Study+ - A Location Aware Study Group App

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***Abstract*—Current tools for supporting study group formation, namely learning management software and social media, are insufficient as they lack social functionality and educational focus respectively. As a result, there are no effective CSCW tools that focus on study group formation available for university students. We present Study+, a location-aware study group web application that improves upon existing solutions for finding and forming study groups. We describe the design and features of Study+, present findings from initial and final evaluations and finally discuss the implications of building a study group formation application.**

***Keywords*—** CSCW; Learning Management System; Social media

I. Introduction

Cooperative learning refers to a set of instructional strategies in which students work together in small groups to help each other learn academic content. One such method of cooperative learning is the formation of study groups [1]. Although research [2] has shown that study groups benefit students by providing an environment that encourages clarification and feedback on group ideas, it has also shown that study group formation is challenging for many new students due to their unfamiliarity with others in their courses and due to a lack of overall time [2].

Although social platforms such as Facebook exist, they are not educationally focused enough to provide high amounts of value to students. On the other hand, although learning management systems (LMSs) are widely used at higher education facilities, their social components such as chat rooms are often neglected unless instructors explicitly encourage their use [3]. As a result of these limitations, there is a need for an application that delivers a robust set of social features while still focusing on the explicit formation of study groups.

Study+[1] is a web application developed by three students at the University of Victoria (UVic) that aims to do exactly this. With its simplistic interface and interactive map, Study+ offers several features to support asynchronous remote coordination and to build contextual awareness for study group participants.

To evaluate the usability of Study+, and to determine the necessity of new features, we conducted an initial round of interviews. We then developed a prioritized list of features based on the results of initial evaluation, value vs. time estimates, and relevant CSCW principles. A final round of interviews was then conducted in order to gather further data on the effectiveness of the app, its use, and its reception among the target user group.

II. Literature Review

Study groups benefit students in several ways. Rybczynski et. al. [2] found that there is inherent value in social learning, as clarification and feedback can be easily provided on thoughts and ideas. Despite this, there are still many students who decide against joining study groups. According to Rybczynski's experiment [2], the most commonly cited reasons for students not joining study groups stems from logistical difficulties such as lack of time, and difficulty in finding groups.

Learning Management Systems (LMSs) provide features to facilitate group coordination such as chat rooms, discussion groups, and forums. These systems are widely used by educational institutions. A study by McGill et al. [3] shows that social components of LMSs that could be used to facilitate group coordination are often neglected unless instructors explicitly encourage their use. This is due to the fact that LMSs are typically perceived as instructor-driven content delivery platforms rather than platforms for collaboration and social connection.

As a result of these limitations, some students gravitate towards more lightweight, socially focused platforms such as Facebook [4]. However, studies shows that students who use Facebook to form study groups have concerns centered on the lack of educational organization and privacy [5]. Nicole Ellison et al. [4] found that first year undergraduate students use Facebook mainly for social purposes, and secondarily for informal learning purposes (i.e., for student-to-student interactions including the formation of study groups).

On the whole, social media sites like Facebook provide a sense of ownership of the learning process by directly involving students in social interactions, but ultimately fail to provide a formal structure in terms of educational content. Although they can be used to support communication and awareness, the workflow for forming a group is too complex, and features such as news feed and messages can be distracting. On the other hand, LMSs are well tailored to this educational focus, but lack the student-driven social incentive to promote collaborative group work [6]. In other words, they help students to keep group memory and establish common ground, but lack communication and collaboration channels.

[1] https://github.com/scottlow/studygroup_client, https://github.com/scottlow/studygroup_server

Furthermore, the level of coupling between users has implications for the design of CSCW systems [7]. Study group formation is a loosely coupled activity, as group members are autonomous and weakly interdependent. As a result, applications designed to support study group formation must support the development of contextual factors, as these act as a foundation for lightweight communication and information sharing [8].

These aforementioned contextual factors can be developed using awareness mechanisms that keep members up-to-date on meaningful events (e.g. who joined the group, etc.). It is important to support proper levels of communication and coordination for groups so that members can achieve common ground and acquire activity awareness [8]. For study group formation specifically, planning and scheduling of individual group sessions must be supported.

The socio-technical dimensions of study groups should also be considered when designing tools that specifically target study group formation, as the tools may be resisted if they interfere with pre-existing social dynamics between students [9]. In order to design effective tools for supporting study group formation, one must understand how study groups are formed, and find ways to provide value to all study group members.

We proposed to evaluate and modify a partially implemented CSCW tool called Study+, which aims to help students improve their experience with forming study groups. Study+ aims to deliver features that improve the coordination process of forming study groups, and that better support the communication process before actual meeting times.

III. Study+

Study+ is a web application created by three University of Victoria students. It was developed to help students (especially those who may not know many people in their courses) find others to study with, and was designed primarily to focus on the one-time, impromptu formation study groups, rather than to facilitate recurring study sessions.

