an interactive dashboard prototype. To evaluate whether a proposed design would ultimately be useful and usable, it was important to build something that would be responsive to moderators' interactions with the interface to simulate the experience of using an actual dashboard tool. Furthermore, an interactive prototype would be able to demonstrate how certain features would work in practice, which was something that could not be conveyed as effectively in the static mockup images (Corry et al., 1997).

The interactive dashboard prototype was developed using Figma, which is an online collaborative interface design software that supports diagramming, wireframing, and prototyping features. Using the findings gathered from the workshop sessions (further described in Section 3.1), many components of the original dashboard design depicted in the static mockup images were revised or replaced. From there, a series of frames that depicted different pages and components of the moderator dashboard were created and linked together using Figma's prototyping tools. The animations and transitions between frames, which were triggered by certain interactions with on-screen elements, were designed to be reflective of what the user experience might be like when using an actual dashboard tool. Two examples of the frames included in the interactive prototype are shown below in Figure 6. The rest of the dashboard prototype frames are included in the appendix.

The moderator dashboard tool is envisioned as an automated, centralized aid for VOCALE moderators. The dashboard would provide moderators with the information and resources needed to streamline the completion of certain intervention-related tasks. For example,

to assist with the reviewing of posts written to the discussion platform, moderators can take advantage of components such as the "New Posts Feed", which collects all new posts written to the platform and provides direct links to the content in Discourse. This will circumvent the need for moderators to have to scroll through each discussion thread to look for new posts from participants. To ensure that participants are meeting the minimum posting requirement, the moderator dashboard offers a "Progress Tracker", which automatically tracks whether each participant has posted twice a week to the platform, and offers a prompt to send a reminder email if they have not. The dashboard also proposes an "Individual Participant View" for each participant, which collects all of the posts made by a specific participant under one page, which is a feature that is not currently offered in Discourse. This page will allow moderators to gain a better understanding of each participant by being able to see all of their posts in one place whilst also offering other insights. Other sections of the dashboard include inboxes for participant requests, inter-moderator communications, and other notifications, an "Activity Log" to log the completion of actions within the dashboard, a modifiable "Task Checklist" to keep track of intervention-related tasks, and an "Analytics" section, which can provide analytic information on both an individual-participant level and intervention-wide level.

Rather than acting as a complete replacement for the study platform, the dashboard encourages moderators to engage with participants directly in Discourse by providing a link to the discussion content in the interface and redirecting moderators to view the post within the greater context of the discussion thread. However, by taking care of other routine work, such as automatically tracking participant posting requirements and aggregating other information that moderators need to keep the study running smoothly, the moderator dashboard can enable VOCALE moderators to focus more on engaging with participants within the intervention.

Figure 6. Frames from the interactive prototype that depict updated versions of the "Participant Tracker" and "Individual Participant View" components of the dashboard.

All of the information displayed in the interactive dashboard prototype was synthetic. Any participant study data depicted in the different dashboard components, such as participant names and post content, was generated based on retrospective participant responses from previously conducted rounds of VOCALE, but no real participant data is featured in any part of the prototype. Additionally, the other moderator users depicted in the dashboard, including their names, post content, and messages, were also created based on previous understandings of moderators' roles and duties (as described in Section 1.2), but they are not representative of any specific current or former VOCALE moderator.

2.2.2 Task-Based Interview Protocol

To guide the usability testing of the interactive dashboard prototype, a task-based interview protocol was developed. The interview consisted of four sections, of which are summarized below. The full interview protocol can be found in the appendix.

- **Section 1: Think-aloud Exploration** – Moderators are presented with the interactive dashboard prototype with minimal guidance. They are given 5-10 minutes to navigate the system and are asked to use a think-aloud protocol to describe their interactions with the interface. Specifically, they are asked to verbalize their thoughts as they interact with the system, the reasons they are making certain decisions, and their reactions to what they experience (Boren and Ramey, 2000). This introductory section gives moderators a chance to familiarize themselves with the system for the upcoming sections of the interview while also gauging the intuitiveness of the design and identifying initial usability issues.
- **Section 2: Task Completion** – Moderators are then asked to complete 3 sets of tasks using a think-aloud protocol:

- **Basic moderation tasks** – Moderators are asked to use the prototype to assist with three basic moderation duties, such as reading and acknowledging new posts, identifying which participants need to be sent a reminder email, and addressing a participant's request for assistance.
- **Use Case #1** – Moderators are presented with a use case that is related to monitoring and responding to participant needs, which is a core responsibility of being a VOCALE moderator. Specifically, moderators are given a scenario about a hypothetical VOCALE participant named Johnny, and are asked to use the dashboard to a) identify whether his engagement with the VOCALE intervention has decreased and b) brainstorm ways to address the situation.
- **Use Case #2** – Moderators are presented with a use case that is related to monitoring improving their own moderation practices, which is important for the effective delivery of the VOCALE intervention. Specifically, they are given a scenario where a previous VOCALE participant has expressed feeling upset over not receiving enough interactions from other participants and moderators through the discussion forum, and are asked to use the dashboard to brainstorm ways to reduce the likelihood of this situation happening in the future and ensure that moderators are doing their best to meet participant needs.

- **Section 3: Semi-structured Questions** – Moderators are asked open-ended questions about their experience using the dashboard prototype, features that they liked or disliked, and what suggestions or improvements should be made in future versions of the dashboard.

- **Section 4: Evaluation Questionnaire** - Moderators are asked to complete a short evaluation form that asks them to reflect on their experience using the dashboard prototype by answering a series of Likert-type scale items: the System Usability Scale and the Post-Study System Usability Questionnaire (further described in Section 2.2.3).

Interview sessions were 60-90 minutes in length and conducted over Zoom. Participants were asked to share their computer screen as they interacted with the prototype, and a recording of each interview was taken after receiving verbal consent from the participants in attendance. The interview materials, which included the interactive dashboard prototype and the interview guide, were reviewed by current VOCALE study team members before the interview sessions took place.

2.2.3 Evaluation Questionnaire Design

The questionnaire provided to participants at the end of the interview session consisted of five sections, as described below.

- **Section 1: Participant Characteristics** – Participants are asked to provide basic demographic information about themselves, such as age, sex, gender, ethnicity, highest education level achieved, and current occupation (*NHIS - data, questionnaires and related documentation*, 2023; Cameron & Stinson, 2019; Lindqvist et al., 2021).
- **Section 2: VOCALE Background** – Participants are asked to provide information about their experience working on VOCALE, such as which rounds of VOCALE they moderated, what study activities they participated in outside of moderation, and what their background was at the time they were a moderator.

- **Section 3: System Usability Scale (SUS)** – Participants are asked to complete the 10-item System Usability Scale (SUS), which assesses the perceived usability of a presented system (Brooke, 1986).
- **Section 4: Post-Study System Usability Questionnaire (PSSUQ)** – Participants are asked to complete the 16-item Post-Study System Usability Questionnaire (PSSUQ), which assesses the perceived satisfaction with using a presented system (Lewis, 1995).
- **Section 5: Final Thoughts and Reflections** – Participants are presented with open-ended questions asking about their overall experience using the interactive dashboard prototype.

The use of subjective measures in usability testing, like the SUS and the PSSUQ, can help with evaluating how much users prefer to use the system they are presented with (Lewis, 1995). The inclusion of subjective usability measures was important, as the aim of this project was not only to design something that *works*, but to design something that moderators would *want* to use. The System Usability Scale (SUS) is a widely-used and reliable measure of perceived usability that provides a final SUS score out of 100 points, with higher values denoting higher perceived usability (Lewis, 2018). The Post-Study System Usability Questionnaire (PSSUQ) is a similarly reliable measure of usability which, in addition to providing an overall PSSUQ score, provides sub-scores on three domains of usability: system usefulness (SYSUSE), information quality (INFOQUAL), and interface quality (INTERQUAL). In contrast with the SUS, scores are calculated on a scale of 1-7, with lower values denoting greater perceived satisfaction with the system (Fruhling & Lee, 2005). Both measures were included to gain a comprehensive sense of system usability and user satisfaction with the dashboard prototype.

The questionnaire was developed using Google Forms, an online survey administration software. It should be noted that the numerical scale was reversed for the presentation of the PSSUQ items, where 7 denoted “Strongly Agree”, in contrast to the original PSSUQ instrument, where 1 denotes “Strongly Agree”. This decision was made to be more consistent with the numerical scales that were presented in the previous section of the questionnaire, where the SUS items associate higher numerical values with stronger agreement, with 5 denoting “Strongly Agree”. The question items found on the questionnaire are included in the appendix.

2.2.4 Interview Participants and Recruitment

All interview participants were either current or former members of the VOCALE study team, and all participants had moderated at least one of the previous four rounds of the VOCALE intervention. Participants were recruited via email and asked to provide times in which they would be available to attend a 60-90 minutes interview session, and the sessions were scheduled from there. Because all participants were considered collaborators on this study, an IRB application was not necessary to conduct this research.

2.2.5 Interview and Questionnaire Data Analysis

The interview recordings were auto-transcribed in Microsoft Word Online (Microsoft 365), and resultant transcripts were manually reviewed to correct any errors. During the process of reviewing the recordings, descriptions of participants’ on-screen actions and interactions with the dashboard prototype were documented and paired with relevant interview transcript excerpts. Using the thematic analysis methodology described in Section 2.1.4, open coding was performed on the interview transcripts in Dedoose to identify topics of interest in moderator’s experiences when using the prototype, and then themes were defined for each of these topics. The themes

presented here are centered around ideas that were commonly occurring across transcripts or appeared to be significant to moderator experiences (Braun & Clarke, 2006; Vaismoradi et al., 2013; Jowett et al., 2012).

Additionally, each participant's reported SUS, PSSUQ, and PSSUQ sub-scores (SYSUSE, INFOQUAL, INTERQUAL) were calculated (Brooke, 1986; Lewis, 1995). Prior to performing the calculation for the PSSUQ scores, the values collected through the evaluation questionnaire were transformed back to standard PSSUQ responses, as participants were presented with a reversed numerical scale compared to the original PSSUQ (as described in Section 2.2.3). Descriptive statistics, such as means and standard deviations for each score, were also calculated. All calculations were performed using Python and validated in Microsoft Excel.

3. RESULTS

3.1 Participant Characteristics

All moderators who attended the workshop and interview sessions were either current or former members of the VOCALE study team and had moderated at least one of the previous four rounds of VOCALE. The 4 moderators who attended the workshop sessions also participated in the task-based interview sessions; there was one additional moderator interviewed who was not a previous participant in the workshops.

All participants identified as Asian, and all participants had achieved a doctorate degree as their highest level of education. Further information about the participants involved in these sessions are provided below in Table 6.

Table 6. Participant characteristics for workshop and interview sessions

Participant ID	Age	Sex	Current Occupation
1	31	Female	Project Manager and Study Coordinator
2	54	Female	Medical Librarian
3	43	Female	Research Scientist
4	28	Male	Data analytics and Research Scientist
5	Prefer not to say	Female	Nurse Practitioner

3.2 Workshop Sessions Results

3.2.1 Workshop Session Details

Three workshop sessions were conducted with a total of 4 moderators in attendance across the sessions (IDs 1, 2, 3, 4). Due to scheduling challenges, out of the three workshop sessions, only one session was a true “collaborative” session with 2 moderators in simultaneous

attendance. The remaining two sessions were conducted as one-to-one workshop sessions, but the content presented in all workshop sessions was identical.

3.2.2 "Likes": Automation of Tasks and Visual Clarity

Two major themes were identified within the moderators' feedback on what they enjoyed when reviewing the dashboard mockups: "Automation of Tasks" and "Visual Clarity".

Automation of Tasks. Moderators generally expressed an appreciation for how the features in the proposed dashboard tool would automate the completion of many tasks that would be completed manually using current workflows. This was largely in reference to the "Participation Tracker", a dashboard component that would automatically track whether VOCALE participants had completed their weekly postings by pulling data from the Discourse platform, checking it against existing posting requirements, and visually indicating whether the requirement had been met for that participant. Currently, the tracking of VOCALE participant's posting requirements requires the moderator to have to scroll through the discussion platform and manually evaluate whether a participant has posted twice for that week, as referenced in Section 1.3. This task can become time-consuming and burdensome as more posts are created. Additionally, moderators have previously identified (in the sessions described in Section 1.2) that the layout of posts and comments on the Discourse website can add extra difficulty when trying to complete this task, as the platform may display replies twice within the discussion thread due to the way that comments are indexed. A functioning "Participation Tracker" would not only aid moderators with ensuring that the basic study requirements are being met, but would also reduce the moderators' task load so that their efforts can potentially be redirected toward fulfilling other intervention goals.

Furthermore, the proposed "Activity Log" component of the dashboard, which would automatically track the completion of study-related tasks across multiple team members by checking requirements in Discourse and internal activity within the dashboard system, was also identified as useful, as it would reduce the need for moderators to have to dialogue about whether certain tasks had been completed and reduce the chance of duplicate or redundant efforts amongst moderators.

Visual Clarity. Moderators also enjoyed certain visual design components of the preliminary dashboard mockups, such as the employment of color-coding, labels to track specific participant details and requirements that are important to the study protocol, and the inclusion of visual indicators. One moderator (ID 4) mentioned that he appreciated the intuitiveness and familiarity of the layout of the dashboard, saying that it had a "clean, social media feel" that is "similar to Instagram or Tiktok", specifically referencing the inclusion of a top banner that contained a collection of participant's avatars and the use of red notification badges that one might find on a smartphone or social media interface. He also provided a further insight on what the future of the VOCALE moderation team might look like as the intervention expands:

> "As time progresses, the VOCALE team will probably have people join who are familiar with social media, grew up with social media, would probably understand pretty quickly what this means, since it takes, you know, inspiration from some of those [social media platforms]. I think it makes sense…I would just have to click around for a few minutes to just, you know, understand some of the intentions and the meanings behind them [depicted features]." (ID 4)

3.2.3 "Dislikes": Clutter, Visual and Semantic Inconsistency, and Accessibility Issues

In contrast, several themes were identified regarding aspects of the dashboard mockups that moderators did not enjoy.

Clutter. Certain components of the proposed dashboard, such as the "Notifications Panel", which collects new posts made to the discussion platform made by VOCALE participants, and the "Activity Log", which tracks internal activity within the dashboard, were identified as potential hotspots for "clutter", as they might quickly become filled with new information at a rate faster than can be cognitively processed by a moderator using the tool. Furthermore, certain aspects of the dashboard's "Main View" were noted to be potentially redundant, and suggestions for collapsing and streamlining the information conveyed into a smaller number of components were provided, such as combining the "Participant List" and the "Participation Tracker".

It was also observed that having *not enough information* can also contribute to the notion of "clutter". A specific example that was given was in reference to the lack of context for in-thread discussion replies from participants in the "Notifications Panel". Without the surrounding comments from other users, a participant's reply can have little meaning when taken out of context. Thus, the utility of the presented information is reduced by the context that is missing, and therefore, the information can be viewed as "unhelpful" and contributory to the clutter.

Visual and Semantic Inconsistency. In general, it is important for the dashboard interface to be able to communicate salient information in a way that is easily understood by the user. Within the dashboard mockups, certain labels were identified as confusing or semantically

unclear, such as the use of the word “Not Found” to indicate when a participant had not posted to the discussion platform. One moderator also pointed out visual inconsistencies in the use of colors across different components of the dashboard: in the “Participation Tracker”, the color red is used to denote when a participant is “missing” a post; however, the red notification badges associated with participant avatars are used to signify that there is “something new” from the participant to look at. The employment of the color red in these two cases can be viewed as contradictory to each other, and can be confusing to a user who is trying to navigate the system. This moderator (ID 3) provided an insight as to how they intuitively associate the color red with something being “missing”, due to her clinician background:

> “Because I am thinking, as a clinician, if we look at the red, it probably means there’s like an emergency condition I need to take care of. It just feels like something needs to be done that has not been done, but I feel here the red actually means the participant has actually completed something.” (ID 3)

Accessibility Issues. An important issue with the use of colors employed in the dashboard mockups was identified: the “Participation Tracker” component relies on the use of red, yellow, and green color-coding to indicate whether a participant has met the posting requirement for the week, similar to the visual schema described by Dowding et al. (2015). However, this design choice may be disadvantageous to color-blind users of the dashboard. As a result, a suggestion to rectify this issue was to ensure that the colors used are of different saturation levels or intensities, and to combine them with labels or icons to ensure that meanings are clearly conveyed without relying on color-coding mechanisms alone.

3.2.4 "Suggestions": Missing Features and Inter-Moderator Communication

Missing Features. Some suggestions for improvement involved adding features that were not originally depicted in the dashboard mockups. These included a way to track participants' completion of REDCap questionnaires and training materials, a "participant characteristics" section where moderators can record notes relating to each participant in a centralized place, and the implementation different icons, symbols, and visual indicators to quickly communicate participant needs, such as new posts to review, technical support requests, or participants who may require additional attention due to low engagement.

Inter-Moderator Communication. As moderators discussed these areas for improvement, a theme that arose amongst their suggestions was the desire for a streamlined communication system between moderators. This can include ways to delegate tasks between moderators and quickly flag items for each other's attention. Supporting these communication features within the moderator dashboard would improve the workflow for moderators when issues arise. For example, if a certain participant's post contains concerning content or content that requires further action, rather than relying on email communication and needing to manually locate and link to the post in the Discourse platform, the moderator dashboard could streamline the process by using automatic flagging features and intra-dashboard messaging, which can increase moderator efficiency and reduce the time it takes for issues to be resolved.

One moderator (ID 3) gave a specific example of a scenario where dashboard-supported moderator communication would be helpful:

"You know Asana? So it's like, sometimes you can assign a task to someone else. [...] If there's a way to assign a task, that might be helpful, because, you know, people can always have like better weeks and not-so-good weeks…Some person's schedule is going to be crazy, and maybe certain tasks they can delegate to another person…*Oh, I have [an] exam tomorrow, I know the reminder email's due tomorrow, so could you do this on my behalf in case I'm preoccupied and forgot to send?*" (ID 3)

3.2.5 Variable Sorting Results and Associated Themes

While there were individual variations in how moderators evaluated the importance of different variables and information displayed within dashboard components, based on the variables that moderators consistently categorized as "very important" or "important", certain trends were identified in what moderators valued in an ideal dashboard.

Notifications for actionable items. In general, moderators largely valued having *notifications for actionable items*, which can be defined as items initiated by a participant action that would require moderator review. Such actionable items can include new posts from participants, which would need to be acknowledged by a moderator; completion of supplementary study materials, which would need to be reviewed by moderators to inform discussion material for future weeks; participant queries and technical support requests; and flagging of post content that would warrant further moderator intervention. The automation and streamlining of this information through the use of a notification system would reduce the burden on moderators to have to identify and keep track of these information types manually.

Compilations of actionable information. Additionally, moderators valued having *compilations of actionable information*, which can be defined as informational summaries that would be useful for moderators to have when needing to perform certain "bulk" actions. This can include lists of participants who have not met the posting requirement for the week, which are needed when sending out reminder emails; lists of participants who have not completed certain study-specific tasks; or even posts that have not received a certain level of engagement, which would help moderators prioritize who they should respond to when visiting the discussion platform. As of now, the tracking and collection of this information must be done manually by moderators, who would have to scroll through Discourse to identify participants that require further moderator action, which can become time-consuming and burdensome.

