Final Project

Gabriela Haas
ghaas6@gatech.edu

***Abstract*—** Ed Discussion and similar forum tools play a prominent role in online courses. The discussions held on these forums replace the discussions and conversations that would otherwise happen in a traditional classroom setting. A significant difference between a virtual classroom and face-to-face interactions is that virtual interactions are asynchronous while face-to-face interactions are not. As a result, there is a more significant gap of time between responses amongst students and staff. This project explores a design alternative that allows students to perceive the state of their questions to TA's and provides them with more feedback than the current system allows.

1 INTRODUCTION

The interface being redesigned is Ed Discussion (edstem.org). The Ed Discussion online forum is only accessible to OMSCS students enrolled in courses that utilize the tool. Students access the forum by clicking on the link provided by their professors via the course syllabus or canvas.

Students use Ed Discussion to ask course-related questions and engage in discussions. Students' tasks include creating discussion threads about topics related to class, responding to classmates' questions, contributing to discussion threads, and reading existing threads that others have created. Students can ask the staff a question by writing it under the appropriate question thread created by their professor, or they can create a new thread. Students create a thread by clicking on "New Thread" at the top left of the screen. From there, students need to fill out a brief form that describes their thread. First, the student must choose the proper label for their thread, either post or question. Question threads require an answer from the staff or classmates, while posts encourage discussion.

Once the post type is selected, the student must select a category for their thread. The available categories include "Class Discussion", "Assignments", "Project", and so on. Some categories have corresponding sub-categories; for example, "Assignment" will trigger options P1, M1, P2, M2, and more. Once the student selects the appropriate label for their thread and writes its title and body, they can post it. Students can also view existing threads on the left side of the interface and click on an individual thread to expand its content and corresponding comments and answers left by classmates and staff.

2 INITIAL NEEDFINDING

2.1 Problem space

The task of participating in the class forum typically takes place on a web browser on a laptop or desktop; however, students can access the forum from their phones as well. Students can access the forum from anywhere if Wi-Fi is available. Students may be at home, the library, or on campus. OMSCS uses tools like Ed Discussion to facilitate virtual discussions and interactions between classmates and staff. However, these virtual tools fall short in some respects and do not allow for the same experience students would have in a traditional on-campus setting. Directing questions to the TA and the professor is easy. However, a response is not received as quickly as if a student went to the professor's office hours or asked questions after class. Furthermore, since students are located all over the globe setting up virtual office hours would be challenging. Implementing a function that lets students know when their question has been viewed would enable them to perceive their question's status. While it might not help questions be answered sooner, it would still give students more feedback than they currently have. Students can then use this feedback to re-evaluate their action plan if necessary.

2.2 User types

Users are undergraduate students, graduate students, professors, and TA's. The age range of users is eighteen and older. Both men and women use the forum. Some users work full-time, some do not. Some users have spouses and children,

while some do not. All in all, users come from all walks of life. Some users may be new to the interface, while some might have experience with it depending on how many classes they have taken or how much experience they have as a TA. Students' motivations for using Ed Discussion include asking questions about assignments, tests, projects, and lectures. Students also use the forum to contribute to discussion threads, create threads, catch up on class announcements, and interact with students and staff. Students are motivated to participate in the forum because doing so will earn them participation points; however, learning from these online interactions is also motivating.

2.3 Needfinding Method 1 – Survey

A survey will be sent out to OMSCS students using PeerSurvey. The survey title, description, and questions are listed below.

Survey Title: Ed Discussion Survey	
Survey Description: This survey is meant to gather students' opinions and attitudes towards Ed Discussion.	
Questions	Answers (a semicolon separates multiple choice answers)
Question 1: What age group do you fall into?	20-30; 31-40; 41-50; 51+
Question 2: Where do you live?	Open-ended
Question 3: Is Human-Computer Interaction your first OMSCS course?	Yes; No
Question 4: Have you taken an online course before?	Yes; No
Question 5: Do you work full-time?	Yes; No
Question 6: Do you have children?	Yes; No
Question 7: What distractions do you encounter while working on coursework? Please be specific.	Open-ended
Question 8: Do you use Discord or Slack to communicate with classmates?	Yes; No
Question 9: If you answered "Yes" to question #8 above, why do you use Discord and/or Slack?	Open-ended
Question 10: What do you like about Ed Discussion?	Open-ended
Question 11: What do you NOT like about Ed Discussion?	Open-ended
Question 12: What is your primary goal(s) when using Ed Discussion?	Open-ended
Question 13: What changes (if any) would you make to Ed Discussion?	Open-ended

Connecting survey to data items – Questions one, three, four, and six tell us who the users are, what they do outside of graduate school, and give us insight into their familiarity with online courses (level of expertise). Question two tells us where the users are and their time zone. Questions five, six, and seven tell us what may be competing for the user's attention while using Ed Discussion. Questions nine and twelve tell us the users' goals while using Ed Discussion and their goals as a student taking HCI. Since questions nine through thirteen are all open-ended, the responses may give insight into the users' needs. Questions eight through ten may also illuminate user tasks based on the open-answer responses.

Potential Biases – Performing needfinding via a survey may come with biases. For example, we may run into voluntary response bias since users with firm opinions tend to be more enthusiastic about responding to surveys surrounding topics of interest. Limiting the survey content shown to participants before they begin the survey can help eliminate voluntary response bias. Based on the survey responses, it is essential not to run into confirmation bias by making assumptions based on responses that confirm prior beliefs. This bias can be avoided by remaining objective when analyzing feedback. Furthermore, confirmation bias can be avoided by looking for responses that prove any preconceived notions wrong.

2.4 Needfinding Method 2 – Reading product reviews on discussion forums

The second needfinding method involves reading product reviews about Ed Discussion. Google scholar was used search for existing product reviews. Two cases studies about asynchronous discussion forums, like Ed Discussion, were discussed in the two case studies. The full versions of these case studies were accessed through the Georgia Tech Digital Library. Both case studies will be analyzed systematically by reading through the case studies, taking notes, and highlighting sections that tied to the data inventory. Both case studies will help address several data items such as who the users are, where they are, their goals, what they need, and their tasks.

While pursuing this needfinding method, it is crucial to avoid confirmation bias. This bias can be avoided by reading the case study and remaining objective when taking notes and highlighting excerpts that do not confirm preconceived notions. Actively searching for excerpts that prove any preconceived notions wrong can also eliminate confirmation bias.

2.5 Conclusions of needfinding

Survey Results – The complete survey responses are located in appendix 9.1. The key takeaways from the survey responses are as follows. Many students face various distractions when pursuing their schoolwork, such as their children, partners, family members, television, and phone notifications. Students live all over the globe; 76% of respondents live in the United States. 48% of students use Discord or Slack to communicate with students outside of the discussion forum. Those who admitted to using Slack or Discord do so to discuss and share study guides, ask questions, and have casual chats with students. Overall, students are happy with the functionalities Ed Discussion provides. However, some respondents admitted they would like an improved way to search for posts and the existing threads to be condensed. One respondent expressed that they dislike being unable to text students using Ed Discussion. A couple of respondents said they liked engaging in casual conversations using Slack, and they received answers to their questions via Slack quicker.

Voluntary response bias was avoided by keeping the survey title and description general enough to make potential participants unaware of the survey's content. Furthermore, leading questions were not asked, and most answers were open-ended, encouraging genuine responses. Confirmation bias was avoided by analyzing responses objectively and looking at responses that highlighted areas for improvement within Ed Discussion that pertain to search capabilities and the layout of the interface.