The initial version of Study+ was developed using various modern web frameworks such as Django and the Django REST Framework for the back end, and AngularJS and Twitter Bootstrap for the front end. A REST API was selected for the back end, as this would allow for a native mobile application to be developed without requiring any sort of server-side refactor as the implemented REST endpoints can be used to communicate with the MySQL database regardless of client-side platform. AngularJS was selected for the front end, as Study+ is primarily a data-driven application, and as a result, lends itself well to the Model-View-Controller (MVC) software development pattern that AngularJS supports.

Study+'s initial design and feature set was based only on a small number of discussions done mostly with Computer Science and Software Engineering students. Furthermore, although it is an application that attempts to enhance both communication and awareness for distributed groups of students looking to find others to study with, Study+ was designed without any formal background on CSCW principles.

As a result of these limitations, this study aimed to expand the requirements gathering process to a more representative sample of the University of Victoria's student body, focusing on gathering both positive and negative feedback, while also gaining insight on how students study and form study groups. Combining these findings with relevant CSCW theories, a list of high value features was devised and prioritized, and development work was done to improve Study+ before final evaluations took place. This section of the report will outline the user interface of Study+ before moving on to a discussion on the features that were added in response to user feedback obtained from initial interviews.

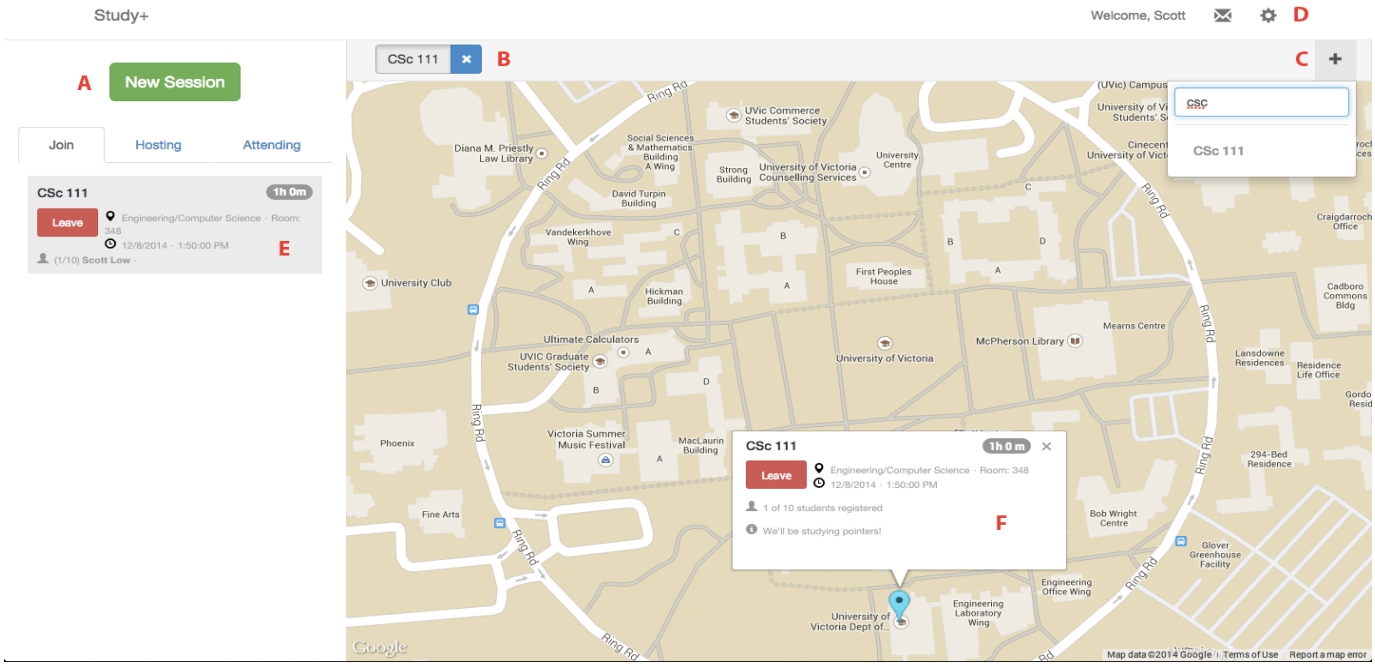

Figure 1. Study+ User Interface

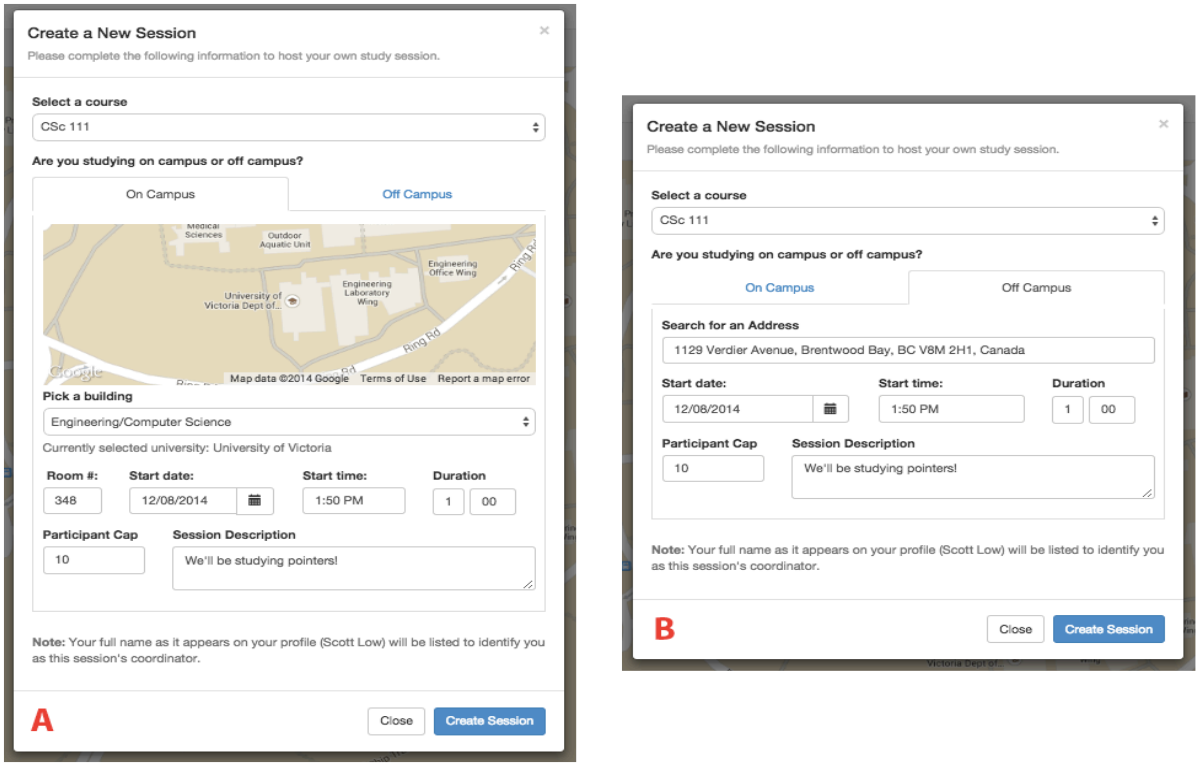

Figure 2. On Campus and Off Campus Session Creation Dialogs

A. User Interface

After signing in, signing up, or pressing the "Get Started" button on the welcome screen, users will be presented with the interface shown in Figure 1. The UI is broken up into four major components, namely the navigation bar (D), the courses bar (B and C), the sidebar (A and E), and the map (F). The following section will outline the function of each component as well as any relevant design decisions.

1) *Navigation Bar:* The navigation bar (D) contains all user-related navigation links. Clicking on the envelope icon opens the messaging centre, while clicking on the gear icon gives users the option to view help, edit their profiles, and sign out.