Visual indicators for information. Moderators generally valued having *visual indicators for information*, which can include visual cues that show if a moderator has already replied to a participant's post, indicators for whether a participant has completed certain tasks, or even the use of hashtags to help streamline participant feedback and inquiries, such as "#moderator" or "#help". These can aid with improving moderator's workflows and decision-making processes, particularly if time is limited, or if there is a large number of participants.

Moderation Variables vs. Analysis Variables. In contrast to the three themes identified above, forms of quantitative information, such as individual participant statistics, the number of replies to a participant's post, the word count of participant posts, ways to measure how much participants were interacting with each other within the platform, or visualizations related to participant metrics, generally ranked lower in importance compared to notifications,

compilations of information, and visual indicators. Upon further review of the workshop data, a theme was identified to support this finding. That is, there exists two different categories of variables: those that are important for *moderation* and those that are important for *analysis*. Variables and data that support notifications and visual indicators within the dashboard can be categorized under the first, as this information is more important during the course of the study to ensure the intervention is running smoothly. Data that supports the generation of visualizations and statistics, such as quantitative metrics about participants, posts, and engagement, was identified to be more helpful after the 8-week period has concluded and the utility of the VOCALE intervention is being evaluated. Ideally, the moderator dashboard should be able to support the tracking and communication of *both* of these categories of variables, with the overarching question being how to best design features that can provide this information without the interface feeling too cluttered or overwhelming.

3.3 Interview Sessions Results

3.3.1 Interview Session Details

Five individual interview sessions were conducted with 5 moderators (IDs 1, 2, 3, 4, 5). All sessions proceeded as outlined in Section 2.2.2., with no changes made to the interview content between sessions.

3.3.2 System Usability Scale (SUS) and Post-Study System Usability Questionnaire (PSSUQ)

The results from the SUS and PSSUQ portions of the evaluation questionnaire are reported below in Table 7. The mean SUS score awarded to the dashboard prototype implied that overall perceived usability was fairly good (M = 74.0, SD = 6.5). A similar result was seen for

the mean overall PSSUQ score (M = 2.4, SD = 0.6), implying that overall satisfaction with the system was fair as well. Additionally, the mean sub-scores for system usefulness (SYSUSE; M = 1.9, SD = 0.4), information quality (INFOQUAL; M = 2.9, SD = 0.9), and interface quality (INTERQUAL; M = 2.3, SD = 0.7) were relatively low, implying that the dashboard prototype design was generally favorable design amongst moderators.

Table 7. SUS, PSSUQ, and PSSUQ sub-scores awarded to the dashboard prototype

Participant ID	SUS Score	Overall PSSUQ Score	SYSUSE Score	INFOQUAL Score	INTERQUAL Score
1	72.5	2.9	2.3	3.7	2.7
2	77.5	2.7	2.3	3.5	2.0
3	82.5	2.1	1.7	2.5	2.0
4	72.5	1.4	1.3	1.5	1.7
5	65.0	2.8	2.0	3.3	3.3

3.3.3 Evaluation of Task Completion

Basic Moderation Tasks. All five moderators were able to complete the three basic moderation tasks that were presented to them during the task completion section of the interview with little to no confusion. In particular, moderators took advantage of proposed features such as the "Quick Access" bar, which provides easy of access to a "New Posts Feed" and "Participant Requests Inbox", as well as the "Progress Tracker", which is an updated version of the "Participation Tracker" from the previous set of dashboard mockups, revised to include a greater usage of symbols and labels to communicate tracking information more efficiently. These observations imply that the features proposed in the preliminary dashboard prototype would be helpful to moderators when needing to complete tasks that are crucial to the facilitation of the intervention.

Use Case #1. In comparison to the relative consistency of solutions observed in the "Basic Moderation Tasks" section, moderators' approaches to confirming a hypothetical participant's (Johnny) alleged decrease in engagement varied more. Three moderators took advantage of Johnny's individual "Participant Analytics" page, which featured mockups of graphs that implied that the time that Johnny had spent on the platform in recent weeks had been decreasing, whilst other moderators preferred to use the information presented in the "Progress Tracker", which depicted that Johnny had missed several weeks of posting requirements. One moderator (ID 1) did note that the dashboard system had provided an "automated" alert notification that Johnny's engagement had decreased, but wanted more detail about the metric thresholds detected by the system that would trigger such an alert.

To respond to the situation, moderators generally said that, once they were convinced Johnny's engagement with the intervention had indeed decreased, they would take measures such as emailing or calling the participant. One moderator (ID 3) suggested that if there was a way for the dashboard to track whether or not participants were viewing or responding to reminder messages from the study team, this could ultimately be useful in determining whether certain participants require further intervening actions from the moderators.

Use Case #2. Moderators' ideas for addressing a situation where a participant felt that they were being neglected by other users on the discussion forum also varied. Some moderators utilized existing features in the dashboard prototype, such as the "Individual Participant View", which collects all of the posts written by and written to a specific individual participant, as well as the "Participant Analytics" page, to evaluate whether or not participants were receiving a fair amount of engagement from other users. One moderator (ID 2) suggested introducing a feature

where participants can be "assigned" to a specific moderator, which might help to ensure that all participants are receiving relatively equal amounts of attention from moderators, particularly as the intervention grows to include larger numbers of participants.

Another prominent suggestion from moderators was to incorporate ways to track more moderator-based analytics. This came in response to a mockup of a pie chart that was included on the "Participant Analytics" page, which hypothetically measured and displayed the proportion of interactions that each participant was having with other users on the discussion platform. Two moderators (IDs 1, 4) identified that having a moderator version of this chart to track moderator interactions with participants, and broadly having an analytics page for each individual moderator, would ultimately be helpful in situations like these:

> "Are there intentions of moderating the moderators? Or like monitoring the moderators, because I think this kind of chart [depicting interactions between users] would be interesting to look at for moderators as well. To see who they're interacting with, because if life one moderator is clearly talking to Theodore more than everyone else, then you're like, *hey, yo, you might want to talk to other people too,* that kind of thing." (ID 4)

> "I think it could be [helpful] for me to look at my own data…because I think I could see this pie chart [depicting interactions between users] being quite illuminating, because across so many participants, you don't always realize who you're engaging with more." (ID 2)

This idea of having the dashboard promote self-monitoring for moderators is expanded upon further in Section 3.3.6.

3.3.4 Design Strengths: Visual Clarity and Streamlining of Existing Workflows

Two major themes were identified within the feedback moderators provided regarding aspects they enjoyed when using the dashboard prototype: "Visual Clarity" and "Consolidation of Existing Workflows".

Visual Clarity. Similar to the findings presented in Section 3.1.2, moderators expressed an appreciation for the overall visual design of the preliminary dashboard prototype. Phrases that were used to describe the interface included that the dashboard was "pretty clean, pretty simple" (ID 4), "not too busy looking, everything seems fairly clear" (ID 2), and that it was "straightforward and intuitive" (ID 3). Given that this feedback implies that moderators would generally be pleased with interacting with the system, this then implies that the layout of the proposed interface is welcoming to users, which is an important component of usability.

Streamlining of Existing Workflows. Another benefit that was identified by the moderators with the preliminary dashboard design was that it would have the ability to improve the efficiency of existing workflows. This is mainly accomplished through the dashboard's proposed ability to consolidate the functions of multiple systems into one interface. Two moderators (IDs 2, 5) provided insights on how the current workflow of VOCALE involves needing to switch between multiple platforms in order to keep the intervention running:

"We have to use so many platforms for one study, like for one project we have to use the platform for participant[s], we have to use another platform to analyze the data, we have to use another platform for surveys…So I think if we have to access so many different things, hopefully it will be better if this platform, this dashboard can be a little more explorative too. Quantitative data automatically [analyzed] without using so many software." (ID 5)

"I think it [the dashboard] would be very helpful because, what we were previously doing was having a bunch of spreadsheets to kind of track everything, and then using our emails, and then going into Discourse. So there was so many disparate areas that you were trying to, you know, say, *OK, did I do this? Did I go through, you know?* And then you know, for me, because I was the REDCap person, I would have to go into REDCap, and say *OK, I need to make sure I sent off the invitation…*there was multiple things that I was trying to balance and track. So you had to go to different places, which was a little bit frustrating." (ID 2).

Ultimately, these benefits contribute to being able to run the day-to-day of the VOCALE intervention more efficiently. Moderators identified that, if the dashboard is able to improve their existing workflows, then it can lead to a better intervention experience at a much broader level:

"I think it [the dashboard] will help support the communication with the moderators as well. So that everybody's on the same page…I think it will help improve the efficiency." (ID 3)

> "I think I would say it [the dashboard] helps me have a more holistic view of the participation, because as it is now like, to do this manually…it would just take forever to have these kind of views of what people are posting or what they're asking…I have to be like scrolling to look for certain posts. So I can see, I think it helps. This would help give us a bird's eye view of what's happening, and then we can be more mobilized to act." (ID 1)

3.3.5 Design Weaknesses: Confusing Symbols and Labels

Amongst various suggestions for improvement over specific design aspects presented in the dashboard prototype, one major theme was identified as a central weakness of the current dashboard design: "Confusing Symbols and Labels".

Confusing Symbols and Labels. One major revision that was implemented between the dashboard mockups and the interactive dashboard prototype was the integration of symbols and icons with the intention of being able to quickly communicate information to moderators about the status of participants and the intervention. However, in all of the moderator interviews, it became clear that there was an ongoing sense of confusion over the chosen symbols that were included in the dashboard. Several moderators reported that the symbols used in the "Quick Access" bar were not intuitive to deduce the meaning of, and considering that that was where their eyes tended to fall to naturally when first encountering the interface (given that the "Quick Access" bar was placed toward the upper-left-hand corner of the screen), this tended to start the usability sessions off with a sense of confusion. One moderator (ID 4) communicated that the use of a green shield icon to indicate inter-moderator communication and messages was inconsistent with their own intuitive understanding of what a shield meant:

> "This shield is really throwing me off. Mainly because when I see a shield, I think of security rather than messages. So that's because, like, messages, I feel like you'd see an envelope or something you know? But yeah. That threw me off for a minute because it was like, huh, there's a green shield. *All systems running*, kind of thing." (ID 4).

Similar comments were made about the labels for the different dashboard components in the sidebar navigation, with one moderator (ID 1) mentioning that the word used to label the updated "notifications-style" inbox was inconsistent with their own definition of the word:

> "I think I would change it to not say 'Actions', because to me that sounds like 'tasks', like when I click on it, it's things I'm supposed to do…[but instead] I'm supposed to review these [things]. So I think if I had to rename this, I might say 'to-do'…or maybe like 'items to review'. That would be clearer to me." (ID 1)

While there was a page included in the dashboard prototype that provided explanations for the meanings of the different symbols used throughout the components of the interface, it was observed that most moderators did not naturally gravitate to read through this supplementary documentation as part of their exploration of the system. This may imply that revisions to the symbol and icon design need to be made in order to make the interface more intuitive to first-time users and make it less reliant needing to review prior documentation.

3.3.6 Other Themes: Customization and Moderator Accountability

Two further themes were identified within moderators' feedback regarding the features proposed in the dashboard prototype, both of which were requests that moderators would like to see in a future version of the dashboard: "Customization" and "Moderator Accountability".

Customization. Several moderators expressed a desire to have the dashboard be more adaptable to their individual workflows. This was observed as moderators were giving suggestions to how they would revise the layout, with some moderators identifying that they would like the "Progress Tracker" to take up more space on the main interface, as they believe they would be spending most of their time and efforts there. Some moderators also expressed that they would like features such as the "Task Checklist", which is currently only accessible via the sidebar, to be a component on the main interface. In contrast, one moderator requested that more quantitative analytics be available upfront upon logging into the system. As moderators' responses and requests tended to vary, this might suggest that, if the dashboard were able to offer more customization in terms of its layout for individual users, this might help improve the workflows and experiences of the moderators. Similar observations were also made regarding the "Analytics" section, where moderators expressed a desire to be able to "pin" different metric counters and graphs to their own account's "Analytics" page, recognizing that not all moderators will find the same visualizations as helpful to view.

Moderator Accountability. One interesting theme that arose in most interview sessions with moderators was the desire for the dashboard to support the tracking of moderator activities, beyond the basic tracking of task completion. This concept was first introduced in Section 3.3.3,

where moderators suggested having moderator-specific analytic pages to monitor and assess moderators' engagement with VOCALE participants. Moreover, moderators also expressed a desire to keep each other accountable to ensure that crucial study-related tasks are being completed efficiently:

> "Assuming there'll be like a supervisory moderator who can use this activity thing [log] to make sure that a specific moderator is, you know, keeping up with the…has done specific activities…and I like the filter by option for the moderator." (ID 2)

> "One question I have is if I assign a task to someone, like Horatio [fake moderator user], and then he actually does it, is there a notification that would pop up somewhere here so that I know it was done? […] I think that would be useful because sometimes I do wonder, like if I ask them [other moderators] to do something and they actually do it, but they don't necessarily email me back. And say they've done it, so then I'm left wondering, like I could email them [to check], but they might not respond right away. So then I have to go check…" (ID 1)

> "I guess one thing that I didn't see is, I can see what task I assigned to me, but it doesn't have the overdue warning. So for example, 'Publish this week's post', if it's assigned to me, I guess it doesn't really say *hey, this has to be posted on Thursday and now it's Friday, this is now overdue*. That is one thing that probably could be added, because I feel I was more OCD about whether things were completed at a certain time. […] If there's a warning that this is already overdue, probably I can message someone to like,

hey, you're supposed to publish the week's topic this week and it looks like you haven't done it. So that would probably be helpful. Because there's like an expectation, and [the dashboard] shows [it as] overdue, so the person [other moderator] won't feel like, oh, you're overreacting." (ID 3).

These excerpts suggest that moderators are interested in improving their own moderation practices through a combination of monitoring each other and self-monitoring their own behaviors. An ideal dashboard would be able to support these actions by providing features that track, measure, and provide feedback to moderators about their own activities within the intervention. In this way, the moderator dashboard can fill a gap in improving VOCALE overall.

4. DISCUSSION AND CONCLUSIONS

This thesis project aimed to propose a preliminary design for a moderator dashboard for the VOCALE intervention. Through employing a user-centered design methodology and conducting structured workshops and interviews with VOCALE moderators, a variety of insights were gathered that went beyond the primary goal of evaluating the usability of the proposed design. These findings are reflected upon and further discussed in the sections below.

4.1 Assessment of the Proposed Dashboard Design

4.1.1 VOCALE Moderation Challenges and Potential Solutions

When examining the experience of VOCALE moderators as they facilitate the intervention, it was clear that moderators face many challenges that can hinder their ability to moderate efficiently. Some of these challenges were more functional, such as needing to manually assess and track participant progress, while others were more holistic to the intervention experience, such as wanting to thoughtfully interact with participants to encourage better engagement with the study. These challenges reflected the sentiments illustrated through in Deng et al. (2023) and Perry et al. (2022)'s work, which reported that moderators of online communities in general are tasked with balancing a wide variety of administrative, functional, and cognitive tasks.

The current moderator dashboard design attempts to address these challenges through the proposal of solutions and features that were developed in response to VOCALE moderators' needs. Based on the findings presented through this thesis work, it can be concluded that the preliminary dashboard design provides a solid foundation for further development. As evidenced by the quantitative usability measures provided in Section 3.3.2, the initial interface design was

viewed favorably by VOCALE moderators. Furthermore, moderators' feedback reflected that the functions depicted in the preliminary interface design would be able to assist moderators with accomplishing most of their day-to-day study-related tasks, particularly through the use of automation and consolidation of workflows. Moderators also generally appreciated the visual design and layout of the proposed dashboard, which can signal that certain aspects of the design helped to reduce the cognitive load on moderators by presenting an interface that was relatively easy to navigate. These initial conclusions are promising, and signify that, with further active engagement of moderators and VOCALE team members in the iterative design process, a useful and powerful tool has the potential to be developed.

4.1.2 Interface Design Limitations and Potential Improvements

However, the current proposed dashboard design is not without its limitations. In particular, concerns still remain over certain design choices implemented in the current version of interface, such as the symbols and labels used to communicate certain types of information. While the choice to incorporate symbols was an attempt to better meet moderator needs, it is clear that more work needs to be done in this area, such as gathering more feedback on what types of symbols would be most conducive to their understanding, or having moderators select the best symbol design out of multiple potential options. Furthermore, the current system design is lacking in several key functions that moderators have identified as helpful, such as the tracking of intervention aspects outside of what is monitored within Discourse. The combination of confusing visual design choices and the presence of potentially "suboptimal" interface functions can all contribute to the dashboard inadvertently producing a type of cognitive "clutter", which can be counterproductive to moderators' workflows and can hinder their efficiency.

However, while there existed commonalities amongst moderators' experiences with the dashboard design, it should be noted that moderators expressed a fair amount of individuality in their personal preferences and recommendations for improvement. This observation echoes Huang et al. (2022)'s work, where the researchers also noticed a fair degree of variability in participant opinions on the most optimal interface layouts, which they noted were largely dependent on individual preferences. In this work, the theme of "Customization" was identified in Section 3.3.6 to pair with this notion of individual variability. While it is unrealistic to design a different dashboard for each moderator user, particularly as the VOCALE intervention scales up in the future, one way to address this idea is allowing for users to be able to rearrange the dashboard interface modules to best suit their own needs and individual workflows, much like how one can rearrange the layout of widgets and icons on their computer desktop or smartphone home screen. In this way, the goal of the moderator dashboard development can then shift to focus on improving the function of the features offered, and the layout considerations would be left to the individual user to tweak as they see fit. In a broader sense, these design shortcomings can be best addressed through designing in a way that is more grounded in visualization literature and through the evaluation of multiple interface layouts and options. These limitations are further explored in Section 4.3.

4.2 Needs and Requirements of the VOCALE Intervention

4.2.1 How the Moderator Dashboard Fits Into the VOCALE Intervention

The "dual-ended" nature of the proposed dashboard design to support both the completion of moderation tasks and the generation of participant insights aligns with extant literature regarding the types of dashboards that can be found in healthcare spaces. Particularly,

the proposed design has partially leveraged the definitions for "clinical" dashboards and "quality" dashboards proposed by Dowding et al. (2015). The components of the moderator dashboard design that can be viewed as analogous to a "clinical" dashboard would be the parts that inform moderators about participant's progression throughout the study, such as the "Participant Progress Tracker" and related notifications regarding participants actions. Consequently, the components of the moderator dashboard that can be viewed as analogous to a "quality" dashboard would be the parts that deliver data about the performance of the intervention overall, such as the "Analytics" section, which could report on aspects such as participants' engagement with the study and their ability to develop the problem-solving skills that were introduced in the intervention. In this way, the VOCALE moderator dashboard has the potential to meet a variety of different needs and requests.