Case study findings – Analyzing case studies that reviewed asynchronous discussion forums provided several key takeaways. The first paper analyzed is titled "A Review of Recent Papers on Online Discussion in Teaching and Learning in Higher Education", written by Michael Hammond. This paper

addressed several data items. First, it pointed out that students appreciate the ability to socialize, which motivates them to study. Students also need to retrieve historical threads and review them efficiently. Furthermore, this paper pointed out that professors and TAs are *also* crucial stakeholders that use the interface. According to the paper, instructors must apply techniques to compensate for the lack of verbal cues present in a face-to-face setting. Additionally, students need to learn in a manner that suits their needs; everyone has a unique learning style, level of confidence, language, and culture (Hammond, 2019).

The second case study analyzed is titled "A systematic review of asynchronous online discussions in online higher education", written by Sarah Fehrman and Sunnie Watson. This paper addressed several data items. First, the paper researched students, professors, and TA's. 50% of the students they researched live in the United States. According to the paper, students crave more authentic connections with fellow students and staff. The paper also suggested that peer-facilitated discussions can increase participation. Furthermore, student success increases when a mix of asynchronous discussions, live discussions, and rapid feedback is integrated into courses (Fehrman & Watson, 2020). According to related work referenced in a paper by Clark, Strudler, and Grove (2015), video discussions helped students feel social. They could feel the professor's presence more than they would while participating in text-based discussions. The paper also highlighted the necessity for students to be given different tools and techniques for learning so they could learn in a way that best suits their learning style (Fehrman & Watson, 2020).

While analyzing both case studies, confirmation bias was avoided by actively searching for a diverse set of user needs. Both case studies highlighted various needs of students and staff. Both studies were analyzed objectively and helped address data items that the needfinding survey could not address.

2.6 *Data inventory*

Who are the users? – Based on the survey, most users are between twenty and thirty years old. 24% of survey respondents have children. Based on the case studies analyzed, users include students, professors, and TA's.

Where are the users? – 76% of survey respondents live in the United States. About half of the students researched in the case studies are from the United States. Since the HCI is an online-only course and based on the distractions survey respondents face, it seems most if not all students are working on coursework at home.

What is the context of the task? – According to survey results, many respondents reportedly face many distractions in their homes, such as housemates, children, noises, and their devices (computer, phone, TV).

What are the users' goals? – The goals of the survey respondents and the students researched in the case studies are to have their questions answered, view important class announcements, view classmates' suggestions for completing assignments, participate in discussions, and complete their coursework.

What do users need? – According to the survey responses, students need a better way to search and filter through the high volume of threads in the forum. Students need a simplistic view; many respondents feel overwhelmed by the number of categories on the interface. Two respondents said they would like to create study groups and communicate with each other. Students need to be able to revisit different threads efficiently. Instructors also need to compensate for the lack of verbal communication. Students need prompt feedback, and they need *some* level of synchronous communication. Students also tend to feel more social, and the professor's presence feels stronger using video-based discussion versus text discussions.

What are users' tasks and subtasks? – Based on needfinding methods, students' tasks include scrolling through threads, reading individual threads and the comments under them, posting their threads, and exchanging study guides and other documents. Based on the survey responses, ignoring distractions at home is a subtask users perform to accomplish tasks in the forum the forum.

2.7 Defining Requirements

Functionality – Students should see when (if) their question thread or question comment has been read by a TA or the professor. All forum users should be able to see if the response time is overdue for a particular question thread or question comment.

Accessibility – Anyone should be able to use the new functionality described above. Accessibility is not a primary concern as the Ed Discussion forum is accessible to all in its current state.

Usability and Learnability – Users should recognize the new functionality with little to no learning curve. The learnability requirement can be measured by asking students to identify the new functionality (read receipts and timer) and their purpose. If many students are confused about the functions and their purpose, this implies the functions' presence is not easily discoverable, and there is a learning curve involved with understanding them.

3 HEURISTIC EVALUATION

3.1 What works well and why

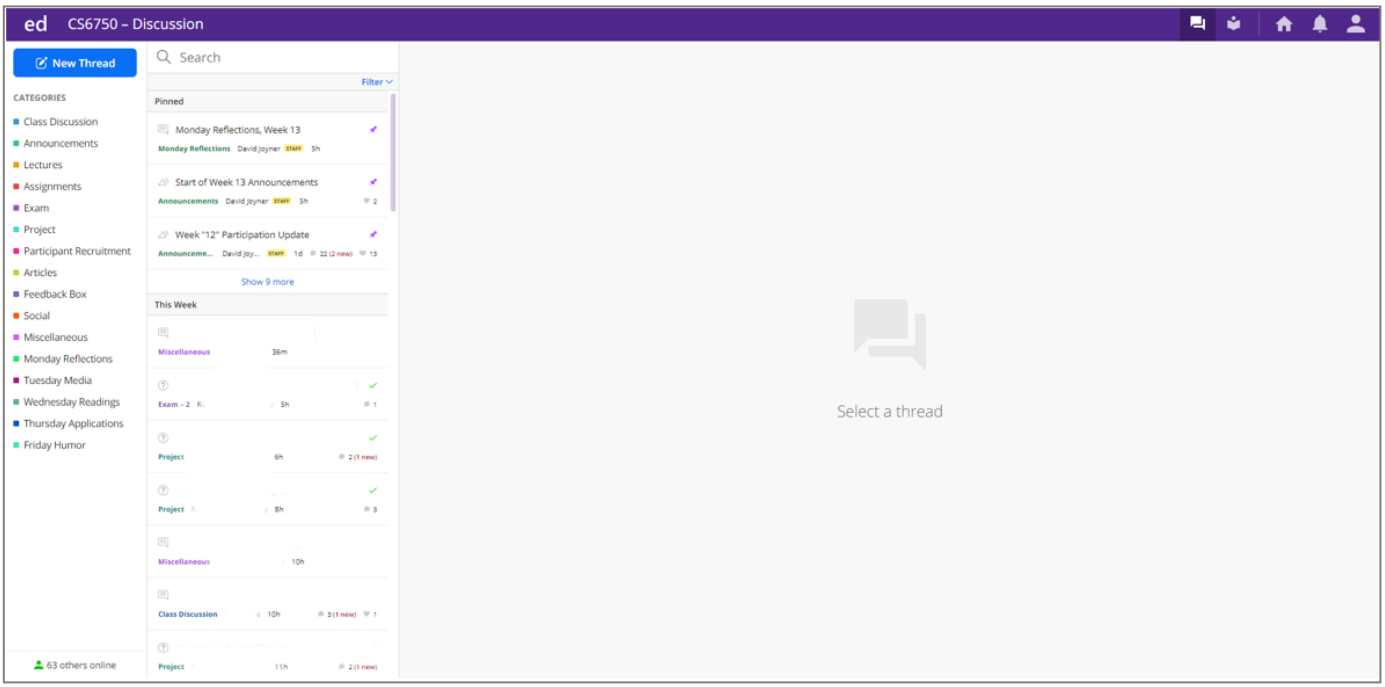


Figure 1—Ed Discussion landing page for a specific course. Student names and thread titles are censored for anonymity. (Source: Ed Discussion)

There are several aspects of Ed Discussion that work well. A view of the Ed Discussion home page for a specific course can be seen in figure 1.