2) *Courses Bar:* The courses bar is where users can add the courses they are currently enrolled in. Courses are automatically populated from the UVic database using a Python script, and adding a course is as simple as searching for a course and selecting it from the dropdown menu (C). Once a course has been added, any study groups that exist for that course will appear in the sidebar (E). Furthermore, all courses a user has selected will appear as pills on the course bar (B). Clicking these pills allows users to quickly show/hide study groups for a specific course, while clicking the blue "X" will remove that course from the user's course bar.

It was decided that courses would need to be added before specific study groups would display because during the initial round of interviews, students said this is the main way that they would wish to find study groups. Some later interviewees said that having the ability to look for groups based on courses with related material, and based on more general terms such as "resume workshops" would be useful, but for the scope of this study, no changes were made to this workflow.

3) *Sidebar:* The sidebar is where most of the functionality of Study+ is implemented. Clicking the "New Session" button will open the Create New Session dialog box (see Figure 2), giving users the option of creating either an on campus or off campus study group by filling in the required fields.

The sidebar also has three tabs that allow users to filter the study groups that display both in the sidebar and on the map. The first of these, the Join tab, allows users to browse all available study groups for the courses that are currently selected (and enabled) in the course bar. The second of these, the Hosting tab, allows users to see which sessions they have currently created. Finally, the third of these, the Attending tab, allows users to see which study groups they are currently attending.

Below these tabs is a list of cards, with each one representing a unique study group. Hovering over any of these cards will open an information bubble for its respective study

group on the map (F), allowing users to easily scroll through the list and find study groups in locations that are convenient for them. Clicking on any of these cards will cause the information bubble to remain permanently open until a new card is selected, giving users the opportunity to focus on the details of a particular group.