4.2.2 A Note on VOCALE Stakeholder Perspectives

The "dual-ended" approach of the current dashboard design mentioned in the previous section can be as connected to the needs of different stakeholder groups within the VOCALE intervention. Whilst all VOCALE study team members are interested in delivering an effective intervention to improve experiences for older adults and caregivers, it can be observed that their ways of approaching this goal may differ on a more granular level. For example, VOCALE moderators may work toward this goal by effectively facilitating the intervention, which involves the completion of study-related tasks on a daily basis. Thus, the features they request from a dashboard tool tended to revolve around features that support the completion of these tasks. This observation may align with extant literature regarding the moderation of online communities (Deng et al., 2023; Perry et al., 2022). If moderators of online communities are primarily preoccupied with needing to monitor and process a large volume of participant data, then it

might be understandable that they would place less priority on seeking out and understanding broader participant insights. However, if the dashboard interface is able to thoughtfully provide participant-level insights, then the dashboard has the potential to support moderators in making day-to-day decisions about running the intervention.

In contrast, other VOCALE team members, such as those who may hold more supervisory roles, may work toward this goal in multiple ways. They may reflect on how to revise intervention materials and study protocols based on participant outcomes, and they also may make assessments on how to improve the moderators' effectiveness at their role. Therefore, these stakeholders might be more interested in having a dashboard that provides more data and information on broader performance of the intervention, as well as features that provide a more thoughtful analysis of how well moderators themselves are engaging with the intervention from a researcher's perspective.

This is not to suggest that these stakeholder groups are not aware of the other's needs and experiences, but rather, it may be a consequence of day-to-day interactions. A strength of the VOCALE team is that its members stem from a variety of different backgrounds, so it is understandable that the project leverages the individual strengths of each member rather than having all members perform the same set of tasks. However, since study team members may interact with the intervention in different ways - with moderators' responsibilities centered around keeping the platform running and primary investigators' responsibilities centered around evaluating the overall efficacy of the intervention - it is also understandable that the immediate needs expressed by each stakeholder group differ. While this may suggest that there is an area for improvement in the way the study team interacts with the project, this can also be an area in which user-centered design can be employed. By carefully examining the needs of both

stakeholder groups, and how these interests might interact with each other, a tool can be developed that can effectively support the requirements proposed by both groups.

4.3 Study Limitations and Recommendations

Despite the insights that were able to be extracted from this work, there were limitations with the employment of the methodology used in this project that may hinder the validity of its conclusions.

4.3.1 Sample Size and Representativeness

One limitation of this work is the relatively small sample size of participants who were involved in the study. A total of 5 moderators were engaged in the workshop and interview sessions, and while these moderators were able to provide valuable insights on VOCALE workflows thus far, this sample of participants may not completely represent VOCALE's future population of moderators. As of present, there are plans for the VOCALE intervention to expand into clinical settings, where future moderators might include healthcare workers and other personnel who may not be as closely involved with the development of the intervention itself. As such, if the current moderator dashboard design were to be implemented as-is into these settings, there will likely be integration issues resulting from the unmet needs of stakeholders that were not addressed through the current line of work. This limitation could be addressed by more rigorous user testing with a larger and more diverse sample of potential dashboard users.

4.3.2 Personnel Limitations

This project did not employ a multidisciplinary design team when developing the dashboard, which is strongly recommended when performing user-centered design work (Kashfi,

2010; Sedlmair et al., 2012). While there were multiple people involved with different parts of the dashboard project at different points in time, at this current stage of development, I was the sole person responsible for developing the dashboard prototypes, conducting user-centered design sessions, reviewing findings, and making subsequent revisions to the dashboard design. While this is fairly standard for a thesis project, it *does* introduce a crucial limitation when considering this work as a whole: the proposed design, and the findings presented here, are likely biased, and lacking the enrichment of having multiple perspectives inform its development. There were likely many design considerations that were not addressed to their fullest extent due to the limited time, scope, and bandwidth of the project. Future recommendations would be to involve more people in the dashboard design process, preferably team members with diverse backgrounds in healthcare, technology, and information design.

4.3.3 Methodological Considerations

In both the workshop sessions and interview sessions, multiple versions of the moderator dashboard design were not presented to participants. Previous healthcare-based user-centered design work has demonstrated the benefit of testing multiple designs to determine which design best meets user needs and expectations (Brown et al., 2019; Cole et al., 2022; Huang et al., 2022). However, in the current work, VOCALE moderators were only presented one dashboard design per session type, and were asked to provide open-ended feedback on suggestions for improvement. This can create difficulties for proceeding stages of dashboard development, as future designers will need to make decisions based on varied feedback stemming from multiple participants, rather than having a more concrete sense that one design choice is preferred or more efficacious over others.

It is strongly suggested that future stages of development should involve the creation of multiple potential designs for dashboard components, as this will not only provide more reliable measures of usability, but will also help streamline the design evaluation process. One method suggested in Huang et al. (2022) involved showing participants multiple interface layouts for a limited amount of time, then asking participants to reflect on layout elements that were most memorable or important to them. Implementing an activity similar to this in future design sessions may aid designers in prioritizing design choices that are more resonant with moderators' needs and preferences.

4.3.4 Limitations in Design Scope

In reflection, the current proposed dashboard design, the study methodology, and the focus of this project thus far has largely been centered around meeting VOCALE moderators' immediate needs and requests from the dashboard tool, with considerably less emphasis placed on the interests of other VOCALE stakeholders and the overarching goals of the VOCALE intervention. Section 4.2.2 presented a brief assessment on the differing immediate requests of VOCALE moderators and VOCALE primary investigators. While these differences are important to consider, it is worth noting that by separating these interests into distinct categories, it is easy to make the mistake of viewing these objectives as in "opposition" to each other, which can then influence the design choices that are made in the development process.

In this case, this resulted in a proposed dashboard design that compartmentalized the "task completion" and "analytics delivery" features into separate components, which sometimes led to confusion and lower usability evaluations for the more analytics-based parts of the dashboard. Upon further discussion with VOCALE study team personnel, it was pointed out that analytics and task completion were interrelated, and that the proper incorporation of analytics

methods can enable moderators to make more informed day-to-day decisions as they go about their study-related tasks. Therefore, a future goal should be to develop dashboard features that are more balanced in meeting moderator needs and broader study interests by engaging in more discussions with different members of the VOCALE team.

4.3.5 Future Recommendations: Visualization Work and Cognitive Load Assessment

As mentioned in the previous section, this work focused mainly on responding to the immediate interests of VOCALE moderators, rather than taking into consideration the surrounding literature on best practices for analytics, visualizations, and dashboard design. The features proposed in the current version of the dashboard, particularly in the case of the analytics-based sections, are likely weakened due to this shortcoming, and this may have influenced moderator's responsiveness to certain dashboard components. For example, the observed preference for features such as notifications and indicators over quantitative measures and insights might be a result of poorly designed analytic components, as this information was likely not presented in a way that was easily understandable to moderators. Future avenues for dashboard improvement should involve a more thoughtful review and incorporation of existing visualization design frameworks and methods for integrating analytics in a way that reduces cognitive load on the user.

Such visualization frameworks can include Munzner (2009)'s four-level nested model for visualization design and evaluation, where the output of one layer feeds into the next layer. Starting by characterizing problems and mapping them into data types, one can then focus on using visual encoding techniques to support the creation of these visualizations. In Hullman and Diakopoulos (2011)'s work on visualization rhetoric strategies, they emphasize the use of editorial layers when approaching visualization construction. These layers include the data layer

and the visual representation layer at the lower levels, and then adding on annotations and interactivity to enhance user understanding. Lastly, Segel and Heer (2010) presented techniques employed in the creation of narrative visualizations. Whilst these types of visualizations can be viewed as a step removed from what may be presented in a moderator dashboard interface, certain suggested principles may still be applicable, such as maintaining a consistent visual platform throughout different panels or pages, using "details-on-demand" functions rather than displaying all information to the user upfront, taking advantage of single-frame interactivity to reduce the amount of traveling the user needs to do between different pages, and using "tacit tutorial" methods such as animations in response to user interactions. Implementing these visualization principles can lead to the increased communication effectiveness of the interface.

Furthermore, measurements of cognitive load should be included in future usability evaluations of the moderator dashboard, as demonstrated in previous design and usability studies (Faiola et al., 2015; Fuller et al., 2020; Huang et al., 2022). One method for quantifying cognitive load is the National Aeronautical and Space Administration's TaskLoad Index (NASA-TLX) questionnaire, a valid and reliable measure of mental workload and performance across different settings (Cole et al., 2022). Whilst measures such as perceived user satisfaction are an important part of usability evaluations, cognitive workload measurements can provide a more comprehensive perspective on whether a design is ultimately practical in use.

4.4 The Moderator and The Dashboard

The thesis project sought to assess the utility of the proposed preliminary dashboard design by seeking feedback from moderators through various user-centered design activities. While a large portion of this feedback was focused on providing concrete suggestions to improve specific aspects of the design, such addressing confusing components and adding missing

features, broader insights about the moderator's relationship to the hypothetical dashboard and the intervention can be explored.

4.4.1 The Meaning of "Meaning" within the Dashboard

At first glance, the moderator dashboard can be seen as having the goals of aiding moderators with completing study-related tasks whilst providing insights about the intervention and its participants. As touched upon in previous sections, at times, it can appear that these objectives exist separately from each other, when in reality, the interactions between these two concepts are much more nuanced and intertwined.

Throughout sessions with moderators, a common feedback point regarding the presentation of participant analytics was that the information seemed to lack a sense of greater *meaning*. For example, one metric tile in the dashboard's "Analytics" page displayed the total number of replies that a participant has received. When exploring Use Case #2, centered around encouraging equal moderator engagement across all participants, one moderator had remarked that, while she could recognize what the number represented at its face value, there seemed to be something *else* missing from the information being communicated:

> "I don't know if there's a way to compare it [the number of replies for this participant] to others because I don't know if, like, 7 is a lot or a little in terms of replies." (ID 1)

This excerpt demonstrates a crucial area for improvement within the moderator dashboard: the need to not only convey analytic information, but to also convey information in a way that is *useful* to the user. This may include considerations on how to reduce the cognitive load on the users who are consuming the information and using it to make decisions. In this case,

perhaps this metric should be delivered along with an indicator of whether or not the participant needs more moderator attention.

This consideration is congruent with insights taken from subsequent discussions with VOCALE study team personnel. Through these conversations, it was revealed that not all moderators approach the task of replying to participants in the same fashion. Some moderators may take a more nuanced approach in determining which user posts require more moderator attention by assessing the level of engagement of the discussion comments around it. If a participant's post has already received a fair amount of interactions from other participants, then the moderator may choose to divert their attention to posts that may not have as much engagement. This is done with the goal of making all participants feel welcomed within the online community.

Here, the dashboard can provide an opportunity to enable moderators to be more efficacious in engaging with participants. By automatically analyzing and identifying posts that are in need of more moderator attention, this can reduce the amount of effort that current moderators have to expend doing this assessment manually, and can also enable more moderators in the future to be more thoughtful in fostering rapport with VOCALE participants. However, this then leads to the question of what are the thresholds to determine when the dashboard indicates something as *needing moderator attention.*

In theory, this process of analysis and decision-making is likely abstracted away from the user, and all that is left is the visual information that is communicated through the interface. At the current early stages of development, we are unable to provide concrete answers regarding these measures of engagement and their related thresholds. However, with careful thought put toward striking the balance between being useful in regard to task completion and informative in

regard to decision making, the moderator dashboard has the potential to address these considerations in time.

4.4.2 Building Better Moderators

Throughout the design process for the moderator dashboard, a prevailing question from members of the VOCALE study team was whether the dashboard was intended to "replace" Discourse; that is, upon its full development and deployment, will moderators even need to visit the VOCALE discussion platform if they can just accomplish all of their study-related tasks within the dashboard interface?

During some workshop and interview sessions, some moderators suggested the incorporation of features such as "quick reply" and "quick like" buttons within the dashboard to circumvent the need to engage with participants through Discourse. While this hypothetical feature may improve moderators' workflows and reduce the amount of time spent on completing VOCALE-related tasks, having a dashboard design that primarily focuses on aiding with perfunctory task completion may be detrimental to the broader goals of the intervention – namely, having moderators build a sense of community within the discussion platform.

The current version of the design is envisioned as having moderators move between the dashboard and the VOCALE intervention platform, with the dashboard acting as an automated, centralized, easily-comprehensible hub of information that moderators can use as a leverage point rather than a replacement for their responsibilities. Still, there remains concerns from VOCALE primary investigators that the dashboard may inadvertently encourage moderators to take a minimalist approach toward their duties.

It is here that we can consider ways for the moderator dashboard to provide opportunities for moderators to become better moderators. A few methods have already been identified

through this project's findings. By implementing channels of inter-moderator communication, such as in-platform messaging and tracking of moderation tasks, moderators are able to work more efficiently whilst holding each other accountable. Furthermore, the dashboard can encourage moderators to engage in self-monitoring of their own behaviors. This was seen in the calls for a dedicated "Moderator Analytics" page, where moderators can see how they are interacting with the intervention and how they are engaging with other participants. However, within this discussion, a key consideration is the idea of moderator privacy: it may be strange, or even discouraging, for all moderators to be able to see each other's performance analytics. In this case, it is suggested that moderators only have access to their own "Moderator Analytics" page, with a potential exception made for the study's primary investigators and more experienced moderators, who may have extra responsibilities in training and supervising newer moderators. This way, VOCALE moderators can partake in a more thoughtful review of how to improve their own moderation practices.

Broader considerations for moderator training outside of the dashboard were also illuminated through this work. In particular, discussions with the VOCALE team ultimately highlighted that VOCALE moderator training should potentially include ways to engage moderators more with their role as a moderator. As in, by encouraging new moderators to view moderation as more than just a collection of tasks and responsibilities, perhaps more care should be put toward pushing moderators to think about what *they* bring to the moderator role as an individual. By making the role of moderation more meaningful to the moderator, the goal is to shift the moderator's priorities from basic task completion to investment in participant outcomes; it is then that the dashboard can be introduced as an aid to meet these higher-level objectives.

4.4.3 The Moderator, The Dashboard, and VOCALE Participants

The focus of this thesis work was centered around the moderator dashboard as a tool that exists within the scope of the VOCALE study team. However, in reflection, the dashboard's effects are much more far reaching. Ultimately, the moderator dashboard exists to improve the VOCALE intervention, which in large part boils down to enhancing interactions between VOCALE moderators and participants.

Part of what makes VOCALE unique is that it is, at its core, a *social* intervention. Community-building amongst participants is integral to its design: participants are encouraged to leave comments on each other's posts as part of the study's procedures. The intervention's discussion prompts and activities can introduce problem-solving strategies, but the way that participants can practice these skills is through engaging in the discussion with other participants. In this way, the moderator plays a key role in facilitating connections by being thoughtful and present in the discussion platform. Their actions may include drawing connections between participant posts to help promote more interactions between participants and building personal rapport so that participants feel more welcomed in the community. Consequently, a question that arises is how to foster more meaningful connections between VOCALE moderators and VOCALE participants.

Despite the proliferation of online social platforms, there still exists challenges with building connections through a screen, particularly if the forms of interaction are more text-based. It may be more difficult to convey meaning through written words alone, and there is always the chance that certain aspects of the intended meaning may be lost in translation upon delivery. For example, a moderator may write a response to a participant that they personally

believe is written thoughtfully and empathetically; however, the participant may not necessarily receive that sentiment when they are reading the response.

It can be thought that, within the context of online communication, meaning exists at the intersection of content, comprehension, and cognition. Ultimately, the way that a piece of textual content is received by someone else is influenced by their understanding of the message and how they feel about it, which is tied to an individual's personal beliefs, attitudes, and experiences. While these factors exist outside of the moderator's scope of control, where moderators can put their effort toward is being more responsive and reactive to participants.

VOCALE moderators can be encouraged to engage in more thoughtful observation of participant behaviors and adjust their own moderation styles to better suit the needs of participants. Furthermore, the moderator dashboard can provide insights on participant behaviors through performing analyses that moderators cannot do on their own. In this way, the goal of the moderator dashboard project is to develop a tool that is synergistic with the needs of VOCALE moderators, the VOCALE intervention, and, at heart, VOCALE participants.

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6. APPENDICES

Appendix A: Dashboard Mockups

Figure A.1: Main view of the dashboard, featuring the different components of the dashboard interface. This includes a Notifications Panel, a Participant List, a Participation Tracker, and button links to a Task Checklist, Analytics & Visualizations section, and Activity Log.

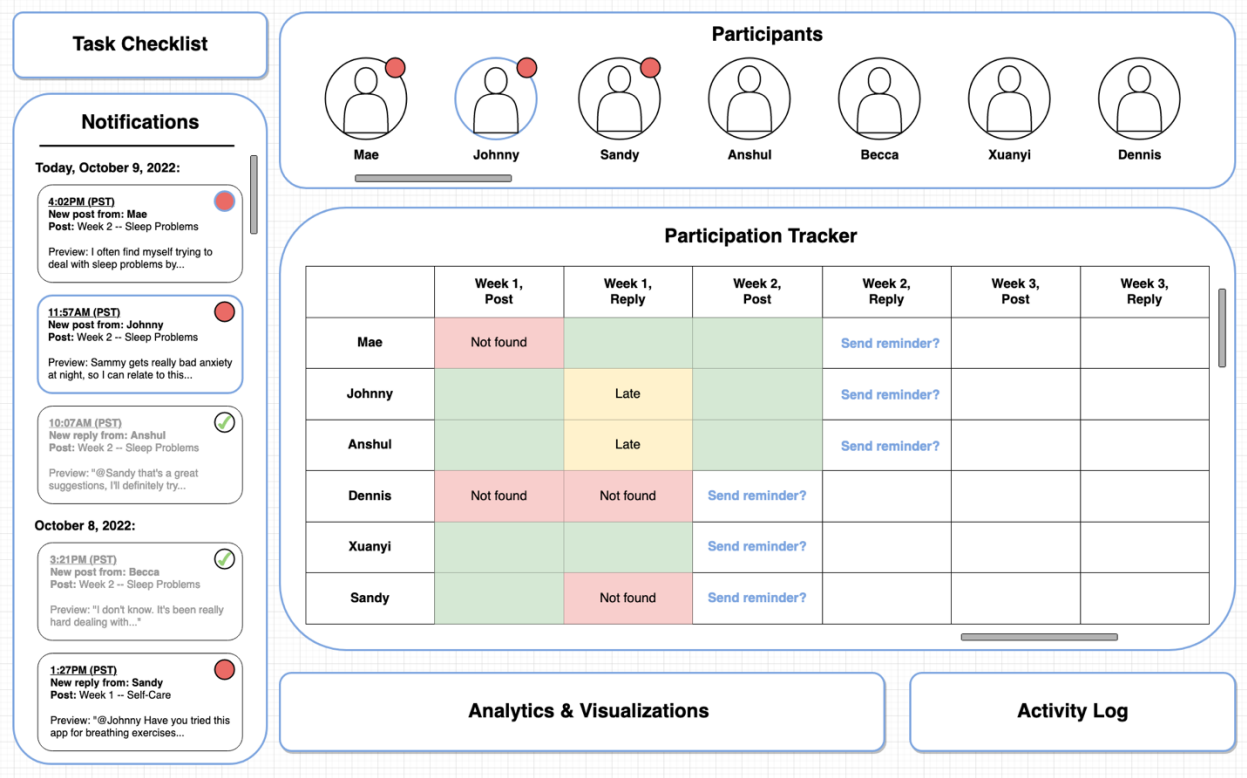


Figure A.2: Task Checklist view of the dashboard.