For starters, the interface makes good use of **discoverability**. Different thread categories are listed on the left side of the interface, and each category has a unique color assigned to it. This color assignment aids users in locating threads in their feed that pertain to a specific category and aid the user in identifying the proper action to achieve their goal (**bridges the gulf of execution**). The color-coded labels on each thread also help the user identify if they filtered on their desired label. Their presence on the thread cards also helps **bridge the gulf of evaluation**. For example, if users want to view all threads categorized under "Project," they can click on that category. After doing so, only threads labeled "Project" will appear in their feed. The user can interpret this new state and evaluate if what they are viewing meets their goal. In addition, the blue button labeled "New Thread" located at the top left of the screen above the list of categories is **discoverable** due to the label's size, color, and title.

Next, when hovering over a category, the label is highlighted, and the mouse switches to a pointer, **affording** the act of clicking. The interface is also **feedforward** because users can predict that clicking on a particular category will allow them to view threads from *only* that category. The interface is also **tolerant** of slips or mistakes users may make. If a user wants to edit or delete a thread they created, they can do so by clicking "edit" or "delete" under the body of their post. Similarly, users can edit or delete comments or answers left under other users' threads. The interface leverages **consistency**; there are several icons at the top right of the screen. These icons are universal; the house icon generally represents a link to a home page. The bell icon is a typical way to represent notifications. The head icon typically represents a link to view a user's account information. All in all, the icons used are good **analogies** of what they represent. Additionally, a red symbol appears under the bell, indicating a new notification

to the user. This red symbol is also **consistent** with other apps such as Facebook and app notifications on smartphones.

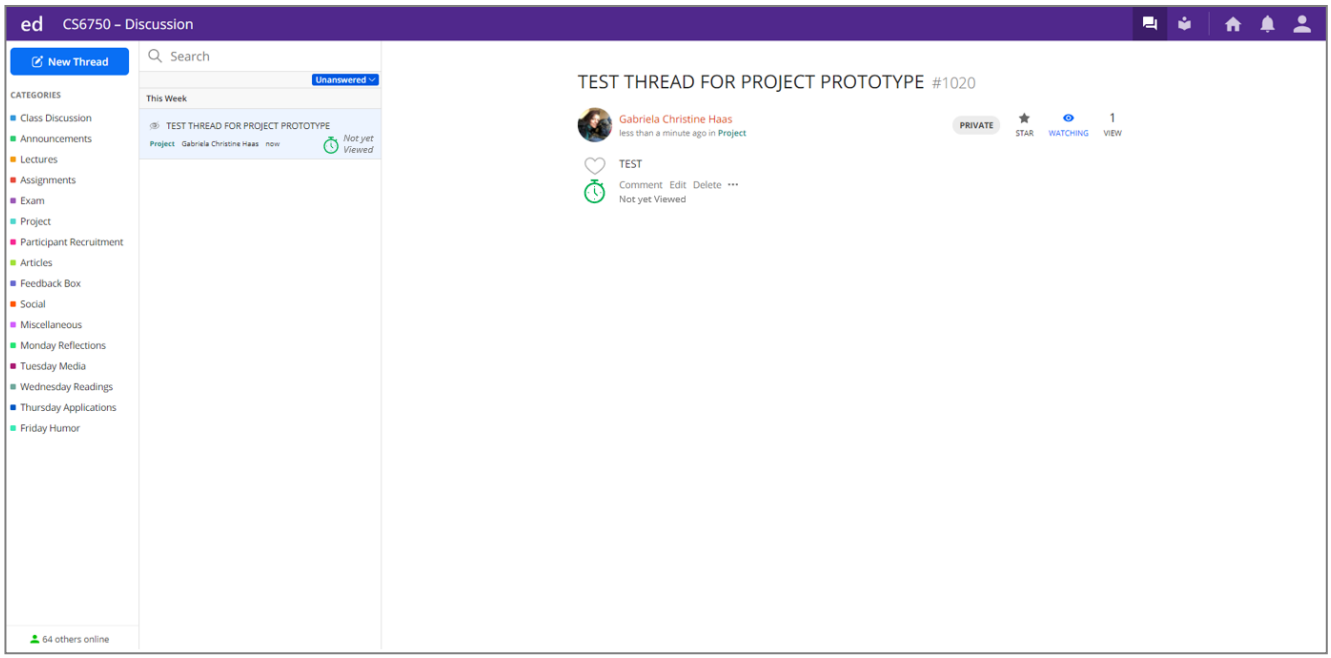
Finally, the interface makes use of **constraints**. Ed Discussion does not allow users to post threads without creating a title, typing the thread's contents, and selecting a category (and sub-category if applicable). The interface also gives the user **feedback** after they impact the interface's state. After creating a new thread, it is automatically visible at the top of the feed to the left of the interface. The thread card indicates how long ago it was created, who created it, and the thread's title is displayed. Likewise, when a user posts a comment under an existing thread, they can see their comment and the amount of time passed since posting it. The user can view these attributes, interpret them, and evaluate if they are closer to their goal or have achieved their goal. In other words, the interface's **feedback** and the thread card's attributes help bridge the **gulf of evaluation**.

3.2 What does not work well and why

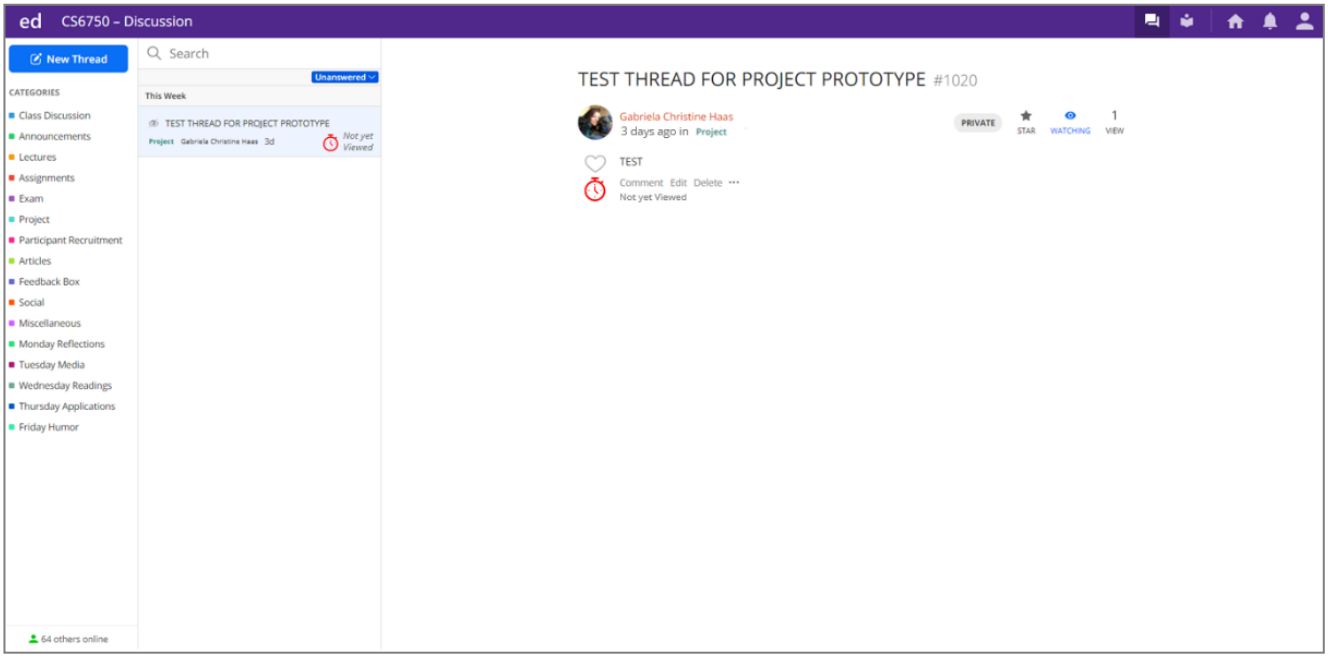
While there are several things Ed Discussion does well, there are defects also. First, the view of the interface does not make use of **simplicity**. The number of categories present on the screen is overwhelming and requires a moderate concentration level to read through them all and identify which one suits the user's goal. In other words, it adds to the user's **cognitive load**. Another thing that contributes to a user's **cognitive load** is manually keeping track of unanswered question threads and question comments. Students must remember which unanswered questions they own on the forum, or they may make a physical note of their unanswered questions. In either case, the user cannot **offload the task** of keeping track of unanswered questions onto the interface.