4) *Map:* The map of Study+ is designed to be the main way that users discover and join study groups. This was done since several early interviewees stated that they would be much more willing to join study groups that were close by, especially given Study+'s focus on impromptu study group formation. As a result, the map takes up the majority of the screen, allowing users to find study groups that are close to them with ease. Pins of different colors (blue for available, green for hosting and yellow for attending) also make it simple for users to visually parse their different types of study groups.

Similar to the study group cards in the sidebar, hovering over any pin will cause an information bubble to pop up, while clicking on a pin will open the information bubble permanently unless another study group is selected. In the event that there are multiple study groups at a single location, clicking a pin on the map, or a card in the sidebar that corresponds to a study group at a duplicate location will cause all study group pins at that point in the map to expand as in Figure 3 below.

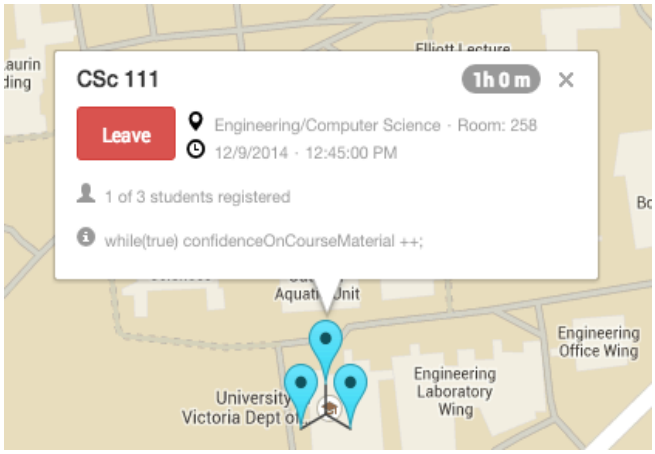

Figure 3. Multiple Study Groups at a Single Location

B. Functionality

After the trends from the first set of formal interviews were analyzed, several features missing from Study+ were identified. A summary of these, as well as the relevant CSCW research that relates to each one is presented below:

1) *Improved Contextual Awareness:* An important aspect of encouraging communication and collaboration in distributed environments is building a sense of contextual awareness [8]. As a result, several interviewees brought up the fact that they would be wary of joining study groups with strangers unless they had more information about their level of study, study habits, and learning styles. In response to this feedback, the concept of user profiles was added to Study+, requiring students to specify their year, level and program of study as well as their learning style when signing up. These profiles can be viewed by anyone browsing Study+ by clicking on a student's name in a study group card in the sidebar.

In addition to user profiles, several interviewees also stated that having more information on what topics/chapters a study group was focussing on would be beneficial for creating a sense of context and understanding between group members prior to meeting. To address this, a required description field was added to study groups to allow group creators to provide more information on the specifics of their groups.

2) Off Campus Locations: Another highly requested feature for Study+ was the ability to create study groups at off-campus locations. In response to this, the Google Geocoding API was used to allow users to enter an address and have this converted to a latitude and longitude that would be recorded in the database and displayed on the map.

IV. User Study

The User Study for Study+ was broken down into two smaller studies that were carried out at different points in the development cycle. The first of these was the initial evaluation, which aimed to both obtain information on how students currently form study groups, and to obtain an initial round of feedback on Study+.

The second study was the final evaluation. Similarly to the initial evaluation, the final evaluation consisted of semi-structured interviews with a question set that was identical to that asked previously aside from a section dedicated to collecting qualitative data. This was done so that students who had been interviewed previously during the initial evaluation and students who participated only in the final evaluation could be interviewed using the same set of questions. Furthermore, it allowed us to test our hypothesis of whether or not the improvements made to Study+ resulted in a more positive response from students, and also allowed us to obtain data on the perceived overall effectiveness of both existing and newly implemented features.

A. Initial Evaluation

This study was an exploratory study with a goal to better understand study group formation amongst students, to gather requirements, and to obtain an initial evaluation on Study+. The study consisted of semi-structured interviews that were carried out on a representative sample of students from the University of Victoria.

We interviewed 13 UVic students. The participants were from different departments and different cultural backgrounds. 8 of them were first year students, 4 were second year students and one was a third year student. The age of participants was 18-25 (mean=21, median=20).

1) *Procedure:* Participants were first introduced to Study+ and provided with a consent form. First, we asked participants some demography related questions (age, year of study, department, etc.). Then we asked exploratory questions to better understand their study habits, study group preferences,

and experience with forming study groups. This was followed by questions related to existing solutions they use to form study groups as well as questions aimed to elicit requirements for study group formation tools in general. After this, a demonstration (Q&A) of Study+ was given to the participants. Finally, we gave them 15 minutes to explore the app and asked them their thoughts and feedback on this application.