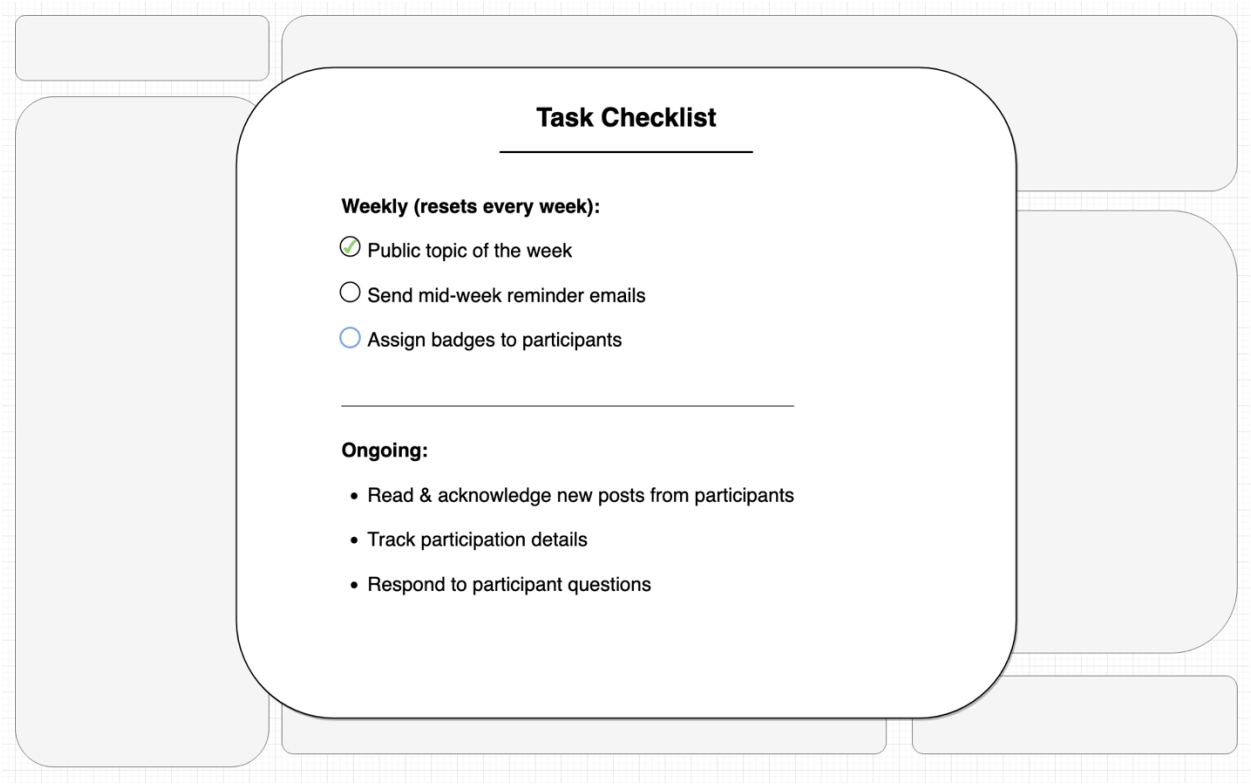


Figure A.3: Notifications Panel of the dashboard.

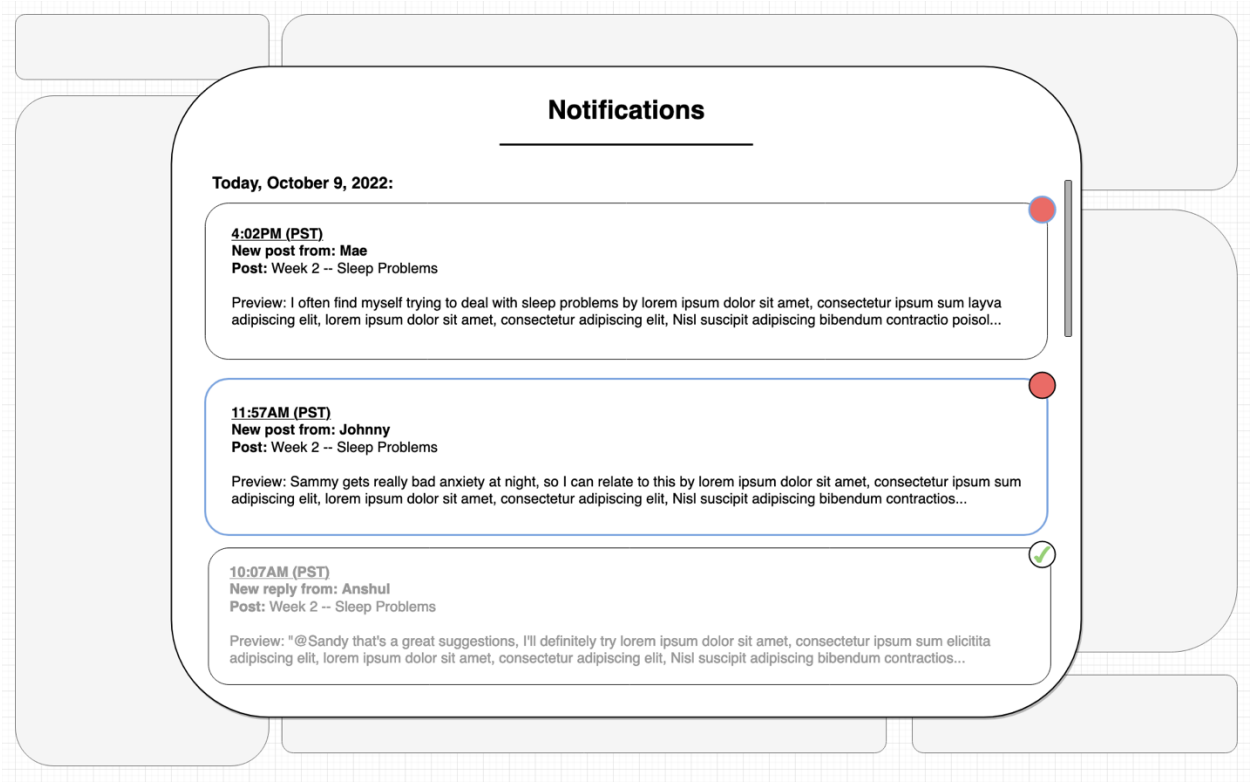


Figure A.4: Participant List component of the dashboard.

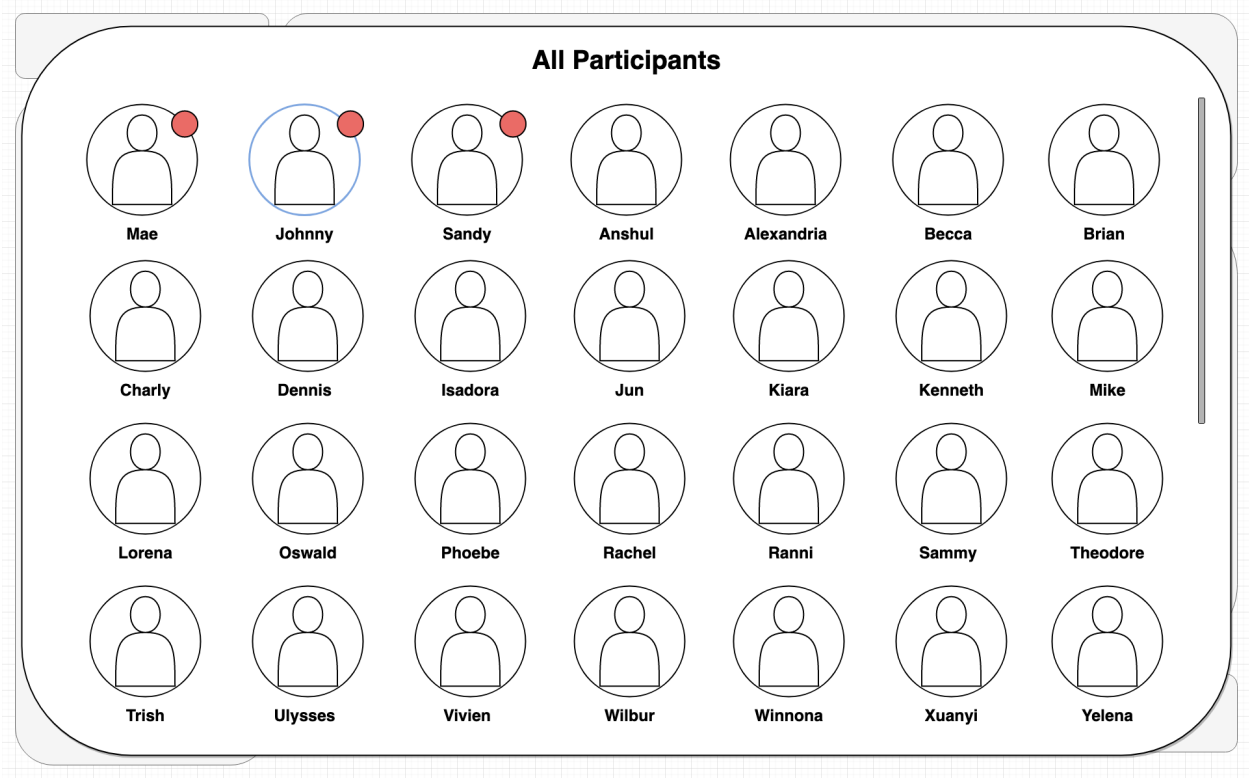


Figure A.5: Participation Tracker component of the dashboard. Automatically tracks whether participants have posted twice a week to the VOCALE discussion platform.

	Week 1, Post	Week 1, Reply	Week 2, Post	Week 2, Reply	...	Compensation (ongoing)
Mae	Not found			Send reminder?	...	20
Johnny		Late		Send reminder?	...	30
Anshul		Late		Reminder sent!	...	30
Dennis	Not found	Not found	Send reminder?		...	0
Xuanyi			Send reminder?		...	20
Sandy		Not found	Send reminder?		...	0
Isadora				Send reminder?	...	30
Ulysses			Reminder sent!		...	20
Oswald	Late		Reminder sent!		...	20
Yelena				Send reminder?	...	30

Figure A.6: Email Template component of the dashboard. Moderators can use this message template when sending reminder emails to participants to post to the discussion board.

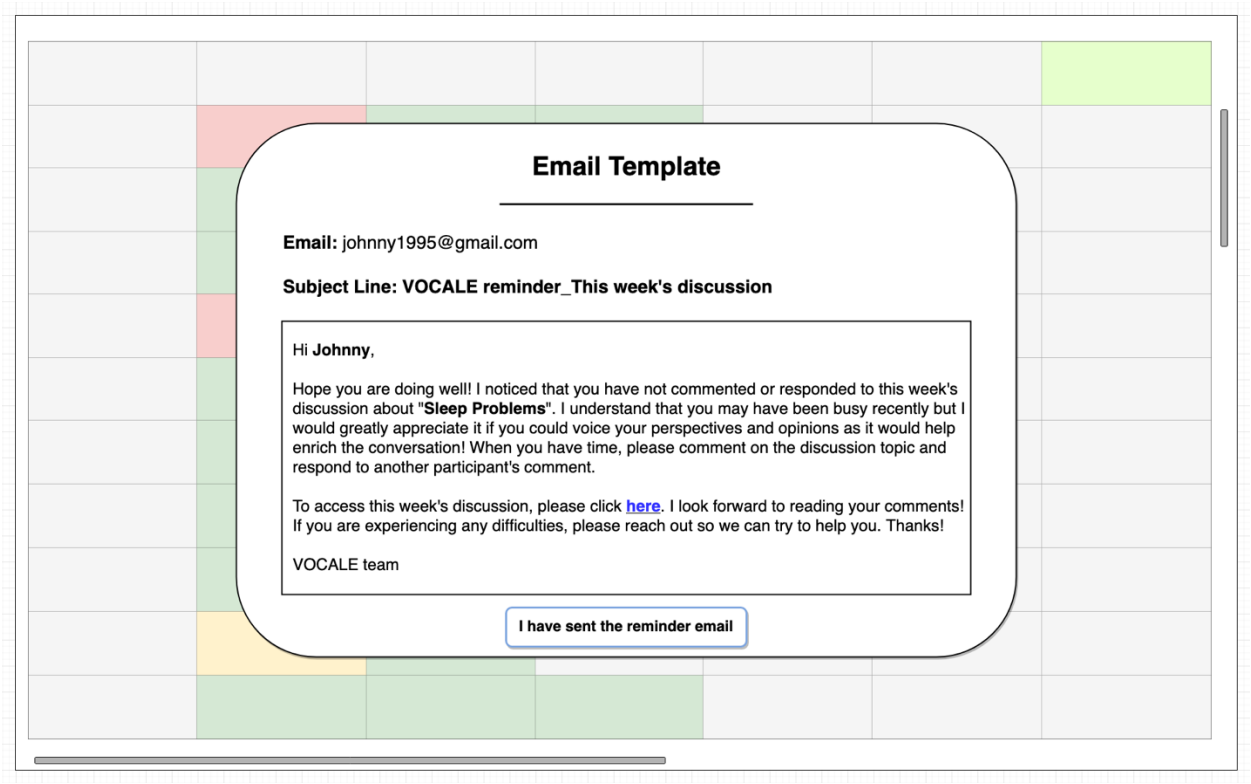


Figure A.7 & A.8: Individual Participant View of the dashboard. Collects all posts made by a participant to the VOCALE discussion platform and also displays other participant information.

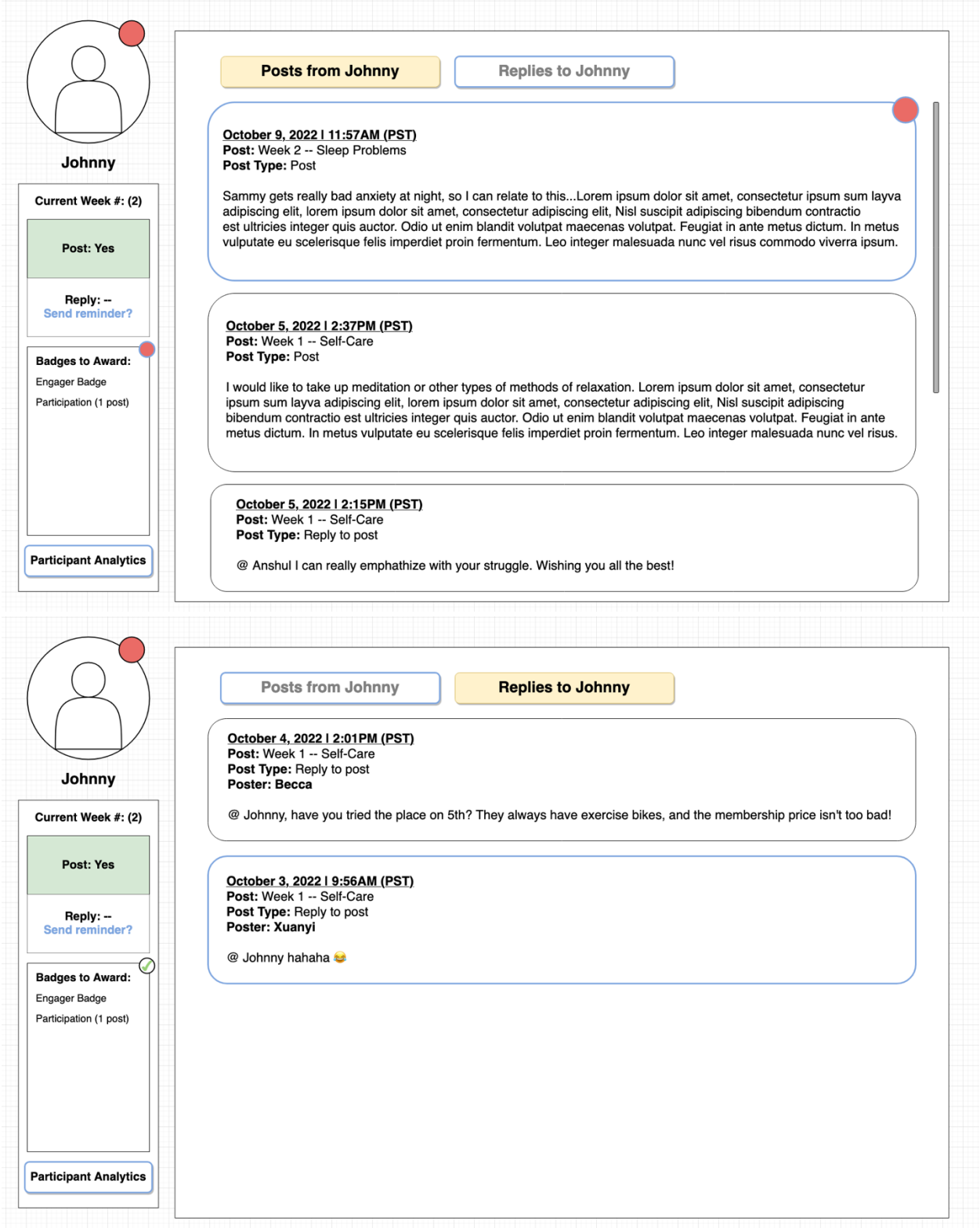
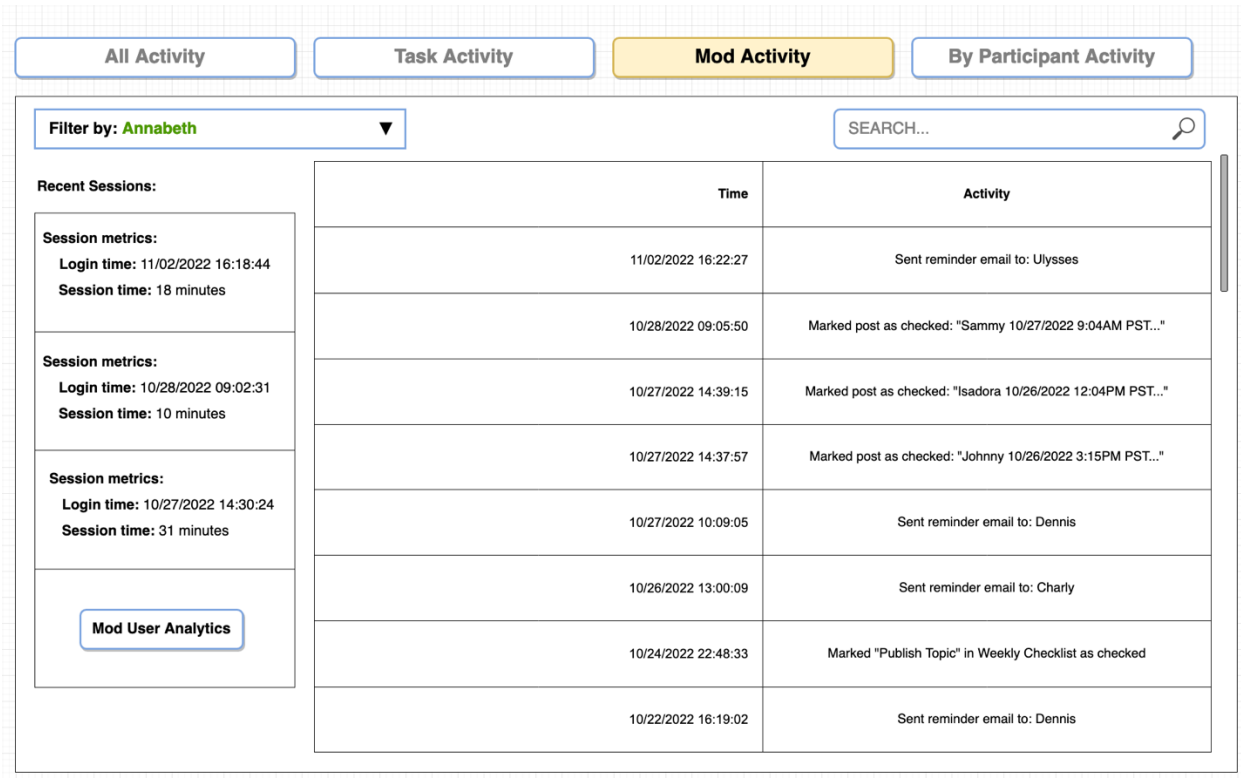
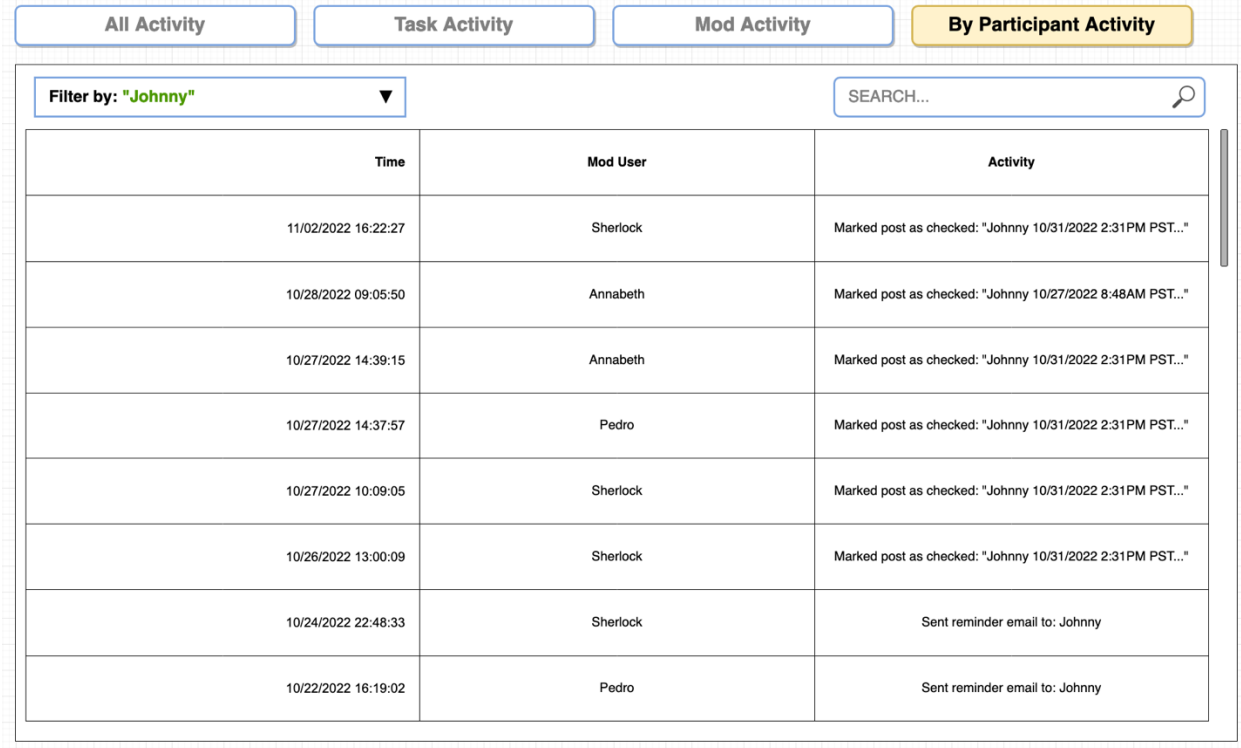