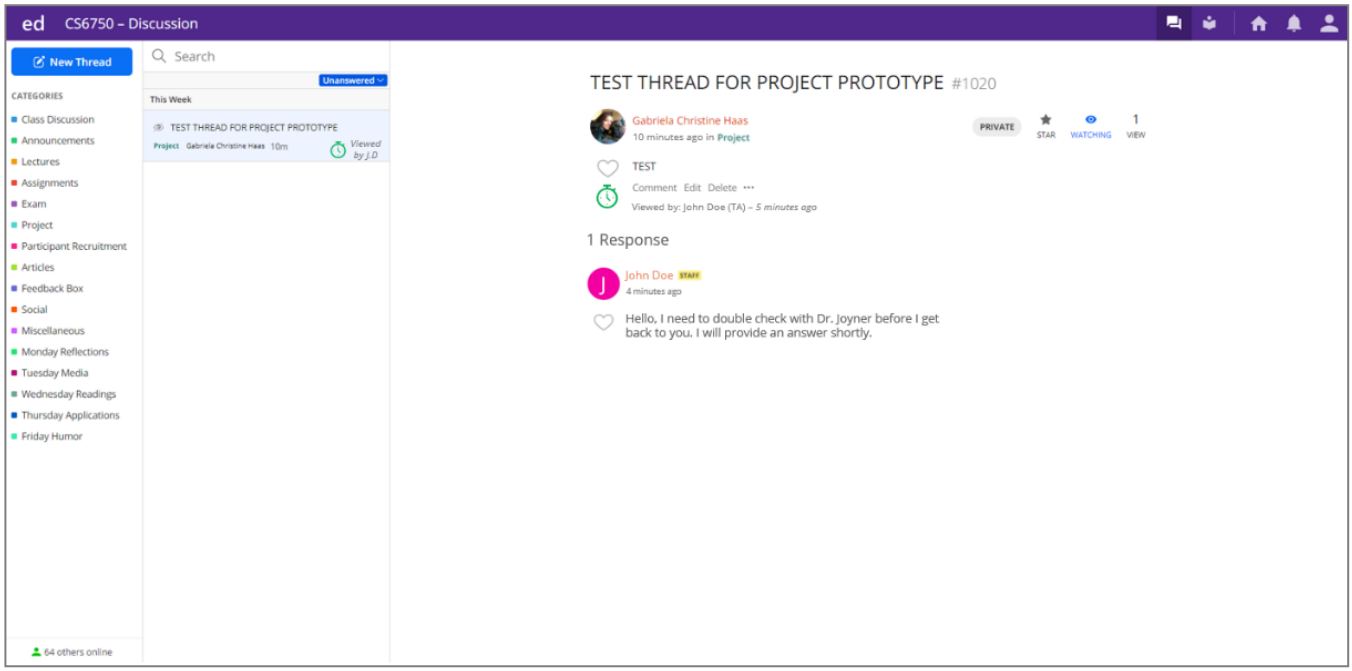
Furthermore, filtering one's threads is simple enough; however, searching for an unanswered question under a mega-thread requires a moderate level of attention because it requires the user to scroll through all the existing questions left by other students. Also, while there are **constraints** in place disabling users from creating threads with no title, no content, or an assigned category, threads are automatically labeled as a question. As a result, users frequently perform **memory-lapse slips** by creating a thread and accidentally posting it as a question

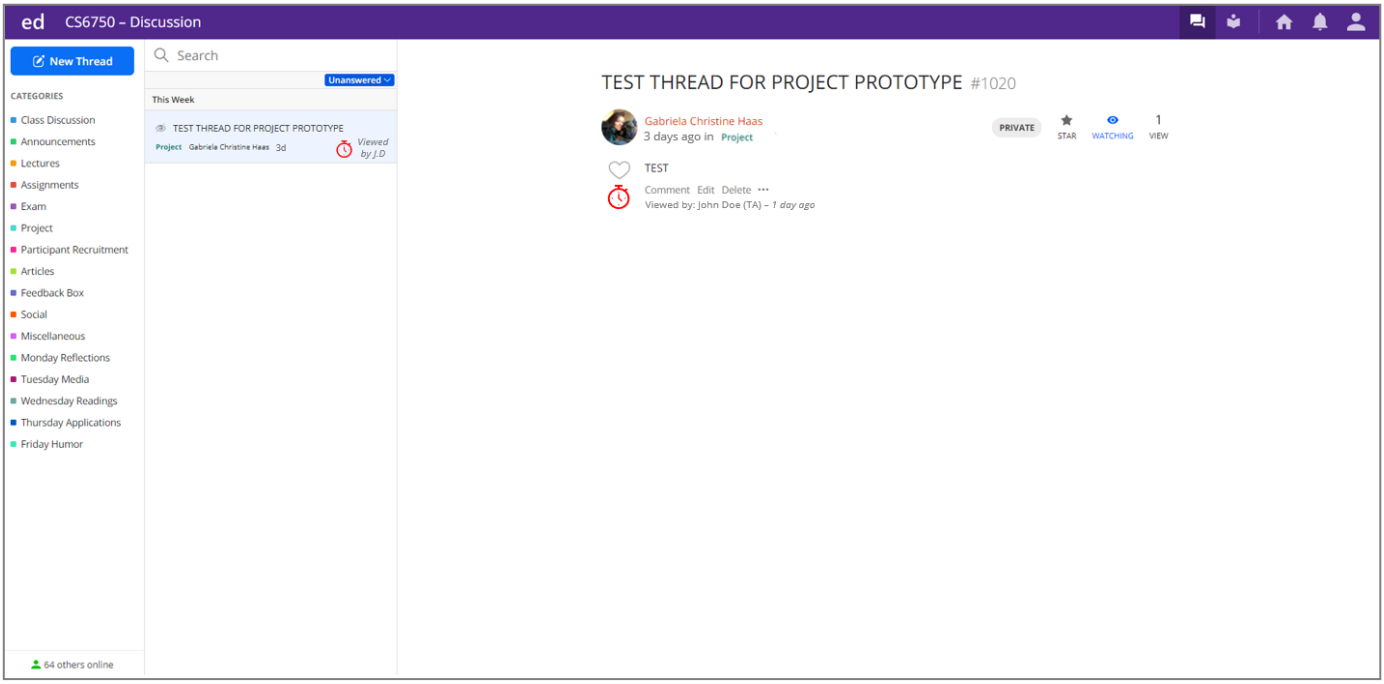
thread when they meant it to be a "discussion" thread. In this scenario, the user knows what they want to do, but they forget to do it. Furthermore, there is a **learning curve** involved with understanding how the “like”, “star”, and “watch” functions will impact the state of the system. The presence of these functions also violates the principle of **consistency**. Nielson describes a similar heuristic stating, “Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions” (Nielson, 1995). These functions are familiar to users that use social media, YouTube, mail applications, and other sites. However, initially, the availability of all three seems off-putting and requires time to learn the purpose of each and how they can be utilized well within the system. Finally, after a user posts a question thread or posts a question under an existing thread that requires a response from a TA or the professor, there is no way to know if a TA or the professor viewed it. The system offers no **feedback** to let the user know that an answer to their question is being worked on or its place in the TA's queue. This widens the **gulf of evaluation** because while it is easy for a user to understand that their thread or comment has been posted and is available on the interface, there is no way to know *when* they will receive a response. Posting a question thread or question comment is merely a task to help users accomplish their goals. For example, a student's goal may be to have a question about the class project answered. Posting a question on Ed Discussion is a task the user performs to accomplish this goal. The user then receives an answer, interprets it, and evaluates if their goal has been met. If their goal has not been met, a follow-up question might be their next course of action.