2) *Findings:* Below we discuss the findings from initial evaluation:

The most common way for students to form study groups was to simply ask members from their classes (9 of 13 respondents said they do this). In terms of specific technologies used, cell phones (texting and/or calling) were the most commonly used with 7 out of 13 respondents stating that they used cell phones to organize study groups. Facebook was the second most commonly used technology for study group formation, with 6 out of 13 participants stating that they use it to form groups. Despite Facebook being a popular choice, participants had several complaints about it such as the fact that it lacked an RSVP system without creating groups/events, and that it was hard to always get replies back from people in a timely manner.

In addition, 5 of 13 respondents mentioned that they have asked strangers in their classes to form groups, while another 5 of 13 respondents stated that they prefer to study with friends. Only one student mentioned that they did not like to study in a group setting. Furthermore, the most common difficulties that students found in forming study groups were dealing with conflicting schedules, and the fact that finding and organizing people to study with was hard to do with current technologies/approaches.

Students have different preferences for study group members. Studying with the wrong people can affect the quality of group study. Students prefer small study groups (3 to 5 people) and group members who have similar learning styles as them. Furthermore, some participants (6 of 13) said they prefer to study in groups whose members were all equally familiar with the material, while others (5 of 13) said they prefer to work with those who have slightly more knowledge on the subject.

Students have different preferences for study group application features

Before showing them Study+, we asked the participants what they thought were the most important features for a study group formation application. The most requested features were calendar integration, the ability to host groups at on and off campus locations, user profiles, chat, and notifications or reminders. Other less requested features were the ability to display locations on the map, a pre-populated list of courses, a name list of classmates for each course, calendar integration, and a responsive and usable UI for mobile devices.

3) Design Implications: Based on the results of the initial evaluation, we created a prioritized list of features based on the amount of value each feature would provide vs. the amount of time each feature would take to complete. Since requests for limited group sizes and for more details on groups came up often in the initial evaluation results, we decided to add participant caps and descriptions to study groups. Furthermore, we decided to implement off-campus locations for study groups as one interview participant mentioned that they would like to use Study+ coordinating study groups at home or at coffee shops.

Other features that were highly prioritized on the value vs. time scale were the ability to export study groups to users' calendars, and to provide email notifications. While work was done towards implementing both of these features, various bugs prevented them from being fully functional at the time of final evaluations. Despite these setbacks, we were able to explain these features to final evaluation participants and obtained a large amount of positive feedback on them as a result.

V. Final Evaluation

The aim of the final evaluation was to evaluate both the usability of Study+ as well as the effectiveness of its core features. The final evaluation consisted of semi-structured interviews with a question set identical to that used in initial evaluations aside from the addition of a quantitative data section that allowed participants to quickly rate the effectiveness of both initial and newly implemented features.

We interviewed 25 UVic students. The participants were from different departments and different cultural backgrounds. 9 of them were first or second year undergrad students, 5 were third year undergrad students, 6 were 3+ year undergrad students and 5 were master students. The age of participants ranged from 16-27 (mean=22.5, median=22).

A. Procedure

Participants were first introduced to Study+ and provided with a consent form. If the participant being interviewed was a new interviewee, followed a similar procedure as in the initial evaluation, asking them some questions on their background followed by open-ended questions focused on better understanding their study habits, better understanding their experiences with forming study groups, and better understanding the requirements that would make a study group formation application appealing to them. This was followed by a demonstration (Q&A) of Study+. Finally, we gave them 15 minutes to explore the app and asked them their thoughts and feedback on this application. If the participant being interviewed had been interviewed previously, they were given a short summary of the major features added during the implementation phase, followed by a 15-minute exploratory session of the new version of Study+. We then asked some application specific follow up questions in order to obtain their thoughts and feedback on the changes that were made.

B. Questions

Participants were asked the strength and weakness of Study+ and if they would use the application in the future. We also asked participants to rank the amount of trouble they had

using Study+ as well as the effectiveness of key Study+ features on a scale of 1 to 10 (1 being difficult/not effective and 10 being easy/effective). To analyze responses of open-ended questions, we used methods from grounded theory [10]. We started with open-coding to define initial categories. We then performed axial coding to confirm that our open-codes correctly represented the interview responses and to merge related categories where necessary. In the case where an interview participant gave multiple responses, we coded all responses separately.

C. Findings

Overall, Study+ received positive feedback from participants. Despite missing some key features such as chat, Study+ was considered to be a useful tool for both finding existing study groups and forming new ones.

1) Strengths: After final evaluation data was analyzed, the following aspects of Study+ emerged as strengths. For a summary of the number of participants (out of 25) who commented on each strength of Study+, see Table I below. The number in brackets represents the number of participants who supported that strength.