Figure A.9-12: Different views of the Activity Log of the dashboard. Each figure depicts a different “tab” in the Activity Log, which represents different filters applied to a log of dashboard activity.


All Activity
Task Activity
Mod Activity
By Participant Activity
Filter by: Annabeth
SEARCH...
Recent Sessions:
Session metrics:
Login time: 11/02/2022 16:18:44
Session time: 18 minutes
Session metrics:
Login time: 10/28/2022 09:02:31
Session time: 10 minutes
Session metrics:
Login time: 10/27/2022 14:30:24
Session time: 31 minutes
Mod User Analytics
Time
Activity
11/02/2022 16:22:27
Sent reminder email to: Ulysses
10/28/2022 09:05:50
Marked post as checked: "Sammy 10/27/2022 9:04AM PST..."
10/27/2022 14:39:15
Marked post as checked: "Isadora 10/26/2022 12:04PM PST..."
10/27/2022 14:37:57
Marked post as checked: "Johnny 10/26/2022 3:15PM PST..."
10/27/2022 10:09:05
Sent reminder email to: Dennis
10/26/2022 13:00:09
Sent reminder email to: Charly
10/24/2022 22:48:33
Marked "Publish Topic" in Weekly Checklist as checked
10/22/2022 16:19:02
Sent reminder email to: Dennis


All Activity
Task Activity
Mod Activity
By Participant Activity
Filter by: "Johnny"
SEARCH...
Time
Mod User
Activity
11/02/2022 16:22:27
Sherlock
Marked post as checked: "Johnny 10/31/2022 2:31PM PST..."
10/28/2022 09:05:50
Annabeth
Marked post as checked: "Johnny 10/27/2022 8:48AM PST..."
10/27/2022 14:39:15
Annabeth
Marked post as checked: "Johnny 10/31/2022 2:31PM PST..."
10/27/2022 14:37:57
Pedro
Marked post as checked: "Johnny 10/31/2022 2:31PM PST..."
10/27/2022 10:09:05
Sherlock
Marked post as checked: "Johnny 10/31/2022 2:31PM PST..."
10/26/2022 13:00:09
Sherlock
Marked post as checked: "Johnny 10/31/2022 2:31PM PST..."
10/24/2022 22:48:33
Sherlock
Sent reminder email to: Johnny
10/22/2022 16:19:02
Pedro
Sent reminder email to: Johnny

Appendix B: Interactive Dashboard Prototype Frames

Figure B.1: Interactive Dashboard Prototype “Log-In” screen.

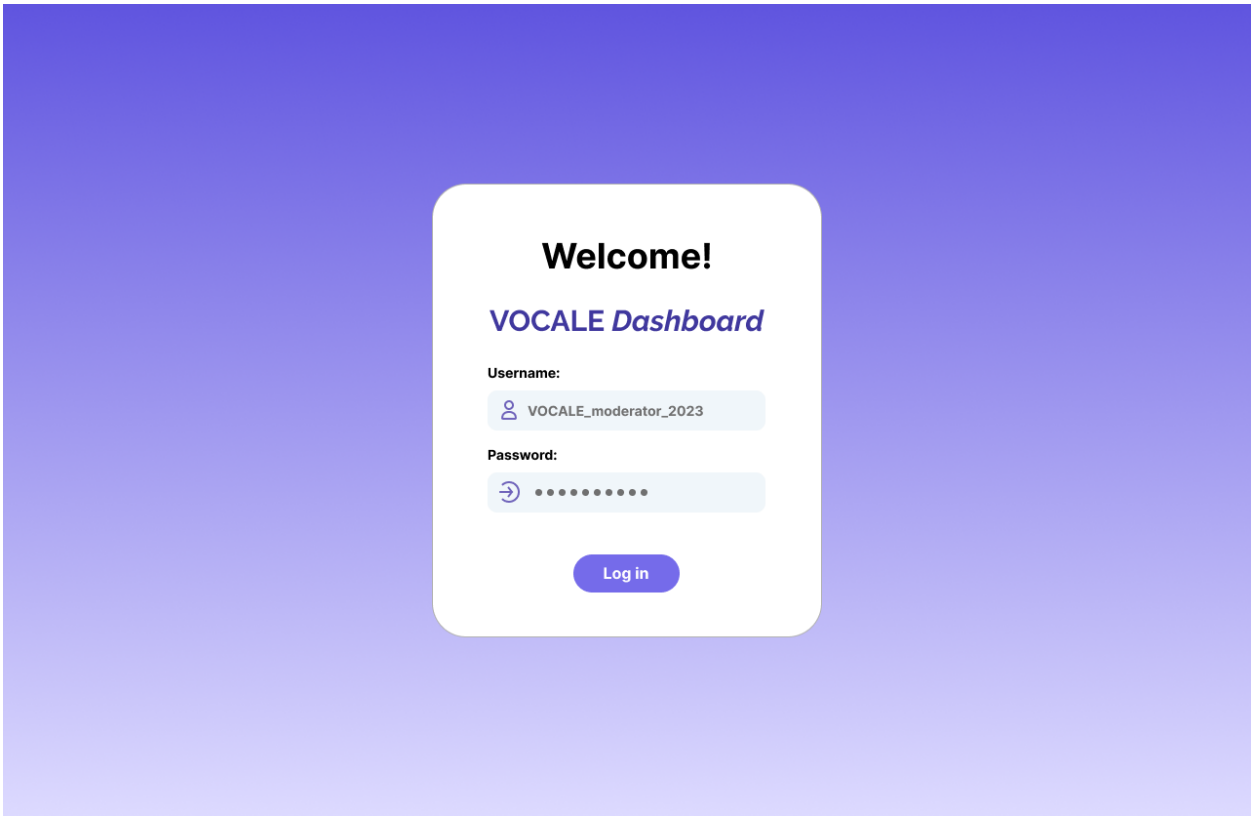


Figure B.2: Main View of the dashboard prototype, featuring different components. Clicking on the components leads to expanded pages of each feature.

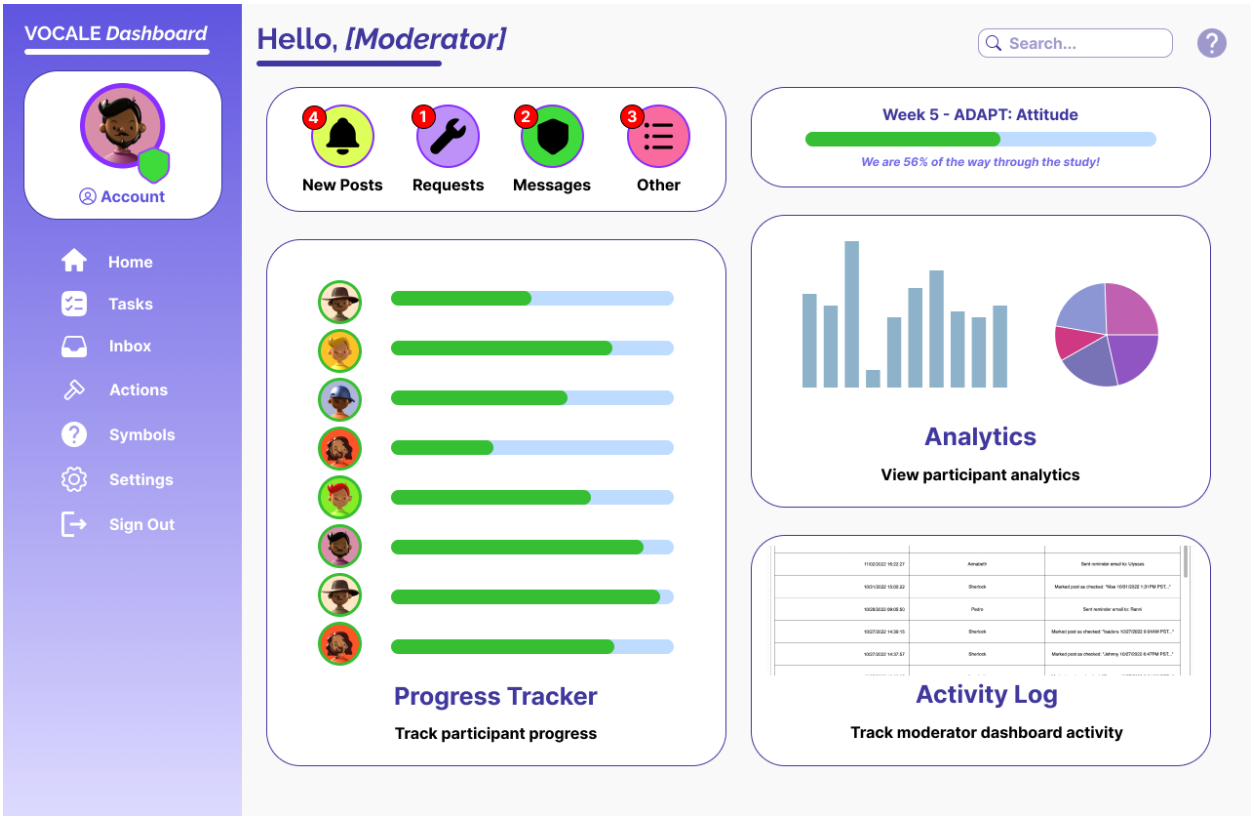


Figure B.3: Participant Progress Tracker. Automatically tracks whether participants have posted twice a week to the VOCALE discussion platform and provides links to posts written in Discourse.

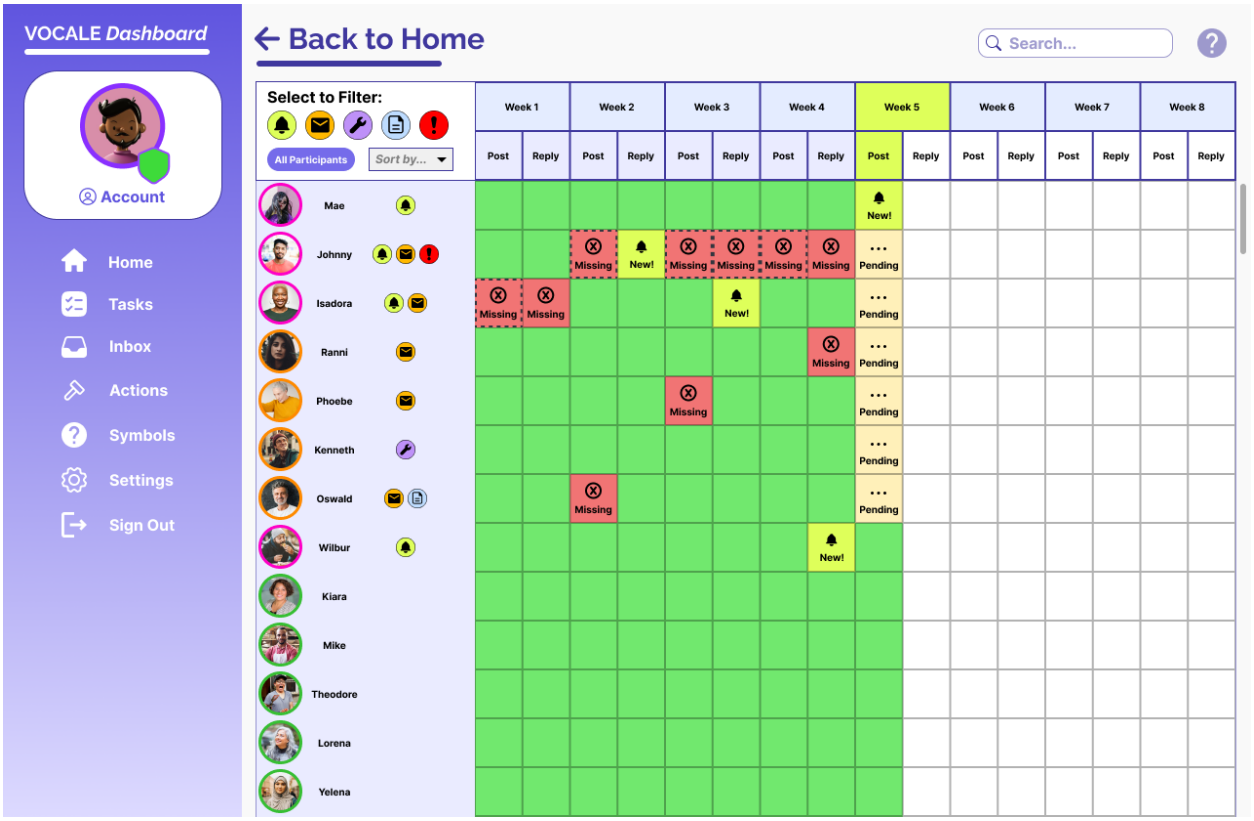


Figure B.4 & B.5: Individual Participant View. Collects all posts made by a participant to the VOCALE discussion platform and also displays other participant information.

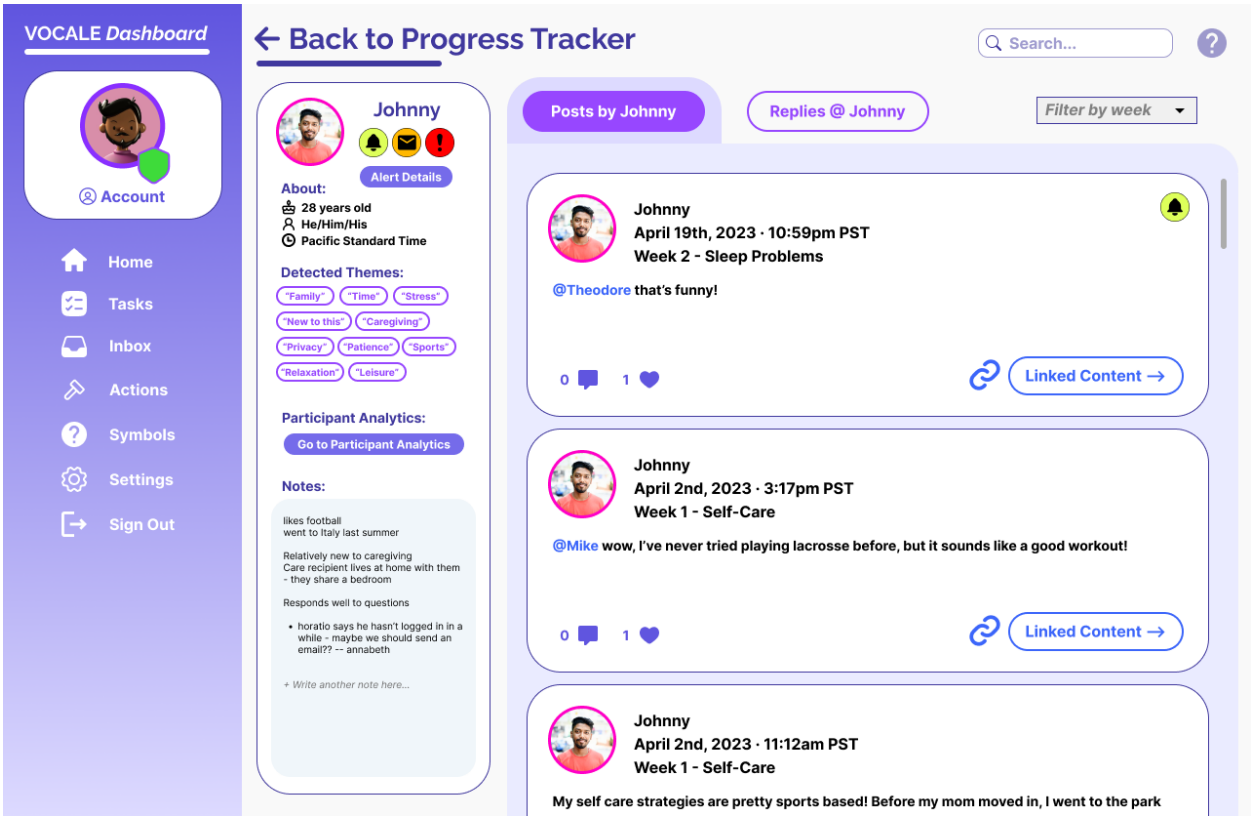


Figure B.6 & B.7: Participant Analytics Pages, featuring mockups of graphs and visualizations that display data relevant to the intervention.

