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***Abstract*—Currently, in OMSCS and other online education programs, the only form of communication is via forums or emails. Students and teachers use third-party applications to conduct study sessions or office hours. This research describes how a defined space is necessary where students can interact and watch video lectures together and form personalized study groups. These study groups will be officially authenticated to the educational program. The aim is to create a social learning environment and keep each other motivated by using different learning methods and staying accountable.**

1 INTRODUCTION

The "study with me" community [1] is increasing rapidly on YouTube and Bilibili, with more and more creators livestreaming themselves studying. The viewers tend to form a parasocial connection [2] with the content maker. The YouTubers use aesthetic work setups along with nature backgrounds and instrumental studying music. Aestheticism tends to make a student "romanticize" studying [3]. An all-time live YouTube video of the "Lofi girl" studying attracted a lot of users and inspired many YouTubers [4]. Lofi music has proved to cause nostalgia in viewers, bringing a feeling of calmness and creating a comfortable virtual environment to study. It makes students feel connected to their past, which makes them feel like they belong and are part of a greater audience who is also currently studying with them. A study shows that aesthetic videos before the Covid-19 pandemic had words such as 'love' and 'beautiful' in their

comments, but after the pandemic, the comments had words such as 'assignment' and 'study' [5].

Several Discord servers are educational servers with study groups moderated by admins. Study Together and StudyStream are one of the largest study group servers with over 400,000 and 200,000 users [6]. The common features in most of these groups are – accountability channels, muted video calls and screensharing, study tips channels, and updating session goals when you join the group. The accountability and study tips channels are where students share texts about their progress and goals along with helpful tools they use or studying habits they follow. The muted video calls and screensharing serve as a place where students can feel the social presence of another person who is also working hard and focusing on their studies. There are other channels too where students can unmute their mics and discuss what they have studied using the Feynman Studying Technique [7], work together listening to a shared playlist, as well as games or movies for a longer break. The whole platform serves as a mental model of a real-life classroom where students can see one another, talk to one another during breaks, have a social life, and connect with each other.

2 MOTIVATION

Wang, G. and Zhang, Y., in their study [8], show how 12 famous streamers studying on Bilibili are unemployed, students, or accountants but all of them are studying and preparing for an examination. Their main reason to live stream was to find company while studying for long hours at a stretch. The viewers are college students looking for company and motivation. The viewing effect of watching someone studying inspires another person to study [9]. Most of the streaming videos do not show the streamer completely, only their hands making notes or typing or programming. Even though no direct instructions are given on studying, students form a sense of community (SOC) through self-regulated learning (SRL). Most students on Discord do not know each other's names. A study shows that anonymity proves to provide more social engagement [10].

Studies on predicting the drop-out rate of MOOCs [11] [12] show that social interaction helps students stay motivated and participate in discussions. In a

shared study space, these discussions could take place more synchronously as one would find a classmate to discuss a topic with more quickly.

Productivity and accountability prove to be positive sources of motivation in a shared study space. The application Forest is used by more than 2 million users to sync timed study sessions, at the end of which the user plants a tree in their virtual garden [13]. It is used to follow the Pomodoro Studying Technique [14], and the Forest Study Chat server on Discord [15] has continuous updates on studying sessions starting every few minutes. Productivity also increases by viewing other students' daily routines.

A negative outcome of a shared study group can be distractions. Students can get caught up in talking or viewing another student's content. However, this distraction is for a short time, and eventually, students will see the other people studying and retain their focus.

3 ANALYSES OF EXISTING TOOLS AND APPLICATION

Current applications that support study groups have no authentication with universities. For the same reason, students are from different time zones and age groups and study different subjects. Microsoft Teams is the only application that has a student account authenticated with the university portal. However, one must join the call to see who is currently studying, unlike Discord, where all the participants studying can be viewed. Discord does not provide complete authentication and has a complicated user-interface design [16], which does not allow it to be suitable for study groups. Other applications have been reviewed and analyzed in Figures 1 and 2. LifeAt Spaces [17] is the only platform that provides aesthetic virtual backgrounds; however, the application is based on subscription, and students need to pay for group studies.

The analysis of accountability tools in Figure 3 shows how different tools are used to track the number of hours studied or share to-do lists with friends; however, no real-time feedback or suggestions are provided to the user. To make the best use of this data, artificial intelligence can be used to interact with the user through a chatbot or a feature for daily tips and suggestions on improving their studying habits and approaching their work in different ways. Figure 4 shows a

few examples of the different studying methods and tips the accountability tool can provide based on a user's data. A list of 35 studying methods have been added in Appendix 1.