Simplicity: A large number of interview respondents found that Study+ extremely easy to learn and use. This will contribute greatly to ease of adaptability upon release. Furthermore, by only focusing on impromptu creation of study groups, we believe that Study+ has a limited enough scope to provide a large amount of value without the overhead experienced with other tools such as Facebook.

> "Its straightforward", "not overwhelming", "easy to use".

Map: The map feature of Study+ was also widely regarded as a useful feature as it allowed users to quickly find study groups nearby. In addition, Study+ helps to build contextual awareness (for students who may not be familiar with certain campus buildings, for example) by displaying study groups as pins on the map.

> "I like the idea to view the map when creating a session, because if you're new to UVic, you may not know the name of the building."

UI: Several participants stated that Study+ had a simple and minimalistic user interface, a fact that contributes to its simplicity. While there are still several minor UI tweaks that were not implemented in time for the final evaluation, we believe that this is a promising sign moving forward as the major UI elements are laid out in a way that is both accessible and meaningful to users.

> "Clean UI", "Everything is well layered out", "I liked visual aspect when it worked."

Course Search: Participants liked that study groups in Study+ were connected to courses, and that searching for courses was easy. While a few respondents stated that having other ways to search for study groups (based on courses which cover the same or related material, for example), the majority of them were happy with the current association of study groups with single courses.

Options for Location Selection: Participants liked that they had the option of being able to choose from either on or off campus locations when creating study groups.

> "Off campus locations are also well executed and useful. Especially useful for people who want to study during reading break/weekends and who are from out of town. "

Participant Cap: After initial evaluations, several participants stated that study groups needed a participant cap or else groups could quickly grow to be unmanageable. Adding this feature in resulted in a large amount of positive feedback during the final evaluation.

> "Love the participant cap, as this is something that turned me off from using the application originally."

Study Group Description: Participants liked the contextual awareness that study group descriptions provided, as they allowed them to quickly see what topics were being covered by which study groups.

> "Easy to find someone who set the same learning goals."

Profile: Participants also liked the contextual awareness provided by user profiles as they helped users to find others who are similar to them in terms of study habits, learning styles, and year/program of study.

> "Adding user profiles was also a good call, as it helps to provide background on who I will be studying with."

Learning Style: Of all the fields in the newly added user profiles, a few participants explicitly called out the learning style field as being the most useful, as they stated that it would be ineffective to study with those who learn differently from them.

Information Bubbles on Map: A small number of participants stated that they liked that hovering over a study group card in the sidebar highlighted that study group on the map. They found that this helped them to gain contextual information about that study group (number of participants, location, time, duration) without breaking their current browsing workflow.

> "I like that mouse hovering on [the sidebar], pops up [a pin] on the map."

TABLE I
STRENGTHS AND WEAKNESSES OF STUDY+

Strengths	**Weaknesses**
Simplicity (15)	Lack of Filtering (8)
Map (13)	Course Button (7)
UI (10)	Bugs (7)
Course Search (5)	UI Inconsistencies (7)
Options for Location Selection (4)	User Help (4)
Participant Cap (3)	Lack of Calendar (4)
Study Group Description (3)	Shareable Study Groups (3)
User Profiles (2)	
Learning Style in User Profiles (2)	User Trust (3)
Info Bubbles on Map (2)	Privacy (2)
Miscellaneous (4)	Miscellaneous (2)

2) *Weaknesses:* After final evaluation data was analyzed, the following aspects of Study+ emerged as areas for

improvement. For a summary of the number of participants (out of 25) who commented on each weakness, see Table I above.

Lack of Filtering: Many participants stated that although Study+ had the ability to filter study groups by course, (by clicking course pills in the navigation bar) this was not enough when there were a large amount of groups in the sidebar. As a result, having the ability to filter by time/proximity was requested, as was the ability to search for locations directly on the map.

Course Add Button: When a user first signs into Study+, the course bar is empty and no study groups are shown on the map. Several participants had difficulty understanding that the "+" button was actually an add course button and that courses had to be added before study groups would be displayed. After having this explained to them, users stated that it would have been more clear if the "+" icon were an actual button, or if there were some indication of what the button did.

> "It's hard to see the "+" button."

Bugs: Some new features of Study+ (such as iCal integration) were not fully tested and there were some minor bugs that came up during final evaluations.

> "Bugs are problematic, but okay because they should be fixed in the future."

UI Inconsistencies: There were some UI inconsistencies in Study+ such as the fact that the right-side menu bar was not aligned properly. While minor, these are all low-cost fixes that will help the application feel more polished. As a result, they should be fixed before deployment.

User Help: Study+ lacks user feedback in many places. For example, there is no feedback when a user enters a wrong password, nor is there confirmation when creating an account. This lack of user help led to some participants becoming confused during the final evaluation when something did not work as expected.

> "It was a little frustrating in the beginning, as I was expecting some response from the Study+ app. But it was fine once I figured out that the app did not always provide feedback."