4 INTERFACE REDESIGN


ed CS6750 – Discussion
New Thread
Search
Unanswered
CATEGORIES
Class Discussion
Announcements
Lectures
Assignments
Exam
Project
Participant Recruitment
Articles
Feedback Box
Social
Miscellaneous
Monday Reflections
Tuesday Media
Wednesday Readings
Thursday Applications
Friday Humor
This Week
TEST THREAD FOR PROJECT PROTOTYPE
Project Gabriela Christine Haas 3d
Not yet Viewed
64 others online
TEST THREAD FOR PROJECT PROTOTYPE #1020
Gabriela Christine Haas
3 days ago in Project
PRIVATE
STAR
WATCHING
1
VIEW
TEST
Comment Edit Delete
Not yet Viewed


ed CS6750 – Discussion
New Thread
Search
Unanswered
CATEGORIES
Class Discussion
Announcements
Lectures
Assignments
Exam
Project
Participant Recruitment
Articles
Feedback Box
Social
Miscellaneous
Monday Reflections
Tuesday Media
Wednesday Readings
Thursday Applications
Friday Humor
This Week
TEST THREAD FOR PROJECT PROTOTYPE
Project Gabriela Christine Haas 10m
Viewed by J.D
64 others online
TEST THREAD FOR PROJECT PROTOTYPE #1020
Gabriela Christine Haas
10 minutes ago in Project
PRIVATE
STAR
WATCHING
1
VIEW
TEST
Comment Edit Delete
Viewed by: John Doe (TA) – 5 minutes ago
1 Response
John Doe STAFF
4 minutes ago
Hello, I need to double check with Dr. Joyner before I get back to you. I will provide an answer shortly.



5 INTERFACE JUSTIFICATION

The wireframe prototypes above represent different states of an individual thread. Based on the responses received from the needfinding survey, it is apparent that a fundamental goal for student users is to get information from the TA's and the professor by searching for existing answers or asking new questions. Furthermore, some respondents said that they use Slack or Discord to get answers to their questions quicker. Existing research also claims that prompt feedback is crucial for student success (Fehrman & Watson, 2020). The prototypes above encompass functionality that allows users to see if their thread was viewed, how long ago it was viewed, by whom, and whether the response time has breached the established target.

5.1 Addressing principal violations

The new functions in the prototypes above **offload** remembering unanswered question threads and question comments onto the interface. Users can only see the timer icons and the read receipts next to unanswered threads and comments they are authors of. Since the timers are eye-catching due to their size and color

(**discoverable**), users exert less focus to locate them while scrolling through their feed or scrolling through comments under a mega-thread. In short, the presence of the timer reduces the user's **cognitive load**. In addition, the timer icons are intuitive and are **analogous** to time. The presence of the icons gives users the option to scroll through their feed to locate their thread or apply a filter. The available options cater to both novice and expert users of the interface and allow users to complete a task the way they prefer. Furthermore, the presence of the timer is a clear indicator that the thread is a question thread. This may help users avoid performing the **memory-lapse slip** described above. If a user created a post thread when they meant to create a question, the lack of the brightly colored timer near the new post indicates they performed the wrong action. To pursue this further, the timer icon and the read receipt attached to the thread let the user know their thread's status. This aligns with how Nielson describes **perceptibility** because the features implemented in the prototype keep users informed about the status of their questions (Nielson, 1995). The interface's **feedback** is also immediate and informative. The timer icon and the read receipt appear immediately after the thread or comment is created. Furthermore, once a TA or the professor reads the question, the read receipt updates immediately. Users can tell if their question has been read, and they can re-evaluate their plan of action if necessary. The presence of the timer icons helps the TA's as well. The icons can help TA's identify unanswered questions more efficiently, and doing so involves less focus due to the **discoverability** of the icon. The TA's also benefit from the color-coded icons and can address breached questions first without exerting as much **cognitive load** to identify them.

5.2 Preserving positive elements

The prototype preserves all the positive elements of the original interface. The prototype is very similar to the original; the timer icon and the read receipts are the only new additions to the interface. Nothing was removed or restructured within the interface.

The original interface makes excellent use of the **discoverability principle,** and the timer icon adds to that. The icon is easily discoverable due to its size, color,

and it is an **analogy** for time. The interface already uses icons that are also good analogies of what they represent, and the timer serves as another good example. Ed Discussion also adopts the principle of **consistency** throughout the interface. The read receipts in the prototype take the interface's **consistency** a step further because read receipts are available in many messaging apps. In addition, Service Level Agreements (SLA's) are familiar to those who have experience working in IT and with incident management. The timer icon's meaning is similar to the response status attached to incident tickets. Moreover, users receive prompt **feedback** after creating a new thread or comment that indicates the user's thread or comment is live and viewable. The additional timer icon and read receipts accentuate this **feedback** by telling the user what the status is of their thread and keeps them informed of who viewed it, when they viewed it, and if the response target has been breached.

6 EVALUATION PLAN

6.1 Qualitative evaluation - Survey

A survey will be sent out to classmates using PeerSurvey. Survey responses will be exported into an excel file and organized. Below are the contents of the survey. Surveys beginning with an asterisk represent required questions.

Survey Title: Ed Discussion Prototype Survey	
Survey Description: This survey is meant to gather students' opinions and attitudes towards a wireframe prototype that implements new features in Ed Discussion.	
Questions	Answers (a semicolon separates multiple choice answers)
*Question 1: How satisfied are you with Ed Discussion?	Very Satisfied; Satisfied; Neutral; Dissatisfied; Very Dissatisfied
*Question 2: Please explain why you chose your answer for question 1.	Open-ended
*Question 3: Please use the link below to access a public google doc showcasing wireframe prototypes that include functions that do not currently exist in Ed Discussion. Please view the wireframes and describe what you like about the prototype.	Open-ended
*Question 4: What do you dislike about the wireframe prototypes?	Open-ended

Question 5: What confusions do you have about the wireframe prototypes?	Open-ended
Question 6: What adjustments would you make to the wireframe prototypes?	Open-ended
*Question 7: Do you think there are benefits to implementing the functions seen in the wireframe prototypes?	Open-ended
Question 8: Do you have any additional comments, questions, or concerns?	Open-ended

Questions one and two address user attitudes and potential needs regarding Ed Discussion. Questions three, four, and five may address whether the learnability requirement was met depending on responses. If many respondents admit they are confused about the prototype, perhaps the learnability requirement was not met. Questions six and seven address user needs. Finally, question eight may address user needs and the functionality and learnability requirements. All in all, if many respondents express confusion towards the wireframe prototype, this could indicate a significant learning curve with one or both new functions.