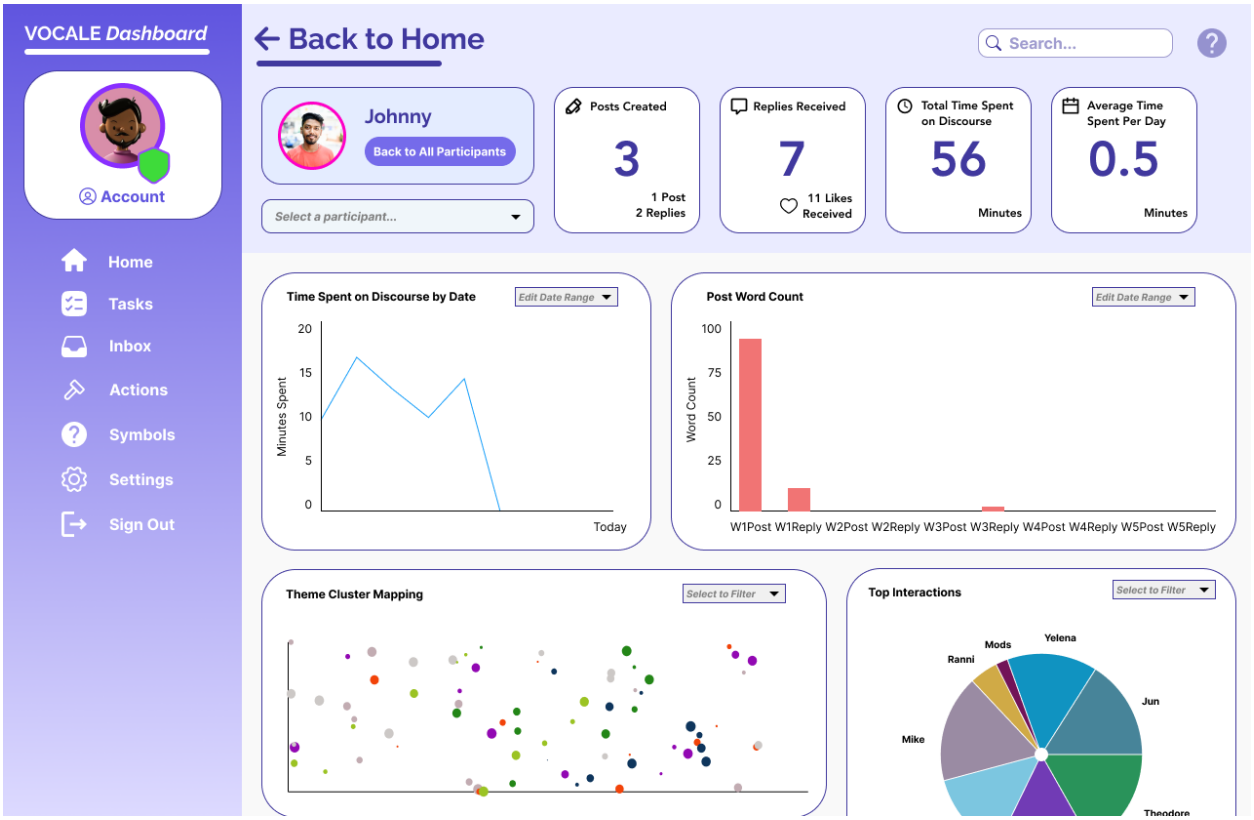


Figure B.8: Activity Log. Features drop-down menus to apply filters to a log of all dashboard activity.

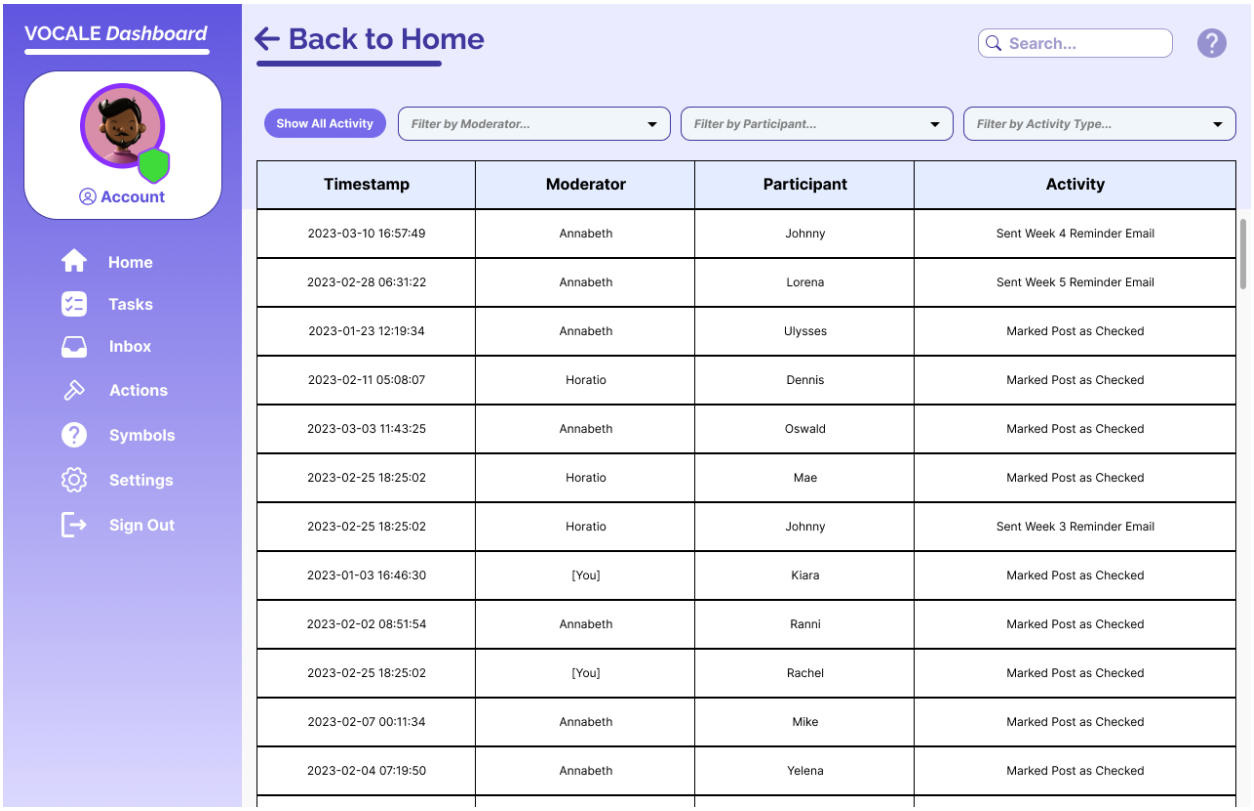


Figure B.9 & B.10: Action Items Inbox of the dashboard prototype. Features two sections, one that collects new participant posts and another that aggregates other alert information.

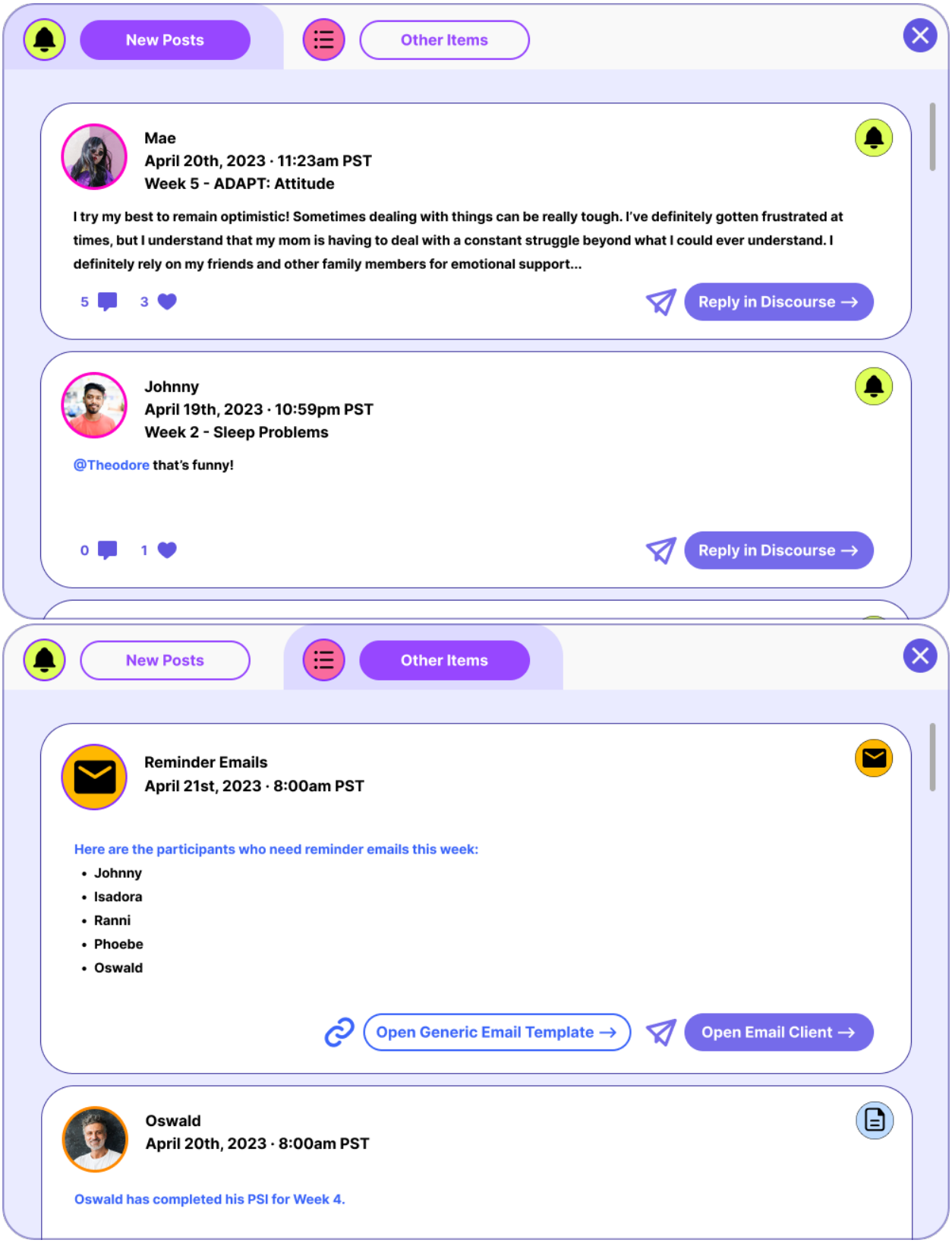
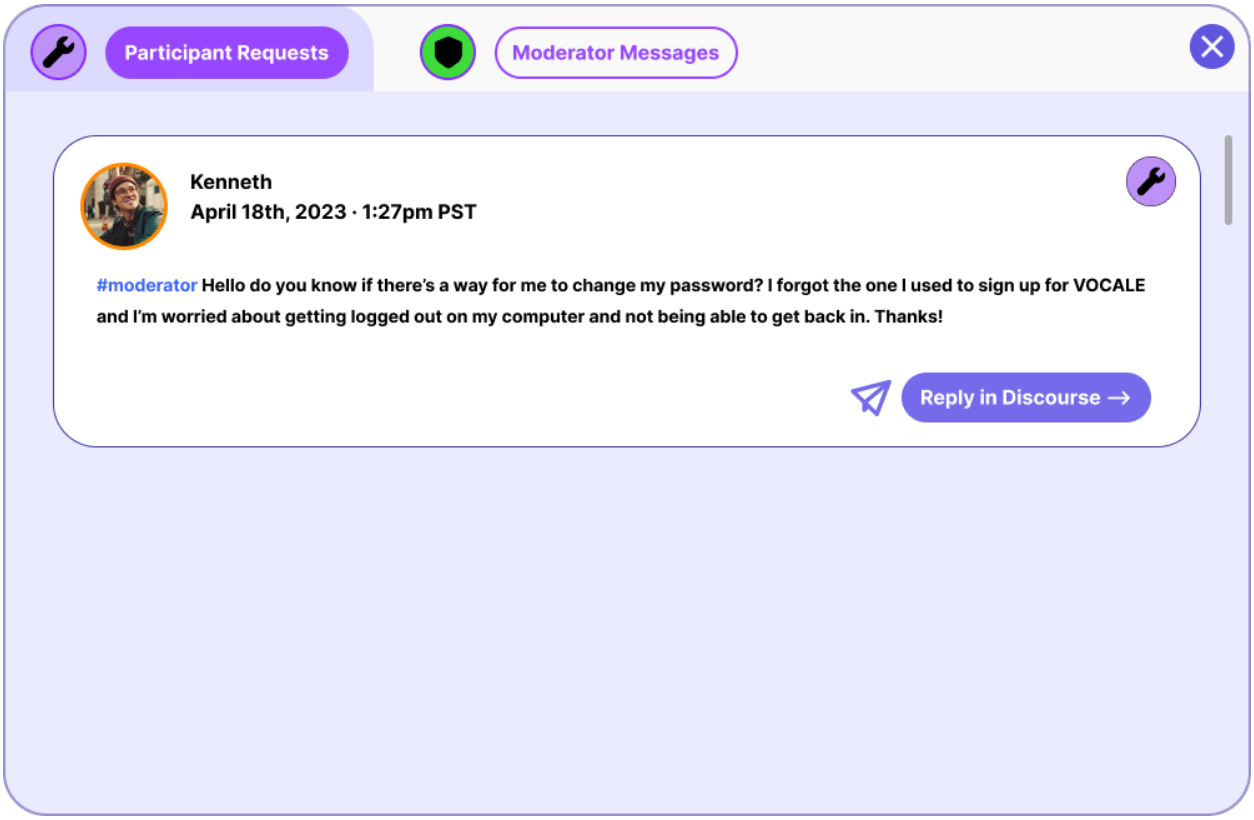


Figure B.11 & B.12: Messages Inbox. Features two sections, one that collects help requests from participants in the discussion platform and another that collects messages from other moderators.



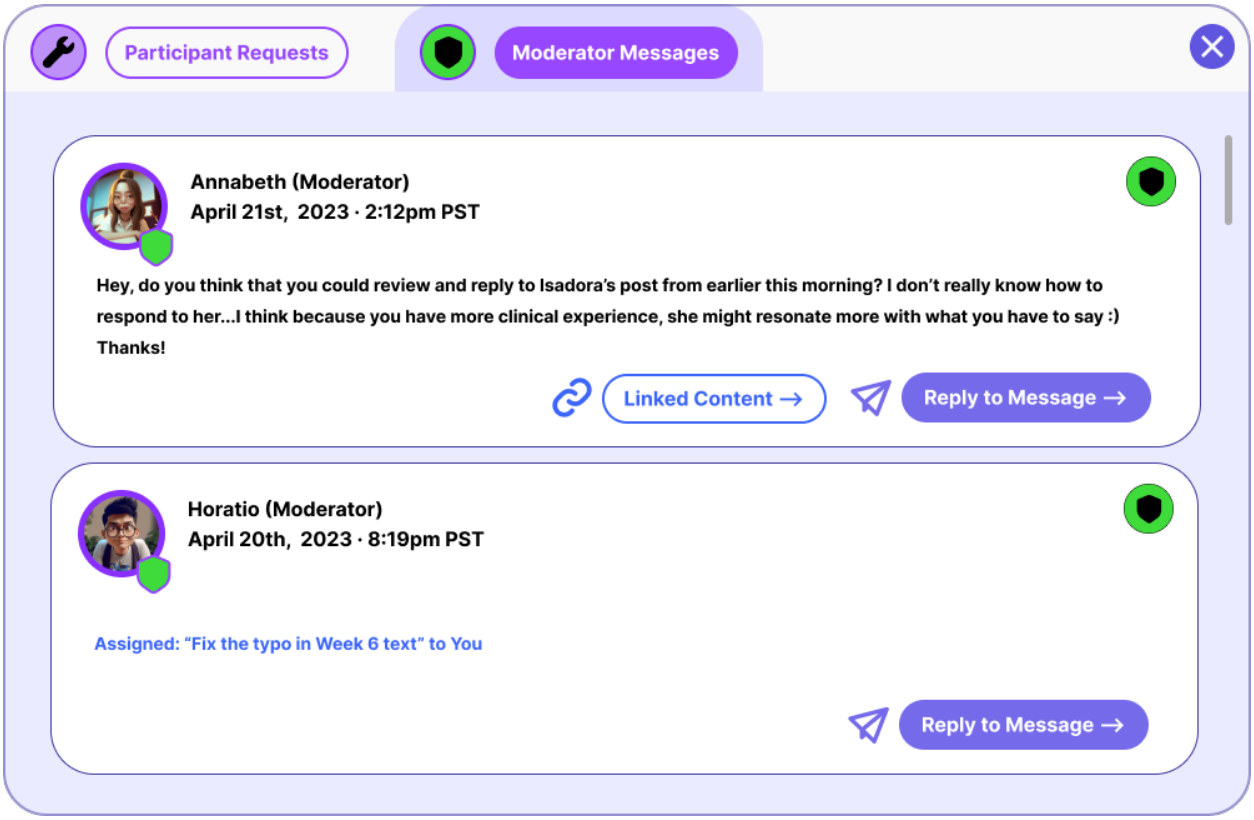


Figure B.13: Email Template. Moderators can use this message template when sending reminder emails to participants to post to the discussion board.