Lack of Calendar: Several participants complained about the lack of a calendar display that shows a timeline of study groups.

> "No integrated calendar really turns me off."

Shareable Study Groups: Although Study+ is designed to only allow registered users to join active sessions, some participants said that they would like if the application generated a shareable link that would allow them to invite their friends to the application/a specific study group.

User Trust: Currently, Study+ does not have any method in place to ensure that students actually show up to study groups. There was some concern from participants about this issue, and rating/karma systems were proposed as potential solutions.

Privacy: Currently, Study+ displays the real names of students on study group cards in the sidebar. A few participants expressed privacy concerns around this and stated that they would feel more comfortable if usernames were displayed instead.

> "Needs more privacy settings, such as the ability to display usernames rather than real names."

Miscellaneous: There were few responses that we were not able to categorize. These include issues such as separating 'lab' study sessions from course study sessions, localization for multiple languages, etc.

Interview participants were asked to rate the difficulty the Study+ on a scale of 1 to 10 (where 1 meant very easy and 10 meant very difficult). We received a score of 2.22 on average (median=2, SD=1.37).

We also asked participants to rate the effectiveness of key Study+ features on a scale of 1 to 10 (where 1 meant not effective and 10 meant effective). Table II summarizes the results. 7 of the 9 features are very effective (mean > 7 and median > 7). Study group descriptions were rated as the most effective feature of Study+ (mean=9.3, SD=1.05). Based on detailed interview responses, this is due to the fact that study group descriptions help to build contextual awareness for students before they join groups. Surprisingly, user profiles, which also help to building contextual awareness and common ground between members, were rated as least effective (mean=5.61, SD=1.94). Currently, Study+ user profiles display users' full names, their year of study, program, learning style and an optional description. This low rating may be due to the fact that user profiles do not provide enough information to build a sense of common ground, or due to privacy concerns as discussed earlier in this report. As a result, further research is required before we can confirm these claims.

TABLE II
EFFECTIVENESS OF KEY STUDY+ FEATURES

Feature	Mean Score	Median	SD
Study Group Description	9.33	10	1.05
Participant Cap	8.30	8.5	1.85
Join Tab (Ability to view available study groups)	7.88	8	1.39
Map	7.58	8	2.15
iCal Integration	7.46	8	2.60
Off-Campus Locations	7.19	7.25	2.39
Email Integration	6.83	7	3.01
User Profiles	5.61	6	1.94

The added participant cap is the second most effective feature (mean=8.3, SD=1.85) of Study+. During the initial evaluation and requirements gathering phase, users expressed concern about the lack of size limitations for study groups. Although research shows that groups of size 3-4 are significantly more productive and more developmentally advanced than groups with larger size (5 or more members) [11], users stated that they have different preference for group size, (e.g. some like to study in groups of 2, whereas some like to study in groups of 7 or more). As a result, giving users the option to explicitly

specify the maximum size of group gives them more fine-grain control over the study groups they create.

TABLE III
EFFECTIVENESS OF KEY STUDY+ FEATURES

Response (Total count)	Reason	Count
Yes (21)	For study purposes	11
	Study+ popularity	5
	Advertisement of Study+ on University's website	2
	Mobile-friendly app	2
	Friends are on Study+	1
No (2)	Don't prefer to study with strangers	2
Maybe (2)	Don't have classes or exams	1
	For study purposes	1

We also asked the participants if they would use the application in future. Table III summarizes the results.

Study+ attract many students as it is designed for study purposes, i.e. to find or form study groups.

> "Useful, easier to find a study group now than searching with Facebook."

Study+ popularity is important for new users to start using the app. Interview respondents confirmed that Study+ will only be popular once it achieves a critical mass of users.

> "Yes, if the user base is large enough."
>
> "Probably not because I have a well-established group of friends to study with. If my friends were willing to use the app, however, I'd probably use it to say where I am/when to encourage meet-ups."

Study+ advertisement on University's website is important. Users want some sort of authenticity of this application. Official endorsement of Study+ is important to users.

> "If there's link on school website, then I feel many people in school will use it."

Mobile friendliness of Study+. Being mobile friendly is useful for users, as they can search for nearby study groups on their mobile phones.

> "Yes, if app supports mobile. It would be helpful and convenient."

Users study habits may cause Study+ to be less appealing to them. For example, some people do not like to study with strangers while others do not like to study in groups.

> "I don't like strangers so no."

Whether or not users are taking classes or exams may cause Study+ less appealing. Users who are not taking any classes may not want to study in groups. This especially applies for grad students.

> "Don't have any exams and classes."

VI. THREATS TO VALIDITY

The main limitation and threat to validity of this study lies in the fact that only one person performed qualitative analysis. This may have introduced some bias in the results. In the future, we plan to reduce this bias by having two or more people performing the qualitative analysis and then calculating the inter-rater agreement. Furthermore, our study was conducted with a small number of participants, who were a sample of UVic students. Their opinion may not generalize to all students. We attempted to mitigate threats to validity by interviewing participants from different year of study, different departments, and different cultural backgrounds.