6.2 Avoiding biases

Performing needfinding via a survey may come with biases. For example, we may run into voluntary response bias since users with firm opinions tend to be more enthusiastic about responding to surveys surrounding topics of interest. Limiting the survey content shown to participants before they begin the survey can help eliminate voluntary response bias. Also, leading survey questions must not be incorporated into the survey, pushing respondents to give an ingenuine answer. This is avoided by asking straightforward, non-leading questions and making each answer open-ended, allowing participants to provide genuine answers.

7 EVALUATION EXECUTION

7.1 Qualitative evaluation results

Twenty classmates responded to the survey described for the evaluation plan. Overall, while the quantity of the responses is not very high, the quality of the

responses is thoughtful. Minor changes were made to the google document containing the wireframe prototypes after receiving the fifth response. It seems the fifth respondent may not have noticed the new functions because they only addressed the screen real estate. My desktop monitor is large, so perhaps my view in the screenshot I used to create the wireframe looks different than theirs (depending on how they access Ed Discussion). The changes made to the document briefly described the added features without giving away *exactly* what the functions do and confirmed that nothing else about the interface had been altered. Following this change, the rest of the respondents addressed the new functions within the interface. In the future, I would publish the survey earlier as I was hoping to gather more responses.

Since the raw survey results are too extensive to include in the body of this project, the complete data set can is located in appendix 9.2. Below is a summary of the responses received.

Regarding question one, 60% of respondents said they are satisfied with the current interface. Only one respondent answered "Dissatisfied", two answered "Very Satisfied", and five respondents answered "Neutral". Overall, most respondents appreciate the ability to see if a TA has viewed their question. However, all but one respondent was confused about the function of the green or red timer icon, and most felt the icon was too large. Also, a few respondents were confused about which posts the read receipts and the timer icon would apply to. Regarding question seven, 80% of respondents answered yes when asked if they thought implementing the new functions would be beneficial. Since this question required an open-ended response, respondents could justify their answers. When answering question seven, most respondents commented on how the read receipts would benefit them. None of the respondents commented on how the timer icon was beneficial when answering question seven. Several respondents also provided various suggestions to the prototype when answering question six.

One of the main takeaways from the survey results is that most students appreciate the additional feedback that the prototype provides. For question seven, one participant answered, “Yes, as stated in Q3. Students are often left in

limbo and are not sure if the TA or Professor saw their question while they wait for a response. Waiting for a response can also be nerve-wracking, so having some insight into the communication process is nice." Another respondent answered, "Yes, I want to know if a TA has at least read my question." The number of positive responses to the read receipt function surprised me because I was unsure how many students would appreciate the new functionality. "You are not your user" is a phrase I kept in mind during this design lifecycle. The functions implemented in the prototype are functions I would personally enjoy, but since I am not my user, I was not expecting many respondents to feel the same way. To pursue this further, I expected respondents to express confusion about the timer icon and its function. The timer was not labeled, and no color legend was provided. Another takeaway highlighted by the survey responses is that the timer is not discoverable, it does not fit the interface (too large), and it causes confusion.

Finally, the survey results suggest several changes to the prototype. For starters, the timer icon and its function need to be more discoverable. A legend needs to be added somewhere on the screen to address the different colors (red and green). The icon should also be made smaller to fit the interface's aesthetic. Next, instead of the read receipt saying, "Viewed by: John Doe (TA) – *5 minutes ago*", perhaps the text should say "TA" to keep the individual's identity private. However, the anonymity of the TA depends on how many TAs are available in a course. This change comes from an individual response to question four where a respondent said, "I also don't love that it shared the exact name of the TA that saw it. TAs are people too and sometimes have distractions or other priorities that can delay them in responding. I would prefer a marker that indicates that someone from the teaching team saw your message."

7.2 Evaluation summary

Additional needfinding could aid in understanding the following questions. What is the average number of questions a student asks? How long does it typically take for students to get a response? What do students do while waiting for a response? Do students consider alternate tasks to obtain answers if they

have been waiting for an answer for more than a day? Do the answers to these new questions correlate to the positive responses to the read receipt function in the prototype? How often do TAs sit down and respond to questions? What challenges do they face while performing this task? How do they go about identifying unanswered questions?

This experience, specifically the qualitative evaluation, made me wonder how TAs would feel about the new functions in this prototype. Would TAs prefer to keep their names out of the read receipts? If so, why? Additional needfinding targeting this group of stakeholders could help determine if TA names should be removed from the read receipts. Furthermore, if the timer icon was made more discoverable, would it aid TAs in locating unanswered questions quicker? Would it benefit students?

Removing the TAs names from the read receipts is a change that I may make; however, more needfinding directed towards class staff would need to be conducted to determine if this change is necessary. Furthermore, since the responses suggest that the timer icon is confusing, a legend would need to be implemented to explain the timer's purpose, and another qualitative evaluation survey would need to be conducted to gauge students' and TAs' attitudes towards the function.

8 REFERENCES

Clark, C., Strudler, N., & Grove, K. (2015). Comparing asynchronous and synchronous video versus text based discussions in an online teacher education course. *Online Learning*, *19*(3). https://doi.org/10.24059/olj.v19i3.668

Fehrman, S., & Watson, S. L. (2020). A systematic review of asynchronous online discussions in online higher education. *American Journal of Distance Education*, *35*(3), 200–213. https://doi.org/10.1080/08923647.2020.1858705

Hammond, M. (2019). A review of recent papers on online discussion in teaching and learning in higher education. *Online Learning*, *9*(3). https://doi.org/10.24059/olj.v9i3.1782

Nielsen, J. (1995). *Usability inspection methods*. IFIP, Internat. Federation for Information Processing.

9 APPENDICES

9.1 Needfinding survey results

#	What age group do you fall into?	Where do you live?	Is Human-Computer Interaction your first OMSCS course?	Have you taken an online course before?	Do you work full-time?	Do you have children?	What distractions do you encounter while working on course work? Please be specific.	Do you use Discord or Slack to communicate with classmates?
1	20-30	USA	Yes	No	Yes	No	Family, outside noise	Yes
2	31-40	Singapore	Yes	Yes	Yes	Yes	phone messages	No
3	20-30	Houston, TX	Yes	Yes	Yes	No	I work in an operations role in the field for 14 days straight then have 14 days off. While I am here, I am always on call. I am often interrupted during school work to go address an operational issue. When off, no distractions.	No
4	31-40	USA	Yes	Yes	Yes	No	Twitch.tv, YouTube, sometimes peer feedback is harsh and I don't want to study for a little bit. Sleep sometimes distracts me.	Yes
5	20-30	Washington DC	Yes	No	No	No	Access to the internet, messages from other people	No
6	20-30	North Carolina, USA	No	Yes	Yes	No	My partner making noise (TV, cleaning, etc.)	Yes
7	31-40	Houston	Yes	No	No	Yes	Pending house chores, guilt of leaving kids un attended for longer period of time	No
8	20-30	India	Yes	Yes	Yes	No	My dog	No
9	20-30	USA	Yes	No	Yes	No	My dog barking at cars outside, my partner doing the dishes (I study in the living room), my own desire for food or coffee	No
10	20-30	NYC	Yes	No	Yes	No	Typically work related matters interrupt me while I'm doing course work.	No
11	20-30	Connecticut	No	Yes	Yes	No	Nothing in particular. Little bit of a few things.	No
12	20-30	Virginia, United States of America	Yes	Yes	Yes	No	Personal tasks (like cleaning) and message notifications from friends and family	Yes
13	41-50	USA	No	Yes	Yes	Yes	Phone notifications, door bell, other desktop notifications	Yes
14	20-30	USA	Yes	No	Yes	No	family, hang out with friends, other work	Yes
15	20-30	US	No	Yes	No	No	Other tasks that may be close to ddl	Yes
16	31-40	NA	No	Yes	Yes	Yes	mobile	No
17	20-30	Alabama	No	Yes	Yes	No	Wife, animals, phone	No
18	20-30	Georgia	Yes	Yes	Yes	No		Yes
19	41-50	USA	Yes	Yes	Yes	Yes	Family interruptions	No