Product	Description	Pros	Cons
Discord	Video chat application	Set different channels, see who is studying on call without having to join the call, personalized usernames and avatars	No authentication, UI is complex
Microsoft Teams	Video chat application	Authentication, admin can control participants on call	No personalized usernames or avatars, cannot see who is studying without joining
Zoom	Video chat application	Admin can control participants on call	No authentication, chat history is not saved
Google Meet/Classroom	Video chat application	Admin can control participants on call	No authentication, chat history is not saved
Focusmate	Book a study session with a group on calendar	Calendar booking, personal profiles	No authentication, compulsory to keep video and mic on
Todoist	Update lists and chat with others	Productivity statistics	No video calling, no authentication

Figure 1: Analysis of Coworking Spaces - 1

Product	Description	Pros	Cons
LifeAt Spaces	Virtual dynamic backgrounds and study space	Aesthetic environment, mindfulness tool, to-do lists	Paid subscription for group study
My Focus Space	Book a study session with a group on calendar	Analysis for productivity, to-do lists	No authentication
Flow Club	Book a study session with a group on calendar	To-do lists	Paid Subscription, no authentication
Social Pomodoro	Randomly connect with someone to study with	Randomly connect with a user	No video calling, no authentication
Focused Space	Video chat application	Wake up calls, Community session, Accountability check-in	Paid subscription, no authentication
Study Together	Virtual background and study space	Analysis for productivity, to-do lists, aesthetic environment, mindfulness tool	No authentication, poor UI design

Figure 2: Analysis of Coworking Spaces - 2

Product	Description	Pros	Cons
Forest	Timer by planting trees with a group of people	Aesthetic timer, productivity statistics	No authentication
Marinara Timer	Directly starts pomodoro timers	Customization as well as automated timer	No authentication, no productivity statistics
Pomodor	Timer	Productivity Statistics	No authentication
FocusList		Calendar-wise productivity statistics	No authentication
Toggl Track	Track other people's progress	Calendar-wise productivity statistics	No authentication
Flow, Be Focused	Timer	Calendar-wise productivity statistics	No authentication
Snaz	Timer – Countdown and Countup	Connect with OBS for live-streaming, add timer as a widget	No authentication
Fivable	Form a group and set timer, share to-do lists	Shared to-do lists, chat in-between	No authentication

Figure 3: Analysis of Accountability Tools

Study Tip	Description
Eat The Frog	Identify your most important task and complete it in the morning. Eat your Frog = Eat your Breakfast!
The Eisenhower Matrix	Identify your tasks that are urgent/not urgent and important/not important.
Kanban Method	Sort your tasks into to-do, doing, and done.
Leitner System	Keep track of the things you need to revise every day, every two days, every four days, every nine days, and every fourteen days
Objectives and Key Results (OKRS)	Identify your objective and break it down into key results, that is, describe where you are going and how to get there.

Figure 4: Study Tips and Descriptions - 1

4 USER INTERFACE DESIGN

The proposed design is called Ed Study Groups, and initial prototype images created on Figma can be found on GitHub [18]. It is designed as an extension to Ed Discussions [19]. The mobile application design of an authenticated study group consists of eight screens as shown in Figures 5 to 12, which have been added in Appendix 2.

The survey results, along with the survey link, can be found on GitHub [18]. The home page consists of the courses the student is enrolled in the current semesters as well as the previous semesters (Fig. 5). The card-based design was shared as a survey to students in the human-computer interaction class enrolled in the Online Master's in Computer Science at Georgia Institute of Technology. The class uses Ed Discussion to connect with classmates as well as teaching assistants

regarding the curriculum. Ed Discussion does not have a mobile application currently. The design is such that a student can use Ed Study Groups as a form of social engagement and use Ed Discussions for formal discussions. To switch from one to another, the account settings page (Fig. 12) has the option to open Ed Discussions.

A total of 73 participants participated in the survey. The survey was shared with 6 participants not in the human-interaction course and who have not used Ed Discussion before. Overall, 84% of the students are willing to use an authenticated virtual study platform. The prototype is card-based, and Figure 13 shows that 93% of the participants, on average, found the eight screens of the mobile application easy to understand.

The connect feature (Fig. 8) shows how a student can connect with someone in the same course they are enrolled in currently or a student studying another subject in the university and is available to study for one, two, or three hours. The number of hours and course/university need to be selected before pressing the "connect" button. The feedback provided by one user was to not set the required hours beforehand but let the students decide the number of hours they want to study once they find a suitable friend.

Along with this connect feature, a group of students can listen to music together, have movie nights or game nights, hold weekend discussions, and teachers can conduct live office hours (Fig. 7). It is like a virtual classroom where there are different classes going on. One can switch from one class to another by selecting the drop-down menu of classes at the top of the screen or going to the home page and selecting the particular class (Fig. 6 and 7).

The profile information screen displays the courses a student has taken in the past semester along with their specialization and expected graduation date (Fig. 10). In this way, online students can also meet during the graduation ceremony.