Another threat to the validity of this study was the fact that most interview participants had never used Study+ before. As a result, the 15 minute exploratory session may not have been enough time for them to fully understand the application and provide feedback on it. Ideally, we would have liked to perform a more comprehensive field study to better understand how Study+ would be used among students, but this was not possible due to time constraints. Conversely, there is also threat to internal validity as some of the users who participated in initial study also participated in final evaluation. This could have introduced bias in the results due to a learning effect caused by repeated testing.

VII. DISCUSSION

The most important observation obtained from this study was the fact that in order to create a successful CSCW application, developers must have a clear understanding of the problem space at hand and how tasks to be supported are currently carried out. Although there is a great deal of literature available to support these findings [12], this was not consciously thought about at the time of initial requirements gathering for Study+. As a result, the respective strengths and weaknesses of existing study group formation solutions (LMSs and social media platforms) were not considered, and the client and server-side architectures resulting from the requirements gathering phase were not designed to support several key features without requiring a sizable refactor.

The major feature that was missing from Study+ (as noted by 5 of the 13 initial interview respondents) was group chat. A real-time group chat would have solved both synchronous and asynchronous communication related issues. Although the need for this was obvious after reading literature based on the advantages of using social media platforms to form study groups, it was non-trivial to implement given the fact that Study+ had not been designed to support it. As a result, despite our efforts to complete chat before final evaluations, technical issues with XMPP servers and client-side integration caused schedule slippages that prevented the feature from being complete at the time of evaluations.

Another issue that came up during the course of this study was the fact that our final evaluation methodology changed dramatically from the beginning of the study to the end. Initially, we wanted to perform a field study for our final

evaluation, as this would allow us to see how the improved version of our application was used in the reality and would have produced a more robust data set for us to analyze. As we started to plan, however, we found it was hard to conduct a field study as Study+ supports impromptu, distributed asynchronous coordination among potential group members. Due to this, we reconsidered our research methodology and conducted semi-structured interviews for final evaluation.

VIII. Future Work

Future work for Study+ will be carried out on two levels. These are extending the app's features based on feedback and carrying out quantitative evaluation.

A. Implementation

Study+'s evaluation through semi-structured interviews provided detailed feedback and highlighted new features. Apart from small UI tweaks and enhancements, there are a number of requested work items that should be completed before Study+ is fully deployed. The future work on Study+ will include a significant amount of development time as several of these work items will require refactoring of both the client and server side architectures.

Highest in priority on the list of future work is chat, as this is the feature with the highest number of requests from both the initial and final evaluations. By implementing chat, we would allow Study+ to not only support information sharing and coordination, but also to support collaboration and cooperation, a fact that according to Neale et al. [9], will result in less distributed process loss and thus more effective study group formation.

Other outstanding work items relating to implementation include the creation of a mobile-friendly UI (a feature that will help with adoption on small-width devices) as well as the ability to renew study groups. Although the latter of these two work items would change the scope of Study+ drastically by enabling it to support both the impromptu and recurring formation of study groups, we believe that this is the correct approach to take based on the feedback obtained in the final evaluation. Finally, although this was not brought up in any evaluation responses, adding the ability to integrate with social media services (such as Facebook) may have its benefits, as it would allow us to tie in several strengths of social media (such as friends lists and chat) while still offering students a more educationally-focused platform for finding and creating study groups.

B. Evaluation

From an evaluation standpoint, we would want to conduct a simulation experiment in order to extend the research we have already conducted on Study+. We would like to plan a more extensive evaluation that would answer the following research questions:

Do students feel more satisfied using Study+ than other technologies for forming study groups?

Study+ helps coordinate the process of forming study groups. This study concluded that 21 of 25 students interviewed would use Study+. As a result, the above question could be broken down into the following questions:

1) Do students spend less time on finding study groups by using Study+?

2) Do students find more suitable groups and compatible group members by using Study+?

3) Does the use of Study+ encourage new students to find study groups rather than study alone?

Study+ aims to support students joining study groups, and as a result, also aims to enhance cooperative learning in universities. This question, and the ones preceding it, would be best answered by conducting a simulation experiment.

IX. Conclusions

We have presented Study+, a location aware study group formation web app that supports distributed asynchronous group coordination activity. We described design, features and implementation details of Study+. We have done an exploratory study to better understand the process of forming study groups, to gather requirements and to perform initial evaluation of Study+. Based on the insights obtained from initial study, we developed new features considering their importance in CSCW aspects and time-constraints. Also, we provided final evaluation on the usability of Study+. Our analysis points to strengths and weaknesses of the Study+. Overall, we received a positive feedback on the usability of the Study+.

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