System Proposal: Environmental Effects on College Studying

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Every undergraduate student is familiar with the long hours spent studying for the next big exam or working on a class project. Despite the rapid advancement of technology and educational tools, studying methods remain about the same. Recently, researchers have begun investigating the effects of an environment on a student's mental health and cognitive function, especially as undergraduate student motivation and mood continues to worsen. In my system proposal, I aim to improve my fellow UNC undergraduate students' ability to locate and personalize their studying time in spaces across campus to help improve studying effectiveness and student mental health.

Population and Setting

I developed my proposal with undergraduate UNC students in mind. I also identified three key features that influence how my system can help undergraduates choose study spaces. First, I studied general statistics encompassing the UNC student body. Next, I determined that as a result of mental health struggles, many students may be discouraged and unmotivated to study. While my system cannot address this issue directly, it could help encourage students to leave their dorms and explore new locations and hopefully make studying less tedious. Finally, I determined the best and most effective medium to reach my given population.

According to the National Center for Education Statistics, in 2021, 15.4 million students were enrolled in an undergraduate institution in the United States (NCES 2021). As of 2024, UNC-Chapel Hill currently boasts approximately 20,700 undergraduate students enrolled (UNC, 2024). UNC also houses twelve academic libraries (University Libraries, 2021), the largest being Davis Library which accommodates 3,013 people (Daily Tar Heel, 2024). From personal experience, many students feel the library system is not able to keep up with the demands of such a large student body, especially during hectic exam weeks.

In addition to the stress, students across the country have reported struggling with mental health issues due to the high-stress environment of universities today. An alarming, "…41 percent [of students] reported symptoms of depression, 36 percent said they experienced anxiety and 14 percent said they have seriously considered suicide," out of (n = 76,406) U.S. college students according to the (Healthy Minds Network, 2023). In addition to academic stress, college-age students experience rapid life changes and increase onset risk of mental illnesses (Pedrelli et. al., 2015). Ziven et. al., finds that mental health problems in college students are often long term, with many students never seeking mental health support (Ziven, et. al., 2009). During the COVID-19 pandemic, mental health plummeted (Copeland et. al., 2021) and continues to affect students to this day (Buizza et. al., 2022). In the aftermath universities have attempted to address the growing mental health crisis (Abrams, 2022).

Along with mental health struggles, smartphone usage is prevalent amongst undergraduate college students. Educause found that an estimated 99% of students own a smartphone (Denoyelles et. al, 2023), adding that smartphones, "…were better suited for quick communications and smaller academic tasks," (Denoyelles et. al, 2023). Smartphones have also increased in educational usage, as Ataş and Çelik found some of the most common uses of smartphones included calling, texting, social media, and reviewing lecture notes for self-directed learning (Ataş and Çelik, 2019). Reportedly, students also used their smartphones frequently, but only for short intervals of time (Ataş and Çelik, 2019), meaning students will likely only interact with short, less demanding tasks on their smartphones.

Problem and Need

While the link between academic success and time spent studying is generally acknowledged (Adams and Blair, 2019), researchers have only just begun uncovering the relationship between academic success and study space, and what environmental factors

affect student performance (Villarreal Arroyo et. al., 2023). Two key questions arise: How can we determine what *actually* helps students? What do students *actually* want in a study space? Some environmental factors, such as natural lighting, have been shown to improve student mood, alertness, and performance (Shishegar and Boukeri, 2016; Porras Álvarez, 2020), but many other factors still require attention from researchers. Furthermore, the connection between mental health, cognitive function, and study spaces still needs to be examined. This indicates that studying could be better personalized and integrated into student life with further research. There also appears to be a consensus surrounding positive and negative aspects of study spaces, which could give curators clues when designing new spaces and tools for users (Hegde et. al., 2018; Adityawirawan and Kusuma, 2021; Zheng et. al., 2024).

Some quantifiable measured factors have been shown to have a positive correlation with student health, mood, and academic performance, including natural lighting and noise-level(Kent et. al., 2009; Golmohammadi et. al., 2021; Jafari et. al., 2019). These quantifiable factors also tend to rate high as factors students prefer or perceive as important in a study space. Porras Álvarez (2020) found over multiple years that classes conducted in rooms with natural lighting performed better when compared to classes conducted in windowless classrooms (Porras Álvarez, 2020, p. 4166-7). Natural lighting is also linked to, "…attention, alertness, sleep quality, mood, as well as memory" (Shishegar and Boukeri, 2016, p. 154). Interestingly, natural lighting was consistently recorded as a top influencing factor amongst student needs in study spaces. One study found that across all demographics, participants instinctively associated naturally lit areas with "happiness" and darker areas with "sadness" (Morales-Bravo and Navarrete-Hernandez, 2022). Another study reports that students felt natural lighting improved their cognitive performance (Brink, et. al., 2023).