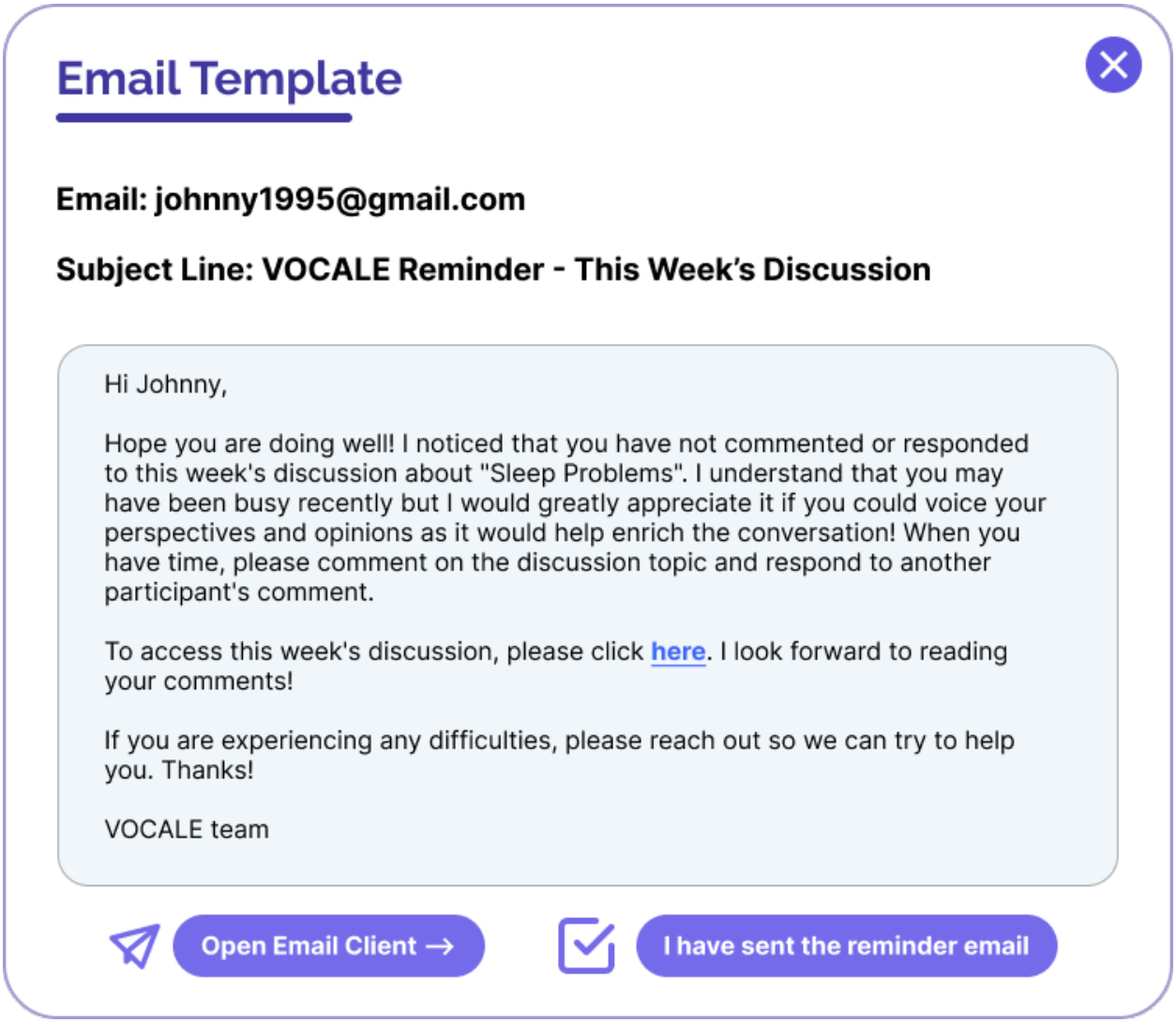


Figure B.14: Task Checklist. Moderators can add tasks and assign tasks to other moderators.

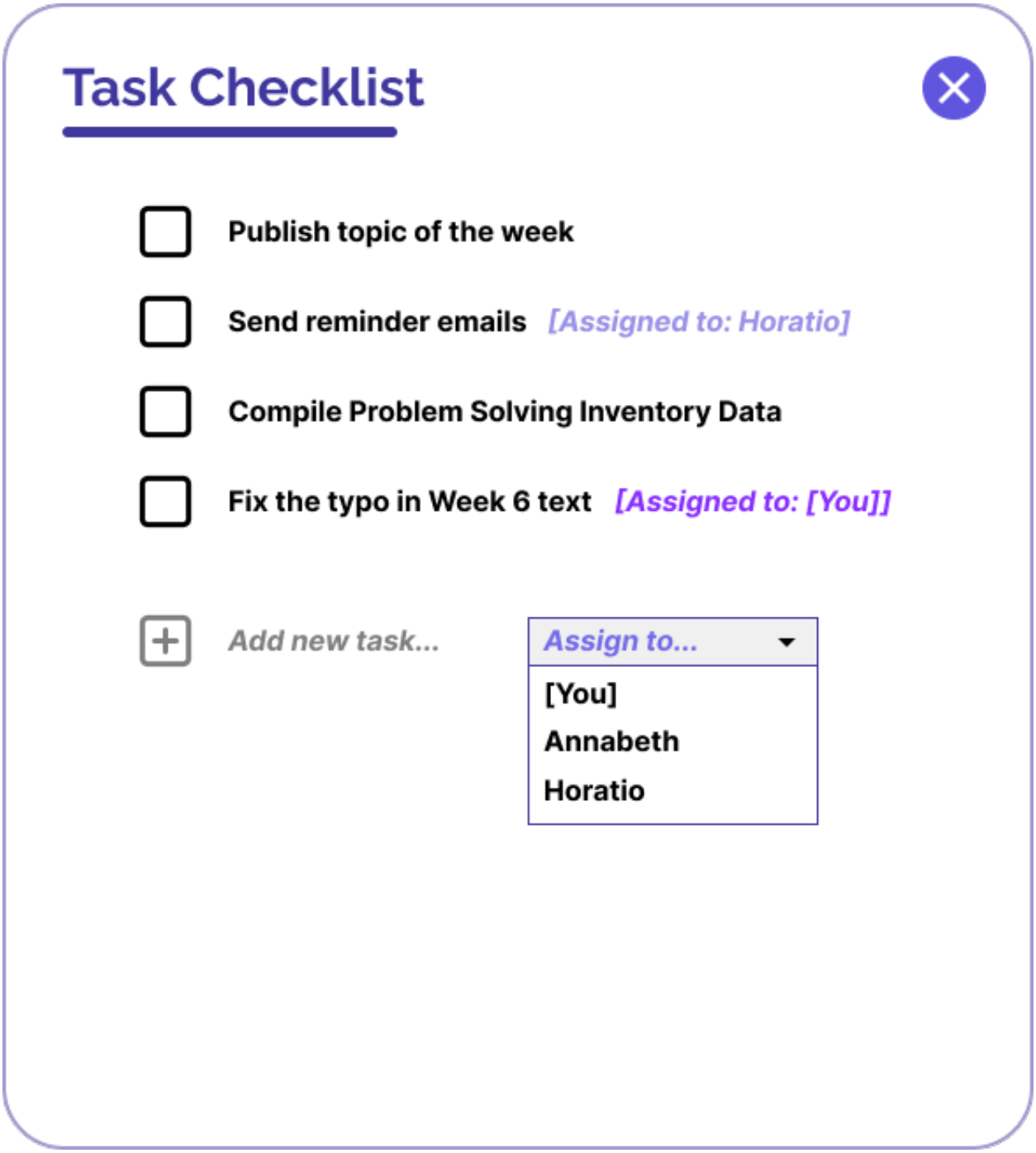
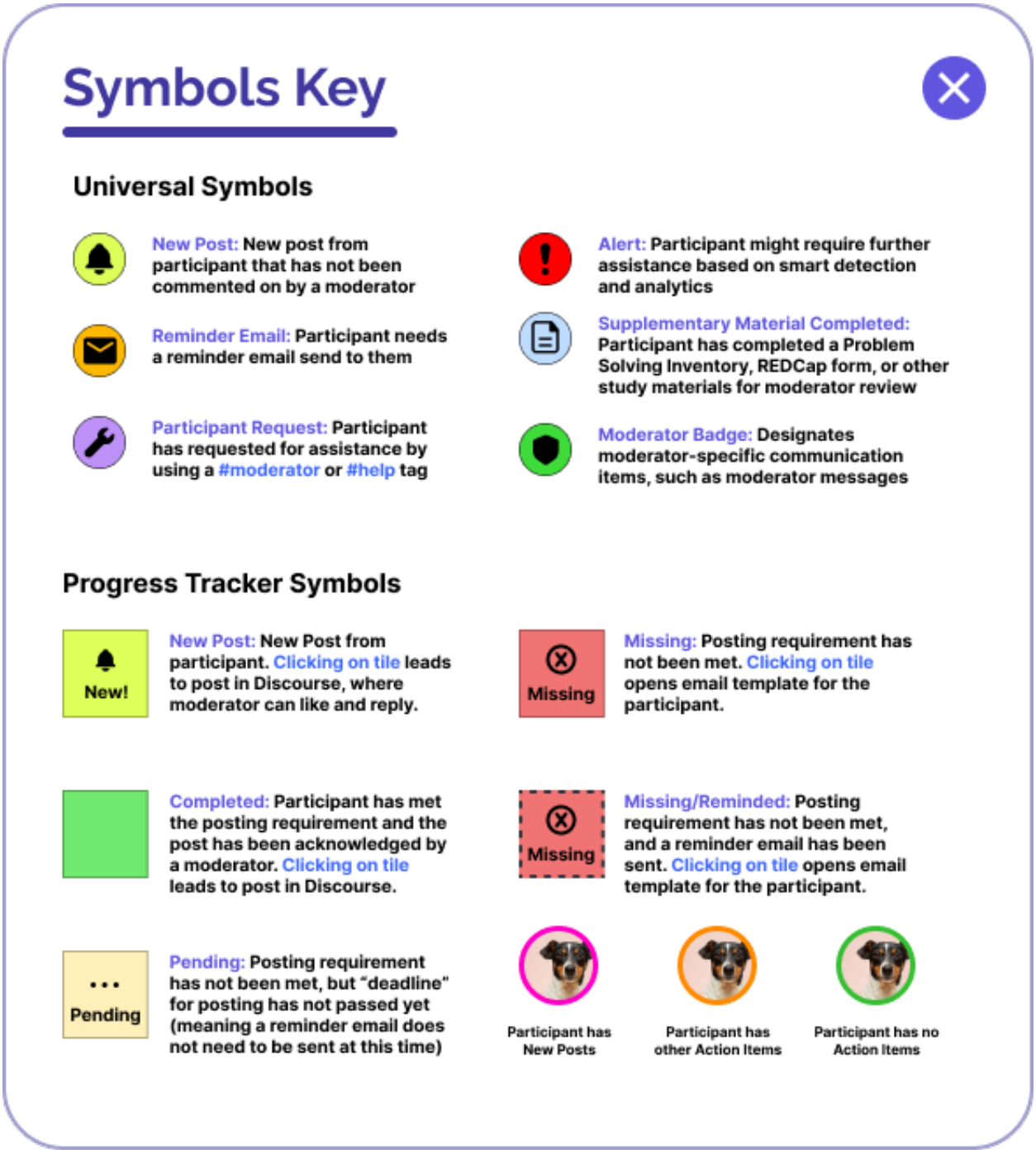


Figure B.15: Key for the symbols used throughout the interactive dashboard prototype to convey information. Accessible through the “help” symbol in the upper-right hand corner and the sidebar on the left-hand side of the screen.



Appendix C: Workshop Session Guide

VOCALE Collaborative Workshop ("Phase 1")
Goal of today's workshop:

- The previous VOCALE Co-creation Workshop (June 2022) focused on validating insights from the individual interviews, prioritizing goals that will contribute to the success of the dashboard tool, and **generating ideas for the dashboard (*quantity* over quality).**
- Today's workshop is focused on **refining the previously generated ideas** and **defining the key components for a successful dashboard**. We will be achieving this through **reviewing mockups, sorting through ideas, and having group dialogues** to further expand on directions for exploration and dashboard development.

Roadmap – 120 minutes total (maximum)

- **Section 1: Introduction (10 minutes)**
  - Explain the objectives and structure of the workshop
  - Summarize findings from previous feedback collection activities (i.e. confirming that the goals, tasks, and protocols summarized from previous sessions are an accurate reflection of a moderator's main objectives)
  - Get people acclimated to Miro controls & navigation
- **Section 2: Mockup exploration (50 minutes)**
  - Explain key features (interactive components highlighted in blue)
  - Generate feedback
  - Group discussion
- ***10 minute break***
- **Section 3: Variable sorting and mapping (40 minutes)** (optional ***5 minute break*** here)
  - Review previous variable ideas
  - Generate new variable ideas
  - Map variable ideas back to dashboard features

Section 1: Introduction (10 minutes)
Welcome everyone to our collaborative workshop session to contribute to the development of the VOCALE moderator dashboard. Some of you may have attended our previous co-creation workshop in June, which was run by Pallavi Bagchi. Since then, I have taken over as the primary person who is driving the user-centered design component of the dashboard. I will now give a brief presentation that gives an overview of the goals of the moderator dashboard development, what the findings have been so far from previous workshops and interviews, and then an outline of today's session. Before we get into that, as a roadmap, today's session will be 120 minutes, with a break after Section 2 and a shorter break after Section 3. Please let me know at any time if you would like to take more breaks, or if you have any questions, and I would be happy to accommodate.

(present the powerpoint here)

- summary of previous workshop goals
- summary of previous workshop findings
- outline today's goals
- outline today's workshop structure
- icebreakers (depending on time and how many people attend)

Please open the Miro link that was sent to you via email. Upon opening the Miro board, you should have editing privileges. Please let me know if you have any issues opening the board.

Please pan over to the upper left-hand corner of the board, to the box that says “Section 1”. As we move through the parts of today’s workshop, you will often be asked to provide your feedback in the form of sticky notes, which you can type on, then click and drag to anywhere on the board. To keep things organized, I would like to ask you all to choose a sticky note color, which will be your designated color for the rest of this workshop. **Please select your color now by writing your name in the colored sticky note that you would like to choose.**
As mentioned in the blurb, there’s stacks of sticky notes located everywhere on this board for your use, but in case you ever run out, please let me know, and I can provide you with another stack.
Before we continue, I would like to review some navigation tips to help you when using Miro in today’s session. Depending on the type of computer hardware you are using, you have different control options that will hopefully make navigating this Miro board easier to deal with.
If you are using a computer with a **trackpad**, you can navigate around this board by using **two fingers on the trackpad to scroll (move) in any direction**. You can also **adjust the zoom by pinching in and out with your fingers on the trackpad (like you're zooming in on a smartphone).**
If you are using a computer with a **keyboard and mouse**, you can navigate around this board by **clicking and holding the right mouse button to drag the board in any direction.** You can also **adjust the zoom by using the scroll wheel on your mouse.**
Please take a second to test out these controls for yourself.
When testing this board, I have found that an **8-10% zoom level** tends to be an “optimal” viewing scale to minimize the amount of click-and-dragging that needs to be done to move yourself around when doing a single task or activity.

Section 2: Mockup Exploration (50 minutes)
Alright, now let’s move over to the box that says “Section 2”. We will now be entering the first part of our collaborative workshop, which involves exploring a series of dashboard mockups. I have created a series of **12 images, which represent mockups of different components of the dashboard. These 12 mockups categorized into 5 groups.** We will be reviewing each group sequentially, where you will have the opportunity to **provide feedback** on the mockups before **discussing your thoughts as a group.**
For each of the 5 groups:

1. I will start by giving a **1-minute overview** of the mockups represented in each group in terms of their **key features.** I will try to highlight the different functionalities that are depicted in as much detail as I can, but these features are also summarized in the yellow boxes next to each group of mockups whenever you need a reminder.
2. Afterward, you will have **5 minutes to provide your feedback** on the mockups within the group using **sticky notes.** There are guiding questions provided in the yellow box next to each group of mockups in case you need some suggestions on what to comment on, but we would like you to provide feedback on **what you like, what you don’t like, and what may be missing** from the depiction (i.e. in terms of **functionality, information, usability,** etc.)
   Some examples of things you can do:
   - Annotating individual components of the mockups
   - Leaving questions, comments, or ideas in the space around the mockups
   - Anything else you think is helpful to provide feedback! Try to provide as many comments/ideas as you can.
3. Once the 5 minutes are up, **we will visit the next group of mockups.**

Once all 5 groups have been reviewed:

1. Everyone will have **5 minutes to read each other's sticky notes** across all of the mockup groups.

    - You can use the **thumbs up stickers to +1 sticky notes** people have made, as in “up-vote” someone else’s comment.
    - Try to think about at least **2 things you would like to discuss or highlight** after reviewing all of the mockups and people's comments.
2. We will then spend the remaining **10 minutes** having a group discussion about the mockups and people's takeaways of potential dashboard features.

Are there any questions? Let us continue on to the first set of mockups, which is titled **Main Dashboard View.** I will now highlight the key features of the dashboard depicted in this mockup.

- As with all of the mockups seen today, **the components highlighted with a blue outline**, such as the Task Checklist, Analytics, and Activity Log buttons, as well as these red circles, **represent “clickable”, interactive features of the dashboard.**
- This mockup is representing the central, “main” view of the dashboard, or what one might see first every time they log into the system. This main view is divided into several parts, each of which would expand to its own section of the dashboard upon clicking on it.
- In the upper left-hand corner, we have a **Task Checklist button**, which will open a checklist upon clicking. We will be looking at that in a later section.
- Below that, we have a **Notifications Panel**, which is depicting a chronological stream of new posts from participants pulled from the VOCALE Discourse. Each item in the notifications panel includes key information, such as poster, timestamp, and a preview of the post content.
    - **Clicking on an individual item in the notifications panel** links to the **actual post/comment in the Discourse discussion board.**
    - **Red "action item" badges in the notifications panel** can be used to mark items as "**checked".**
        - **These badges will disappear from the participant avatar** once all items have been "checked" or addressed.
- On the top, we have a preview of a **Participants List**, showing the avatars of the Participants enrolled in the study. Clicking on that component would open an expanded Participant List, which we will be looking at in a later section.
    - **Clicking on a participant avatar opens the participant view** for that participant, which we will explore in a later section.
- Below that, we have a preview of the **Participation Tracker**, which automatically tracks a participant’s progress through the study and their completion of study-related tasks. We will be exploring an expanded version of the Participation Tracker in a later section.
- Lastly, the **Analytics & Visualizations** and **Activity Log buttons** would open to reveal subsequence parts of the dashboard upon clicking. We will be looking at what the Activity log looks like in a later section.
- One thing I would like to note is that not all information that can be provided may be captured in this static view. Scrollbars may imply that more information is available than can be seen.
- **If you have a question or would like more information**, feel free to ask during the workshop, or leave it in a sticky note!

You will now have 5 minutes to provide your feedback on this mockup by using the sticky notes piles located around this panel. You are free to comment on anything you would like, and if you have any questions, please feel free to ask.