20	20-30	GA, USA	No	Yes	Yes	No	Messages from cell phone.	No
21	20-30	US	Yes	No	Yes	No	office work, chores, errands	Yes
22	31-40	United States	Yes	No	Yes	Yes	My two toddlers always play to me.	Yes
23	20-30	USA	No	Yes	Yes	No	scrolling the internet	Yes
24	20-30	Northern Virginia	No	Yes	Yes	No	My dog, my parents, my phone	No
25	20-30	United States	Yes	No	No	No	Nothing distracts me	No
26	20-30	Florida	No	Yes	Yes	No	Ability to watch videos or play games on my pc	Yes
27	20-30	GA	No	Yes	Yes	No	Other hobbies	Yes
28	20-30	South Korea	Yes	No	Yes	No	I dont have any	No
29	20-30	N/a.	No	Yes	No	No	N/a.	No
30	41-50	Prefer not to answer	No	Yes	Yes	Yes	I tend to slack off by browsing	Yes
31	41-50	US	Yes	Yes	Yes	Yes	Family, office work, cooking, kids activities, dinner time - lot of distractions :(	No
32	20-30	US	Yes	Yes	No	No	Dog, chores	Yes
33	31-40	India	Yes	No	Yes	No	Office work responsibilities	Yes

#	If you answered "Yes" to question #8 above, why do you use Discord and/or Slack?	What do you like about Ed Discussion?	What do you NOT like about Ed Discussion?	What is your primary goal(s) when using Ed Discussion?	What changes (if any) would you make to Ed Discussion?
1		easy to ask questions, share things with classmates	posting is annoying	get answers	lobby
2		easy to use, all announcements there	seems ok	finding out announcements, posting for participation	NA
3		The only source of interaction we really get with classmates and the ability to see different personalities. I also like the separation between pinned chats and general chats to see what is important from the TAs without having to search. IT is fairly clean and decluttered.	The billions of categories gives me anxiety.	Get answers to assignment questions and interact on humor Fridays.	Make a way for me to hide the categories I don't care about. Or hide that bar completely. A way to "follow" people to see what they are posting.
4	Slack has a group creating a study guide, good way to socialize with other students.	The humor section, reading about issues people have with questions any responses from TA's.	Not enough emoji options like Slack.	To get participation points and get people to help with my needfinding exercises	Make the option to be question rather than post, because the TA's complain about it every week.

5		If a classmate runs into an issue, there is a chance I will as well, so seeing their questions is helpful	The search functionality is overwhelming	To see any updates to class information or material	Make the search function better
6	Because I enjoy the less formal interactions that you can get outside of the more formal course platforms	I like that the categories can be color-coded and that it's easy to search by category.	I REALLY hate the message threading in Ed Discussion. If you sort by "Newest first", the thread order doesn't make a lot of sense.	Usually, to get answers to questions that I have about assignments. Sometimes, to have lighter social interactions about the class.	I don't particularly like the way that messages are threaded, so I would try to fix that...Other than that, I don't have that many issues with the platform.
7		It can be accessed through canvas and has become a routine while I am opening lessons or looking for assignments	Nothing	To read discussion/get class updates	None
8	I haven't interacted with any of my classmates	clean ui	I cannot text my classmates	participation points	allow texting between students
9		I like the tags and filters I can use to find a specific topic	I don't like that I cannot save a post (at least I don't know how to), I am copy-pasting the url to let myself find the post I need for now	find answers to my question, see what other classmates are interested in.	I want to be able to track a post and save a post to get notice when a new reply is added.
10		The colored coding is nice	It's a bit difficult to navigate. It's quite overwhelming when I first used it.	Discuss with peers	I would want the organization to be a bit cleaner. There are so many categories, it's very difficult to navigate.
11	N/a	It just works	Can’t think of anything	Searching for answers related to assignments	N/a
12	I like the idea of having groups within a channel with Slack	I do appreciate how all the posts are organized in categories	It feels more like chat board for students to use instead of a full discussion	To find answers to possible questions I may have and see other student's perspectives on assignments, lectures, readings, ect...	Allow students to make study groups within the site. So people can schedule to come online at the same time and communicate live between one another
13	Ask quick question or get quick answer	Pins and Tags	Too many posts to catch up sometime	Class announcements and course related info	NA
14	more casual conversation	good for getting educational answers	NA	getting answers to concerns I have	NA
15	My teammates use Slack	Categorize topics and easy to search	Search function: cannot keep the result and needs to retype the same word to search again	Check answers for my questions	Improve the search function
16	not in this class	intutive	na	read about clarifications	none
17		Its pretty sleek, it has what I need	Feel like I'm constantly missing	Answer a specific question	Show me a more currated view of what I missed

			posts		between visits
18					
19		the categorization of the posts, formatting options for the comments	couldn't think of anything better, but may be the search functionality	to know what's going on, to know answers to my questions	
20		Yes. I do not use that frequently but I found the overall appearance is good. I like the colors.	Maybe it can make important things more sharp. For now, most things on the interface has almost the same font size.	Finishing the course and checking for important announcement.	Use larger font sizes for discussion titles or other important things.
21	additional info	easy and neat interace	sometimes difficult to find relevant threads	stay up to date with course requirements, deadlines, clarifications etv	
22	I have just discovered the Slack and I wanted to try it and find to interact my clasmates.	class discussions and personal mega threat	nothing . I like the all sections.	understand what is happining in my classroom.	it doesn't need changes , but some modification might be need it such as "pinned" feature I don't think so it is useful.
23	slack is easy to use	honestly, nothing	I think the search is inconvenient and I'm not a fan of the UI	to read the instructors post	make it more pleasing to the eye
24		It consolidates all posts and allows me to ask public and private questions	sometimes it feels crowded, it's hard to find things.	To ask a question	more advanced search functionalities
25		It is properly categorized as per exam, project, assignments which makes it easier to find discussions.	I guess it works fine	To go through the discussions on various topics or to ask some clarifications myself	Nothing. Works fine for me.
26	Slack to keep up with suggestions from classmates or collaboration documents	The ability for direct feedback from TAs and professors	There should be the ability to filter out categories or assignments which are past-due	Find suggestions for completing assignments by classmates	N/A
27	Easy to use	Can tag posts	A lot of posts everywhere	Asking questions	
28		I can contain some valuable information to complete assignment.	I dont have any	Getting information	Nothing
29		N/a.	N/a.	N/a.	
30	Because the class uses slack	The interface is clean and structured	I don't have any gripes	To catch up on announcements and discussion	I am ok with the interface
31		the interactions - it helps to find what others are working on, and feel that I am not alone. I like that staff have a separate section, as most messages there are important	Difficult to find what is important.	Staff communication, find other trending discussion topic in class, ask questions	A trending feature...
32	To communicate with TA, classmates	I think its better thab piazza, visually better and easy to use	Too many options in category	Homework help	
33	To see the notes prepared by other classmates	Good place to see all messages altogether in a sorted fashion	Too many messages	To check for questions/doubts asked by other	