Figure 14 shows that users who did not use any form of timers before are willing to use productivity tools. Personalization mentioned in the survey was for usernames and avatars. 75% of the participants agreed to use customized names and avatars.

5 DEPLOYED WEBSITE

The website (https://ed-study-groups.web.app/) is a functional website where students can login using Google. The user's name and profile photo get directly imported. It is similar to the idea that when a user signs in, their information and student ID are loaded into their profile. This prevents continuous supervisation on students as action is recorded in their student account and action can be taken by the university.

The accountability chatbot is also integrated into the study group for personalized recommendations and guidance. This tool is linked with ChatGPT 3.5 and is trained on the listed study methods (https://app.chatgptbuilder.io/web-chat/?p=1952388&ref=1682998930209)

6 SCALABILITY

The scaling of an idea is equivalent to the additional cost per student [20]. The proposed idea of an authenticated virtual study group, along with personalized accountability tools, would require high maintenance for the privacy and protection of data as well as supporting thousands of video calls. An additional cost would be required for the architecture, but when divided by a large number of students, it would result in a minimal amount. The warnings against a user for misconduct can be stored and reviewed instead of having teaching assistants supervise the group continuously. A lot of resources would go into building a personalized accountability tool. For a generic relatable response, it could be integrated and trained with ChatGPT [21].

7 FUTURE WORK

Future work includes applying machine learning to a user's data to analyze their studying habits and automate their daily schedule and to-do lists. The software can learn the most productive hours of a student and suggest completing the most challenging task. It can learn when a student tends to procrastinate and suggest completing the easiest task by converting an assigned reading to an

audiobook. Empirical research will be conducted based on the feedback of the website and activities in the study group.

8 CONCLSUION

Students find their own way of studying and connecting with each other. They either form their own small groups or be a part of a community like “study with me” on YouTube [1] or Study Together and StudyStream Discord servers [6]. With more online degrees becoming available, such as those provided by The Open University and the University of the People, social engagement platforms need to evolve from discussion threads to authenticated study groups that provide better connecting features and personalized settings. The proposed design of an authenticated group supports all these features. It need not be restricted to online programs, even on-campus students can solve their assignments together after classes on this shared platform. Students may not always join, the way they do not always participate in the forums, but they would always have a group of people with shared interests with whom they can study together.

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APPENDIX

1 Study Methods and Description

Sr. No.	Study Method	Description
1.	Eat The Frog	Identify your most important task and complete it in the morning. Eat your frog = Eat your breakfast!
2	The Eisenhower Matrix	Identify your tasks that are urgent/not urgent and important/not important.
3.	Kanban Method	Sort your tasks into to-do, doing, and done
4.	Leitner System	Keep track of the things you need to revise every day, every four hours, every nine days, and every fourteen days
5.	Leitner System	Keep track of the things you need to revise every day, every four hours, every nine days, and every fourteen days
6.	Objectives and Key Results (OKRS)	Identify your objective and break it down into key results, that is, describe where you are going and how to get there
7.	80/20 rule (Pareto Principle)	80% of your results come from 20% of your efforts. Identify the tasks that need majority of the work done when you begin.
8.	Seinfield Method	Identify a task that needs to be done on a daily basis to form a habit
9.	Reverse Planning	Identify a task that involves working backwards from a deadline and breaking a task into smaller, manageable parts
10.	Active Recall	Identify a task that involves actively recalling information from memory, such as by taking practice tests or quizzes

		(Example - Learning a new language, interview preparation)
11.	Mind maps (Anki Web is a famous software)	Mindmaps help create visual representations of concepts or ideas, using diagrams or flowcharts to help you understand and remember information
12.	Cornell Method	It is a note-taking system that involves dividing your notes into three sections – a small section for the main points, a larger section for details and examples, and a summary section at the bottom
13.	The Learning Pyramid	Identify tasks that require passive learning (less effective) such as reading and listening to lectures compared to active learning (more effective)that involves doing such as practicing, teaching, discussing the material with others
14.	SQ3R Method/SQ4R (Survey, Question, Read, Reflect, Recite, Review)	Survey, Question, Read, Recite, and Review – This method is a systematic approach to read and study textbooks. Survey the material by reading headings and subheadings, formulate your questions, read and recite answers to your questions, review the material by summarizing it
15.	Mind Palace Technique (Method of Loci)	Create a mental image of a familiar location and associate different pieces of information with different locations within that space
16.	Chunking Method	Break down long reading assignments into smaller subtopics, which can help you focus on one piece of information at a time