We will now be moving over to the right, to the next step of mockups titled **Popovers**. These mockups represent views that would appear when one clicks on certain sections of the

dashboard, such as the Task Checklist, Notifications Panel, and Participant List from the previous main dashboard view. As implied, these sections wouldn't open to be their own pages, but rather would be like a menu that appears over the existing components (kind of like a dialogue box).

- **Task Checklist Popover:**
    - This module provides a list of tasks for moderators to keep in mind as they perform their study-related duties.
    - **Weekly checklist items reset** (i.e. uncheck themselves) at the start of each week. Checking these items can assist moderators with tracking tasks that should be completed with each new week.
    - Ongoing task list items cannot be checked, and instead act as ongoing reminders for moderation.
- **Notifications Popover:**
    - This module functions as an **expanded view of the notifications panel** featured in the main dashboard view. All functions **(i.e. checking red badges, clicking on items to link to comment in Discourse)** remain the same.
- **Participant List Popover:**
    - **Shows all participants enrolled in the study** via their avatar icons and their display names. Clicking on a Participant Avatar will open the individual participant view for that participant, which we will be looking at in a later section.
    - **Red "action item" badges will disappear from the participant avatar** once all items for that participant have been "checked" or addressed.
- Not all information may be captured in this static view. Scrollbars may imply that more information is available than can be seen.
- **If you have a question or would like more information**, feel free to ask during the workshop, or leave it in a sticky note!

You will now have 5 minutes to provide your feedback on these mockups by using the sticky notes piles located around this panel. You are free to comment on anything you would like, and if you have any questions, please feel free to ask.

We will now be moving back over to the left, to the next step of mockups titled **Participation Tracker**.

- The participation tracker **automatically checks whether or not a participant has posted twice that week (both post and reply).**
    - **Color coding** is used to denote whether a post was found, not found, or posted late.
- The **"Send reminder?" prompt** appears when a post type for the current week has not been found.
    - Clicking the "Send reminder?" prompt opens the **email reminder popover**, which contains an email template that can be used when drafting the reminder email to a participant.
    - **Clicking the "I have sent the reminder email" confirmation button** at the bottom of the email reminder popover **logs that a reminder email has been sent in the Activity Log,** which we will be reviewing later**.**
- The **compensation column** is found at the end of the participation tracker and automatically calculates the **total ongoing compensation** for each participant based on the number of posts they have made.
- The **first column (participant names) is a floating column**, and would remain fixed/visible on the screen as a user scrolls horizontally.
- Not all information may be captured in this static view. Scrollbars may imply that more information is available than can be seen.

    - In this mockup specifically, **several columns (corresponding to Weeks 3-8) were not shown in detail** in order to showcase the compensation column. These omitted columns would function similarly to the previous columns.
- **If you have a question or would like more information**, feel free to ask me during the workshop, or leave it in a sticky note!

You will now have 5 minutes to provide your feedback on these mockups by using the sticky notes piles located around this panel. You are free to comment on anything you would like, and if you have any questions, please feel free to ask.

We will now be moving back over to the right, to the next step of mockups titled **Individual Participant Views.**

- The individual participant view shows **all posts made by a participant user**, as well as **all posts/comments addressed to the participant** (using the button toggles at the top of the view).
- **Red "action item" badges in posts stream** can be marked as **"checked",** and **clicking on a post links** to the actual post/comment in the Discourse discussion board.
- **The red "action item" badge will disappear from the participant avatar** once all items for that participant have been "checked" or addressed.
    - This may include **new posts** from the participant, **reminder emails needing to be sent**, or **badges** to assign.
- Clicking the Participant Analytics button links to the analytics page for that participant.
- Not all information may be captured in this static view. Scrollbars may imply that more information is available than can be seen.
- **If you have a question or would like more information**, feel free to ask me during the workshop, or leave it in a sticky note!

You will now have 5 minutes to provide your feedback on these mockups by using the sticky notes piles located around this panel. You are free to comment on anything you would like, and if you have any questions, please feel free to ask.

We will now be moving back over to the right, to the next step of mockups titled **Activity Log.** This part of the dashboard acts as a record of all of the actions taken through the dashboard, and is intended to help moderators keep track of their duties as a team.

- The activity log records **all moderator activity made *within the dashboard*.** This may include checking off items, sending reminder emails - basically many of the interactive “blue” items that were seen in earlier views.
- Activity can be **filtered** using the button toggles and the drop-down filters (i.e. by participant user, by moderator user, by task type, etc.)
- The **search bar** can be used to search for specific activities logged.
- The **"Mod Activity" view** filters all dashboard activity by a certain moderator, and also provides a preview of their **session metrics.**
- Not all information may be captured in this static view. Scrollbars may imply that more information is available than can be seen. Detailed drop-down menu options were not shown, but may be inferred using the information found in the example view.
- **If you have a question or would like more information**, feel free to ask during the workshop, or leave it in a sticky note!

You will now have 5 minutes to provide your feedback on these mockups by using the sticky notes piles located around this panel. You are free to comment on anything you would like, and if you have any questions, please feel free to ask.

Alright, now that everyone has had a chance to provide individual feedback on the mockups, please take the next 5 minutes to read through other people’s sticky notes. Remember, you can

use the thumbs up stickers to up-vote other people's comments. Try to think of some things you would like to bring to the group discussion.

(lead into 10 minute group discussion here)

We will now be taking a 10 minute break. Please return at [insert time here].

Section 3: Variable Sorting (40 minutes)
Please scroll down to the next instructional box, titled "Section 3: Variable Sorting and Mapping".
In the following section, **there is a collection of data variables** that were previously identified as helpful to moderators from the June 2022 VOCALE Co-creation Workshop.
We will now be looking to **prioritize the variables** that are most salient to moderation through a **group sorting activity**, and then **mapping them back to potential dashboard features.**
You will have a chance to review these variables, work together as a group to determine the "best fit" rank for the variables listed, and then think about where these variables might fit within an ideal dashboard.

***Part I: Individual Review* | (10 minutes)**

1. Within the workspace, **please review the idea cards.** The cards have been roughly grouped into different categories, where each group of cards are related to a part of the VOCALE platform or moderating the VOCALE intervention.
2. If you feel that there are variables that are missing that would be helpful within a dashboard, **add them to the pool (using the blank cards on the far right of the board).**

***Part II: Group Sorting* | (20 minutes)**
Once everyone has had a chance to review the cards in the pool and create new ones, you will work together as a group to **create a collective ranking of the idea cards.**

1. **As a group, sort the idea cards in the workspace into 4 categories of prioritization:**
2. **Category 1:** *"Very important"*
3. **Category 2:** *"Important, but not the most important"*
4. **Category 3:** *"Nice to have, but not a priority"*
5. **Category 4:** *"Not that important, and could maybe consider removing"*
6. You're encouraged to use **placement/position across the entire ranking space** to visually represent a more precise ranking of importance (i.e. you can think of it like placing idea cards on a "continuous" spectrum from more important to less important.)
7. While I'll be happy to jump if there are questions, this is mainly to be a group-driven activity. **Please discuss amongst your teammates to come up with what you feel is the most appropriate ranking of the ideas presented.** It's okay if there's not a unanimous decision -- this is mainly to encourage discussion about aspects of moderation across the group.

We will now be taking a 5 minute break. (Unless people would just like to power through.)

***Part III: Group Discussion and Mapping* | (10 minutes)**
After the sorting is finished, we will discuss **how and where these variables might be integrated into the dashboard** by **mapping them back to potential dashboard features.**

1. For this activity, we will use the **sticky notes** to **annotate the idea cards.**

Appendix D: Task-Based Interview Session Guide

VOCALE 1:1 Task-Based Interviews ("Phase 2")
Goal of today's session:

- The previous VOCALE workshop sessions (Feb-May 2023) focused on gathering feedback by reviewing mockup images of a preliminary dashboard interface and discussing how information might be best be presented within an ideal dashboard
- Today's session is focused on **testing the usability of a preliminary dashboard interface**. We will be achieving this through **exploring an interactive dashboard prototype, attempting to complete tasks related to moderation using this prototype, and then having a discussion about your experience using the prototype.**

Roadmap – 90 minutes total (maximum)

- **Section 1: Introduction (10 minutes)**
  - Explain the objectives and structure of the interview session
  - Summarize findings from previous feedback collection activities
  - Get people acclimated to Figma interface navigation
- **Section 2: Prototype Exploration (5-10 minutes)**
  - Allow moderators to explore ("click around") the dashboard prototype on their own to gauge the intuitiveness and initial usability of the system
  - Explain certain less intuitive features, like color-coding and icon keys (especially if I can't get the hover-over contextual tool-tips to work in time)
- **Section 3: Task Completion (20-30 minutes)**
  - 3 basic moderation tasks
  - Use Case #1
  - Use Case #2
- **Section 4: Semi-Structured Questions (20-30 minutes)**
  - Evaluate overall user experience with the system
  - Gather suggestions for further improvement
- **Section 5: Evaluation Questionnaire (10 minutes)**
  - Demographics
  - Background with VOCALE
  - System Usability Scale (SUS)
  - Post-Study System Usability Questionnaire (PSSUQ)
  - Final feedback questions

Section 1: Introduction (10 minutes)

Welcome to today's interview session, and thank you for attending! The activities today are designed to help contribute to the development of the VOCALE moderator dashboard. I will now give a brief presentation that gives an overview of the goals of the moderator dashboard development, what the findings have been so far from previous workshops and interviews, and then an outline of today's session.

Before we get into that, as a roadmap, today's session will be 80 minutes at maximum. While I envision that the sections will flow smoothly into each other, please let me know at any time if you would like to take a break, or if you have any questions, and I would be happy to accommodate.

(present the powerpoint here)

- summary of previous workshop goals
- summary of previous workshop findings
- outline today's goals

- outline today's session structure

Please open the Figma project link that was sent to you via email. You should have viewing rights to the project prototype.
Please pan over and zoom in to the area in large pink text that says "START HERE". Once you have done that, you can start the dashboard prototype by clicking on the "Play" button in the upper-right-hand corner of your screen.
The prototype is a simulation of a dashboard. It is not based on or using any real data from VOCALE, but the buttons, features, and pages are intended to be responsive to your clicks. As in, this isn't like a PowerPoint where the slides appear in a fixed order; rather, you are in control of where you want to navigate to by clicking on the buttons and tabs on the screen.
If at any point you get lost, or are unable to make it to the place that you were expecting, there is a "Restart" button in the bottom-right-hand corner that takes you back to the first frame (the "log-in" screen). As a reminder, this session, including your screen-share, is being recorded. Please keep yourself off of mute, as you will be encouraged to think-out-loud as you explore today's prototype.

Section 2: Prototype Exploration (10 minutes)
You will now have 5-ish minutes to explore the dashboard prototype on your own. This first "task" is as open-ended as it sounds - it's really about allowing you to get comfortable with navigating the system for later, when we try to use the dashboard prototype to accomplish certain specific tasks.
As mentioned previously, I am requesting that you think-out-loud as you are navigating today's prototype. **This means that you are encouraged to speak any thoughts that you have when you are interacting with the system - such as if things don't work the way that you expect them to, or if you happen to be intrigued by something that you see or experience.** This will help me better understand the needs of users who would interact with a future version of this dashboard system.
I am happy to answer any questions that you may have throughout this process. Other than that, the only times I will preemptively jump in is to clarify if a certain feature or button doesn't work *on purpose*. (As in, certain duplicated sections, like pages that may be identical across participants, might not have been created for *each individual participant* in today's prototype.)
Alright, I will put **5 minutes** on the clock, but feel free to take more-or-less time as you feel you need. Please remember to speak out-loud!

Section 3: Task Completion (20 minutes)
Alright, now that you've had a chance to get acclimated with the prototype, you will now be asked to complete a series of tasks. These tasks have been divided into one set of "basic" tasks, followed by two use-case scenarios.
Please continue to think-out-loud as you are attempting to complete each task. This may include speaking about what you are doing and why you are doing it, what you expect to happen when you do something, what's confusing you, etc. Again, I will be happy to answer any questions that you have, and I'll be around to walk you through certain parts that unfortunately couldn't be replicated in earnest today's simulation (such as actually liking/responding to a post on Discourse).

- **Basic moderation tasks:**
    - How would you use the dashboard to read and acknowledge new posts from a VOCALE participant?
    - How would you use the dashboard to identify which participants need a reminder email sent to them this week?

    - How would you use the dashboard to assist with answering participant questions or requests for technical support?
- **Use Case #1: Participant-based action –** ***How can the dashboard support actions that are related to monitoring participant's engagement throughout the study?***
    - Your co-moderator has mentioned in last week's study team meeting that Johnny's engagement appears to have decreased in the last few weeks, something that you did not notice until now. How would you use the moderator dashboard to a) affirm or deny your co-moderator's observations, and b) take action to address the situation, if needed?
- **Use Case #2: Moderator-based action –** ***How can the dashboard support actions that are related to keeping moderators accountable and improving moderators' effectiveness at running the study?***
    - As part of the preparations for an upcoming round of VOCALE, you and the study team are reflecting on how the most recent round went. In the process of reviewing old exit interview transcripts, you come across a previous participant who mentioned that, while they originally were excited about joining the study, they lost interest toward the end, because they felt like they weren't getting as many replies compared to other participants. They also felt slightly ignored by the moderators, feeling that some other participants got longer replies from the moderators than they did.
    - Knowing that a large part of a moderator's job is to keep participants engaged in the study, and also knowing that the upcoming round of VOCALE will contain even more participants than previous rounds, how might you use the moderator dashboard to try to address these concerns?

Section 4: Semi-Structured Questions (20 minutes)

Alright, that's it for all of the tasks that I had planned for today. You may now stop sharing your screen. I'd like to thank you for your time and patience as we worked through this together, and your feedback will ultimately be beneficial to the VOCALE team in the present and future. Now, I'd like to ask a few open-ended questions regarding your experience using today's dashboard prototype.

- Overall, what was your experience like today interacting with the dashboard prototype?
    - What were some things you liked about the system presented to you?
    - What were some things that you disliked about the system?
- Were there features that you saw represented today that you felt had potential, but you felt could be improved? If so, what improvements would you offer?
    - Were there any features that you felt were missing after today?
- Overall, how helpful do you think this dashboard prototype would be to VOCALE moderators if it were to be developed into a fully-functioning tool?
    - Are there things that are hindering its helpfulness?
- Has interacting with today's prototype made you think differently about what your moderation experience has been like?
    - Perhaps, think back to a specific struggle you experienced when you were a moderator for VOCALE - would having this dashboard tool have helped you at the time? Why or why not?

Section 5: Evaluation Questionnaire (10 minutes)

Before we close out for today, I have emailed you a link to a short survey that I would like to ask you to fill out. Please navigate to the email that was sent before the beginning of this session, open the link to the Google form, and complete the questions there.

Appendix E: Evaluation Questionnaire

VOCALE Moderator Dashboard - Prototype Evaluation

Thank you for participating in today's session to evaluate the usability of a preliminary VOCALE moderator dashboard prototype. Please take a few minutes to answer the following survey questions about your experiences today.

Thank you so much!

Demographics
The following questions ask you to provide basic information about yourself.
[All questions provided with: If you do not wish to share, you can select "Prefer not to say".]

1. Please enter your name:
2. Please enter your email address:
3. Please enter your age:
4. Please select what sex you were assigned at birth, such as on your original birth certificate:
    1. Female
    2. Male
    3. Prefer not to say
5. Please enter your gender identity:
6. Please select the most appropriate choice(s) for your ethnicity:
    1. American Indian/Native American/Alaska Native
    2. Asian (South or East Asia) or Asian American
    3. Black or African American
    4. Hispanic or Latino/Latina/Latinx
    5. Middle Eastern or North African/Mediterranean
    6. Native Hawaiian/Pacific Islander
    7. White/Caucasian/European American
    8. Prefer not to say
    9. Unknown or None of these fully describe me
    10. Other (enter option)
7. Please enter your highest education level achieved:
8. Please select your current employment status:
    1. Employed part-time
    2. Employed full-time
    3. Volunteer
    4. Homemaker
    5. Student
    6. Retired
    7. Not Employed
    8. Prefer not to say
9. Please describe your current occupation:

VOCALE Background
The following questions ask you to provide some information about your experience working on VOCALE.

1. During what years were you active with VOCALE?
2. During which round(s) of VOCALE were you a moderator?
    1. Round 1 (Healthy Aging - Facebook)
    2. Round 2 (Healthy Aging - Facebook)
    3. Round 3 (Healthy Aging - Discourse)
    4. Round 4 (LBD - Discourse)
    5. Round 5 (LBD+ - Discourse)
    6. Not applicable
    7. I'm not sure/I don't know
3. When you were a VOCALE moderator, were you a primary or a secondary moderator?
    1. Primary moderator
    2. Secondary moderator
    3. Not applicable
    4. I'm not sure/I don't know
    5. Other (enter option)
4. Outside of being a moderator, what other VOCALE tasks were you involved with?
5. At the time that you were a moderator, describe the type of experience/background you brought to the moderation role and/or the VOCALE team.
6. How would you summarize the positive aspects of being a VOCALE moderator?
7. How would you summarize the challenges of being a VOCALE moderator?
8. Is there anything you wish you would have changed about your VOCALE moderator experience?

System Usability Scale (SUS)
The following 10 items ask you to reflect on your experience using the VOCALE moderator dashboard prototype as "the system".
If for any question, you do not wish to answer or do not feel an appropriate answer choice is available, you may leave the question blank.
[All questions presented on a Scale of 1-5, with 1: Strongly Disagree and 5: Strongly Agree]

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Post-Study System Usability Questionnaire (PSSUQ)
The following 16 items ask you to reflect on your experience using the VOCALE moderator dashboard prototype as "the system".
If for any question, you do not wish to answer or do not feel an appropriate answer choice is available, you may leave the question blank.
[All questions presented on a Scale of 1-7, with 1: Strongly Disagree and 7: Strongly Agree]

1. Overall, I am satisfied with how easy it is to use this system.
2. It was simple to use this system.
3. I was able to complete the tasks and scenarios quickly using this system.
4. I felt comfortable using this system.
5. It was easy to learn to use this system.
6. I believe I could become productive quickly using this system.
7. The system gave error messages that clearly told me how to fix problems.
8. Whenever I made a mistake using the system, I could recover easily and quickly.
9. The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.
10. It was easy to find the information I needed.
11. The information was effective in helping me complete the tasks and scenarios.
12. The organization of information on the system screens was clear.
13. The interface of this system was pleasant.
14. I liked using the interface of this system.
15. This system has all the functions and capabilities I expect it to have.
16. Overall, I am satisfied with this system.

Final Thoughts and Reflections
The following questions ask you to reflect on your experience using the VOCALE moderator dashboard prototype. Please take some time to answer these questions and click "submit" when you have finished.

If for any question, you do not wish to answer (or you feel that you have already commented on it during the interview session), you may leave the question blank.

1. What were some positives aspects you noticed when using the VOCALE Moderator Dashboard Prototype?
2. What were some negative aspects you noticed when using the VOCALE Moderator Dashboard Prototype?
3. Do you have any suggestions or improvements for the VOCALE Moderator Dashboard project?
4. Any additional comments about your experiences using the VOCALE Moderator Dashboard that were not captured in this survey?