				students	

9.2 Qualitative evaluation – survey results

Num	Q1: How satisfied are you with Ed Discussion?	Q2: Please explain why you chose your answer for question 1.	Q3: Please use the link below to access a public google doc showcasing wireframe prototypes that include functions that do not currently exist in Ed Discussion. Please view the 4 wireframes and describe what you like about them.	Q4: What do you dislike about the wireframe prototypes?
1	Very Satisfied	Everything I expect from the site, I am able to find it	I like the viewed by option introduced.	The viewed by option seem to be redundant since we have "watched views" feature already. does it matter to know who saw it?
2	Satisfied	it's accessible and user friendly	Simple interface	There are lots of subtabs and tasks on the left side of the screen
3	Very Satisfied	n/a	n/a	n/a
4	Satisfied	I like that posts are coded under different topics	I like knowing if a TA has viewed a post	Not clear what red v green means on the timer
5	Neutral	can't complain about anything	better screen real estate format	can't see any other changes
6	Satisfied	It satisfies all my needs	It is not cluttered	N/A
7	Satisfied	I think it is ok to use and I don't have any issue	I like that it shows how many people are online	Nothing, maybe a way to hide that I'm online
8	Neutral	As an alternative to Plazza it's much more well designed visually but there is nothing that ED stem provides that is better than what piazza can provide	check	icon on the side bar for viewed is too large
9	Satisfied	It meets its purpose.	I can see if the TA checked my post.	The TAs might avoid from looking at the actual posts.
10	Satisfied	There are some features that are missing that other message platforms have but it's pleasant to use and all important features work.	The glyphs used make sense and are clear. The text is easy to understand when it comes to comprehending what it is trying to convey.	For the left pane, the glyph is kind of large, and I feel if the text is longer for the post, it could make that part of the interface too busy.

11	Satisfied	a decent amount of ux work has been put it, no obvious problems	centralized place for project prototypes is a good idea	--
12	Satisfied	Its easy to filter and find relevant discussion topics. It's also straightforward to post something and view responses.	I like how the icon is obvious, the colors green vs red are also an easy way to	Nothing really.
13	Dissatisfied	not that user friendly	ok	lot of white space
14	Satisfied	Because I am satisfied	I like that they show a member of the staff read my post	I don't understand what the timer is for. When does it turn from green to red?
15	Neutral	I'd like to use markdown to post a comment/thread, but I just learned that I can use markdown in Ed just recently.	Having known my post already read/processed by the TA definitely helps reduce my worries on important inquiries.	I am not sure on what is the difference between the green and red time indicator.
16	Satisfied	The design is better than Piazza, it can be difficult to find information in posts that have a lot of threads but otherwise I like it.	I like the timer, it's helpful for time sensitive questions.	The timer icon might be a little confusing, it almost feels like the post will expire or something
17	Neutral	It has a vanilla feel that is familiar with other collaboration platforms. I prefer the layout and use of Piazza and Slack though.	It's a nice integration with the overall theme. I like the colors and the icon to represent the timer.	There's nothing that I dislike as the revision is minor and does not add additional cognitive load to tasks. See question 5 regarding confusion for the gulf of execution.
18	Neutral	The subchannel function is super confusing	I think it is pretty straight forward	Nothing

19	Satisfied	Properly serves its role as a forum board for a class. While the interface could potentially use improvements, the board functions well and meets all my needs as a user.	I really like this idea. A certain subset of posts / questions do require a TA / Professor response so it is comforting to know that someone on the teaching team saw the message.	I'm not sure how it would work with a large teaching team. What if multiple TAs saw the post? Do we only show the last person who saw it? Does scrolling past the post in the feed count as seeing it, or do they need to click on it to expand more details? I also don't love that it shared the exact name of the TA that saw it. TAs are people too and sometimes have distractions or other priorities that can delay them in responding. I would prefer a marker that indicates that someone from the teaching team saw your message.
20	Satisfied	I think mainly because I am used to using it now so all its features are now very familiar	I like the timer icon and that it shows whether a TA has viewed the thread or not.	I'm a bit confused as to what the green and red colors mean

Num	Q5: What confusions do you have about the wireframe prototypes?	Q6: What adjustments would you make to the wireframe prototypes?	Q7: Do you think there are benefits to implementing the functions seen in the wireframe prototypes?	Q8: Do you have any additional comments, questions, or concerns?
1	its pretty straightforward	n/a	to an extent, if the post requires immediate attention and you want to know if you can contact the TA for that	n/a
2	n/a	n/a	yes it could be implementing easily	n/a
3	n/a	n/a	n/a	n/a
4	Not clear what red v green means on the timer	Add color code or more text about the meaning of the timer.	Yes	n/a
5	n/a	n/a	better display for bigger screens	n/a
6	N/A	N/A	Yes but not necessary	n/a
7	n/a	n/a	Yeah because if I see a TA on then I would expect an answer soon	n/a
8	will all students see this timer or will only the poster see it?	make the icon on the side bar smaller	Yes, I want to know if a TA has at least read my question	None
9	None	Instead of viewing, maybe give TA an option to notify if the TA is working on it.	Yes, the students can see if their posts are looked by TAs.	Maybe this option should be used only in a specific topics.

10	n/a	The left pane information should be simplified so that there's still enough space to read the main text.	Yes. Knowing when your post was viewed and answered by a TA will help in important questions and communications happening. As well as follow up as necessary.	n/a
11	--	--	centralization, less following random links	--
12	n/a	n/a	Yes. I think its important to see whether a TA has responded especially to conversations directed specifically at them	n/a
13	not that different	n/a	not really	n/a
14	I don't understand what the timer is for. When does it turn from green to red?	I don't understand what the timer is for. When does it turn from green to red?	Yes	n/a
15	I am not sure on what is the difference between the green and red time indicator.	Make the purpose of the green/red timer icon more clear.	Yes, there are.	Maybe we can add information regarding average/standard processing time before a question is answered by TA.
16	noted above	change the icon to an eye	Yes, I think it's helpful to know if a TA or professor has read your post	Nope
17	I'm not sure what the timer icon is for? Is this to set an alert if you don't receive a response within a defined threshold (i.e., 4 hours, 1 day, etc.)?	Of I don't understand what an icon or option will do, I tend to hover over it to see if a dialog box is prompted to explain the setting. Or I just click it and see it what happens. Thinking about those two things and how to represent them would be helpful.	I think it's a good idea. When I post a question, I can see the number of views, but I don't know if it has been viewed by the staff.	Surveys are good for qualitative feedback where responses can be aggregated to understand next steps. On future surveys, I recommend adding selectable options to gauge user interest (i.e., Very Helpful, Helpful, Not Helpful, etc.) to understand general interest and increase the amount of participants to take your survey.
18	N/A	Maybe send auto reminder to TA if the questions has been viewed but not answered	Yes	n/a
19	See Q4. Some of my dislikes are related to confusions.	I would include the raw number of people from the teaching team that saw the message instead of including the specific person's name. Ideally, the individual who is supposed to respond (ie: Forum TA) could be the	Yes, as stated in Q3. Students are often left in limbo and aren't sure if the TA or Professor saw their question while they wait for a response. Waiting for a response can also be nerve wracking, so having some insight into the communication process is nice.	Not every type of post needs to have this. I think this could be reserved for Questions only.

		account that triggers this UI.		
20	I'm not sure what the red and green colors indicate	Perhaps there could be some indicators to show what the colors mean	Yes I think the function where you can see if a TA has viewed a thread will be useful	n/a