This trend seems to indicate that when users perceive something as improving their mental and cognitive function, that factor is likely relevant to their mood and motivation towards studying, such as spacing, aesthetics, comfort, and technology tools (wi-fi, chargers). Some studies support these factors: Closs et. al. (2022) observed how spacing/distance (or proximity) and room functionality influenced student engagement in class lectures. Students quickly disengaged in lecture halls with little interaction, whilst rooms with whiteboards, natural lighting, and space encouraged student interaction and interest (Closs et. al., 2022, Cayubit, 2021). Similarly, students reported valuing physical space as a factor in mentally demanding tasks (LeGrow et. al., 2023). Cox (2011) also observed how the character of a room influences its inhabitants, and especially student engagement (Cox, 2011). Zheng et.al., adds that a newly redesigned library architectural design, aesthetics, and optimal noise seemed to encourage student learning and motivation (Zheng et. al, 2024). Students also enjoyed varied spaces for different activities like individual and social areas, which helped foster a sense of community and learning (Zheng et. al., 2024, LeGrow et. al., 2023). Most importantly, these factors considered important to improving a study space remained relatively consistent across the various qualitative student surveys and interviews conducted (as seen in empirical evidence).

So, how can we determine what *actually* helps students? What do students *actually* want in a study space? I believe the key lies in observing what factors students perceive to be an improvement in a study space. Additionally, building a supportive community for undergraduates around studying may help in fostering an atmosphere of learning, as Rusticus et. al. (2023) finds social interaction and a sense of "belonging" improve student engagement and perception of a positive learning environment (Rusticus et. al., 2023). Hattie et. al. identified mobile learning apps as supplementary tools for traditional learning methods because they offer more personalization and interactivity (Hattie et. al., 2023). By leveraging

mobile app flexibility and personalization in tandem with university student smartphone habits, I believe an app focusing on a cataloguing and categorizing system of study locations based on certain attributes, such as natural lighting or atmosphere, can help students more easily and efficiently customize their studying experience. The system could also cater to more experimental study techniques and identify novel factors important to studying though user data analysis.

Empirical Evidence

Hegde et. al. (2018) found factors ranked most relevant in study spaces through a survey-based study of 165 participants, including undergraduates, graduates, and faculty, at the Texas State University library. Hegde et. al. argues that "study/work spaces" like libraries need to adapt to diverse patron needs. Categories were constructed based on different needs such as "mode preferences" (prefers to study alone vs in a group), types of assignments/tasks, individual preferences, and factors considered positive in a study environment by the participants (Hedge et. al., 2018).

One initial shock was the number of students who preferred to work in groups: 21% preferred to work solely in groups, 63% worked in groups occasionally, and only 16% studied alone. This initial finding challenges the traditional assumption of study spaces as individual places. Hegde et. al. observed that amongst all population, varied seating options, charging stations, writable surfaces, natural lighting, and separate rooms were all top preferences (in no order). Undergraduates specifically ranked varied seating, natural lighting, and printing options as their highest needs. Factors reported as positive in a study space included: natural lighting (ranked as the biggest motivator for studying), low noise level, privacy, and chargers and wi-fi. Respondents disliked noise and distractions. Some undergraduates also reported avoiding crowded areas. Hegde et. al. concludes that future learning space development may

focus on atmosphere[1] as opposed solely to physical space to best, "…provide space for multiple learning styles and types of work" (Hegde et. al., 2018). Overall, Hegde et. al.'s findings are corroborated with study data from Adityawirawan and Kusuma (2021), a similar study evaluating café environments and student preferences.

Empirical Evidence II

Busy college students have become ubiquitous in cafés, especially since cafés appear to offer many of the factors determined as positive for a study space. Adityawirawan and Kusuma (2021) conducted a study on the relationship between student motivation and a café's spatial environment, or an Informal Learning Space (ILS)[2]. Participants (n = 419) ranked factors from 1 to 10 in a survey questionnaire: section included motivations for using a café study space and characteristics of the café such as comfort (lighting, furniture, ILS size), "naturalness" (natural lighting, acoustics), layout, individualization, and privacy amongst others (Adityawirawan and Kusuma, 2021). The affective and cognitive dimensions behind the students' decision making was also observed.