17.	The Reflection Method	Take time to reflect on what you have learnt and consider how you might apply that knowledge in different situations
18.	The Analogical Reasoning Method	Compare the new information to something you already know, or using a metaphor to explain the new information
19.	The Inquiry Method	Asking further questions on a topic to deepen the knowledge
20.	Reading Aloud	Read notes aloud
21.	The Mnemonic Devices Method	Using memory aids such as acronyms, rhymes, or songs to memorize lists, formulas, or vocabulary words
22.	The Feedback Method	Involves seeking feedback from peers or instructors on your performance
23.	The Brainstorming Method	Generate a list of ideas related to a topic or question without worrying about their quality or relevance
24.	The Multi-Modal Learning Method	Using different senses such as light, sound, touch to learn and remember information
25.	Mindfulness	Taking a few minutes before studying to clear your mind and study with a calm and centered mindset
26.	The Storytelling Method	Using stories or narratives to help you remember information
27.	The Dual-Coding Method	Combining words and images to help understand and remember information

28.	Pre-reading Method/Flipped Class-room	Previewing the material before starting to read or watch lecture
29.	The Jigsaw Method	Dividing topics and having each member in a study group become an expert on one of the parts and teaching it to one another
30.	The Mind Dump Method	Write down everything you know about a topic, then organize and review the information to identify gaps and reinforce learning
31.	The Gamification Method	Reward yourself after completing a set of tasks
32.	The Exercise Method	Taking breaks during studying to engage in physical exercise. This can help you improve focus and reduce stress and anxiety (Example, play with a ball, learn a dance move)
33.	The Dual-Language Learning Method	Learn a material in two languages to improve retention and enhance language skills
34.	The KWL Method	Know, Want to know, Learned Method
35.	The Six Thinking Hats Method	Look at a topic from six different perspectives or modes of thinking

2 UI Design Prototype Images

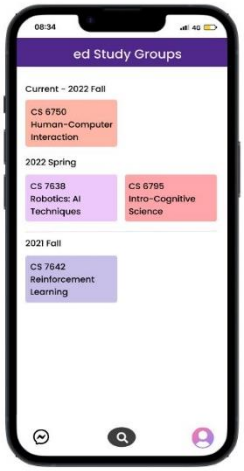


Figure 5: Home Page

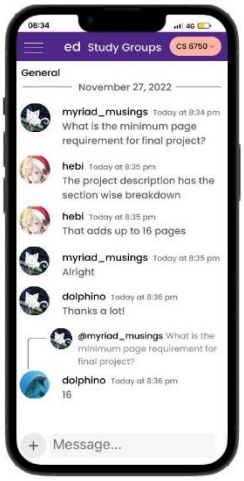


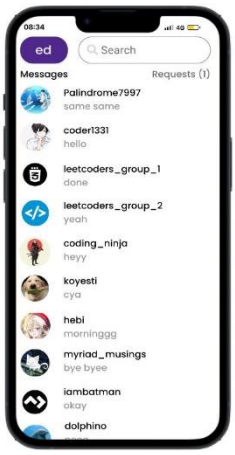
Figure 6: CS 6750 study group chat

Figure 7: Navigation bar

Figure 8: Connect feature

Figure 9: Connected with a friend chat screen

Figure 10: Profile Information



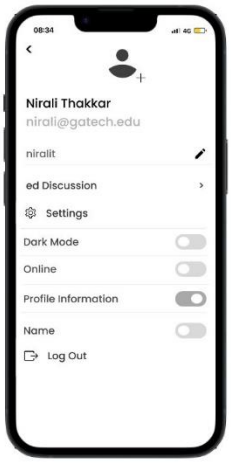


Figure 11: Messages

Figure 12: Account Settings

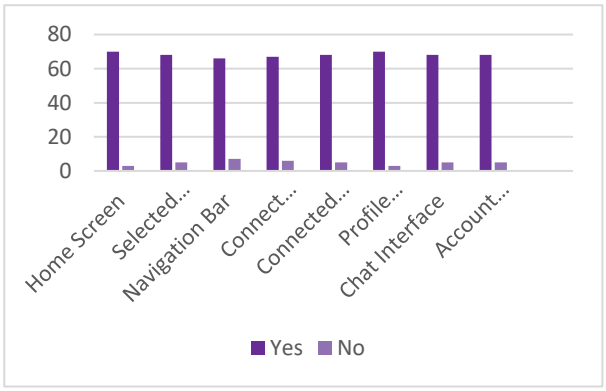


Figure 13: Eight screens of the UI design and its ease of understanding by the participants.

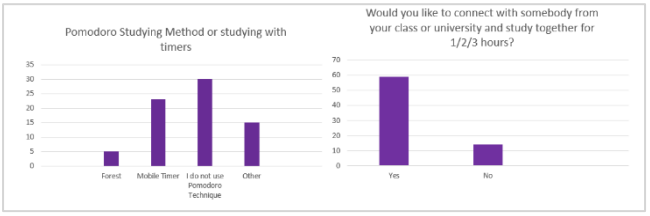


Figure 14: Participants who have not used timers or accountability tools are willing to do so after seeing the design