Students reported that motivations for studying at a café included restoration (improvement of mood) and productivity (Adityawirawan and Kusuma, 2021). Characteristics of the café space rated highest were comfortable seating and furniture, natural scenery, café aesthetics, and device amenities such as wi-fi (Adityawirawan and Kusuma, 2021). On average, students ranked concentration and relaxation the highest motivators for studying at café, each having nearly a 9 out of 10 score. Adityawirawan and Kusuma also reviewed user affective scores (how students perceived the café) and cognitive scores (how students perceived meeting their study goals). Overall, affective scores ranked higher, indicating that students were more confident in their assessment of the study location

[1] Defined by Hegde et. al. as, "…the lighting, noise levels, views, and sense of crowdedness [of a location]"
[2] An "Informal Learning Space (ILS)" is defined by Adityawirawan and Kusuma (2021) as anywhere… "…learning activities can occur outside the formal system in traditional schools. [Includes] home, riding public transportation, sitting in the cafés, or in the park is referred to as the concept of a flipped classroom. This term is further popularized as informal learning space (ILS)," (Adityawirawan and Kusuma, 2021, p. 109)

compared to their studies. Adityawirawan and Kusuma also point out that due to the less formal and more flexible setting at a café versus a university library, students may perceive studying progress differently (Adityawirawan and Kusuma, 2021, p.117). Cafés also offered extended hours and other features such as drinks and food not offered by libraries.

System Proposal

In the problem and need section, we identified two key questions: "How can we determine what *actually* helps students? What do students *actually* want in a study space?" As seen in Hegde et. al.'s findings, factors perceived as favorable in study spaces are generally agreed upon. However, current study space development still has a lot of catching up to do on user needs, and most study spaces have no way of accommodating every individual's niche needs for specific tasks. I also proposed that students were best reached through usage of a smartphone app for quick informative, yet social tasks. Therefore, I believe the best solution to this issue is personalization and empowerment of the student themselves.

A study space database mobile app, like Google Maps or Yelp will list known study spaces on a map. Users can choose to search for specific study locations or they can search by tags like "natural lighting", "ambient noise", etc. This search feature would be the main purpose of the app. Students can quickly locate study spots matching their preferences without expending excess energy. Students can also evaluate fellow student reviews and gather information on certain locations to make decisions. According to Parikh et. al., decision making choices involve some form of information gathering and evaluation to help inform decisions (Parikh et. al., 2015). Favorite locations could be saved for future visits. My proposed system also addresses gaps in the current, informal system of study spot location, occurs either through happenstance or word of mouth, by standardizing and sharing knowledge across app users. Current informal student ratings are also inconsistent, lacking

intentional categorization of factors. Using an app, students will review on a standardized scale, write comment reviews, add pre-determined and specific tags to their reviews based on their experiences. The current scope for this app is around UNC-Chapel Hill and surrounding areas, so most students would be UNC students, giving students a sense of community. Ideally, students with similar preferences in study spaces could form study groups and smaller, more specialized study communities through the app as well. A study by Wang et. al. observes that, "…the communication function of the mobile social apps used by the students can effectively promote the knowledge sharing process between [users]" (Wang et. al., 2022). Other UNC student-based communities with specific purposes and similar goals of community already exist: such as "RateMyProfessor" and "Coursicle", which have become tools of information dissemination and review known and used by thousands of UNC students when registering for courses. In summary, the search functions and review features of my proposed system should allow students to take charge and find their own study spaces, while building a supportive and informative learning environment and student community to inform decisions (Parikh, 2015).

Empirical Evidence

The power of a user-generated review community is highlighted in Boswell's (2020) investigation of RateMyProfessor (abbreviated RMP), a website allowing students to rate professors based on several categories, and how student decision making is influenced by both positive and negative reviews (Boswell, 2020). RMP reviews include a ranking from 1 to 5, a written review, and tags describing the course or instructor. Participants were given positive and negative reviews of fictitious professors, then ranked the professors. Boswell, and several other researchers, found that users were influenced by reviews (Boswell, 2020, p. 10; Fogel and Zachariah, 2017; Hicks et. al., 2012). Boswell adds, "Evaluation positivity may have had no impact on how seriously students considered the information because they

perceived any information to be potentially useful …" (Boswell, 2020, p. 12). Boswell also posits the risk of review manipulation or misinformation (Boswell, 2020), but I believe with careful moderation and fostering of a positive and helpful community, students will be more inclined to submit genuine information.

Conclusion

My system proposal aims to address student study space preferences in the current climate of insufficient or ineffective study spaces on the UNC-Chapel Hill campus through evaluation of student perceived needs and encouragement of a learning-motivated community to help students improve their academic performance and cope with mental health issues in constructive ways.

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