A Qualitative Approach To Understanding Student Information Sharing Behavior For The Benefit Of Educational Technology

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1. Introduction

1.1. What is information sharing?
Information sharing is a “voluntary act of making information available to others” (Jarvenpaa & Staples, 2000). It requires at least two people, one information provider and one information receiver or seeker, as well as the delivery of a message. Two people engaged in conversation would be an example of information sharing. A key point to notice in Jarvenpaa and Staple’s definition of information sharing is that it is a voluntary act. Volition is the difference between sharing and not sharing. Voluntarily sharing information, though important, becomes tricky when thinking about it in today’s competitive undergraduate academic environment.

1.2. Why is information sharing important for learning outcomes?
Information sharing is important for education because “learning, especially today, is much less about acquiring information or submitting to other people’s ideas or values, than it is about putting one’s own words to the world, or finding one’s own voice, and exchanging our ideas with others” (Ackermann, 2001). The constructivist theory of learning is based on the premise that humans generate knowledge from an interaction between their experiences and their ideas. Traditionally, educators have embodied this belief through assignments and exercises where students are required to wrestle with the ideas presented in the material on their own. However, we believe that information synthesis does not only occur individually but can and does occur when students learn from each other. This socioconstructivist paradigm has become increasingly prevalent in education over the last fifteen years (Cañas, 2006) as evidenced by the inclusion of group work in course plans. The process of sharing individual interpretations of course material results in learners co-constructing a shared understanding that would not be possible alone (Greeno & Collins, 1996).

In organizational contexts, Andrew Murray writes that new tools “can bridge geographical and organizational information divisions by moving conversations out of e-mail and hallways and into shared spaces such as blogs and wikis. This way information becomes searchable, serendipitous and connections are made, and ideas pollinate in ways they couldn’t before” (Conry-Murray, n.d.). Murray is talking about encouraging innovation and idea
incubation in business rather than learning, but he observes that it is equally easy for ideas to become trapped inside the very tools workers use to do their work as it is for them to spread and ignite. The same can be true of educational technologies.

1.3. Why look at information sharing in educational technologies?

Today’s American undergraduate students are unique as they represent the first batch of students entering college who have grown up immersed in technology, a cohort dubbed “Digital Natives” by Prensky. Prensky says this of today’s undergraduates: “They have spent their entire lives surrounded by and using, computers, video games, digital music players, video cams, cell phones, and all the other toys and tools of the digital age” (Prensky, 2001).

The time is right to develop technologies to support education. The 2011 Horizon Report—used by educators to identify and describe emerging technologies likely to have a large impact over the coming five years on a variety of sectors around the globe—reasons why:

- “The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators in sense-making, coaching, and credentialing” (Johnson et al., 2011).
- “People expect to be able to work, learn, and study whenever and wherever they want” (Johnson et al., 2011).
- “The world of work is increasingly collaborative, giving rise to reflection about the way student projects are structured” (Johnson et al., 2011).

Yet, conflicting opinions on the effectiveness of educational technologies handicaps research and development. The frustrations of a few researchers at the Open University of Netherlands are reflected in the introduction to their work on a specific educational technology: “Electronic collaborative learning environments for learning and working are in vogue. Designers design them according to their own constructivist interpretations of what collaborative learning is and what it should achieve. Educators employ them with different educational approaches and in diverse situations to achieve different ends. Students use them, sometimes very enthusiastically, but often in a perfunctory way. Finally, researchers study them and—as is usually the case when apples and oranges are compared—find no conclusive evidence as to whether or not they work, where they do or do not work, when they do or do not work and, most importantly, why they do or do not work” (Kirschner, Strijbos, Kreijns, & Beers, 2004).
1.4. E-textbooks as an example

One particular educational technology tool showing a trend of growth is the e-textbook, which until recently, has not been taken seriously. This changed when the eReader platform [e.g., Amazon Kindle (2007), Barnes and Noble Nook (2009)] and the tablet platform [e.g., Apple iPad (2010), Samsung Galaxy Tab (2011)] entered the mainstream consumer market. Some educators believe it will not be long before printed textbooks are replaced with digital versions (Lewin, n.d.). The 2011 Horizon Report postulates about the promise of e-books in general:

“The most interesting aspect of electronic books, however, is not the devices they are accessed with; it is not even the texts themselves. What makes electronic books a potentially transformative technology is the new kinds of reading experiences that they make possible. Publishers are beginning to explore richly visual interfaces that include multimedia and collaborative elements” (Johnson et al., 2011).

In our research, we use the e-textbook as just one example of a new tool for education. Mason and Rennie enumerate a list of the current tools, including but not limited to: blogs, forums, chat, social bookmarking, wikis, micro-blogging (e.g., Twitter), video, social networking, and virtual worlds (Mason, Rennie, Ebooks Corporation, 2008). However, we are more interested with students behaviors and attitudes about information sharing than with any educational technology in particular.

Existing research suggests an individual’s attitude towards sharing information is affected both by internal and external factors (Bock, Zmud, Kim, & Lee, 2005). In other words, there are both psychological and technological barriers to information sharing. In our own research, we believe that by understanding the psychological barriers, it is possible to design better tools to lower the technological barriers.

For our research we focus on the exchange of academic information—such as notes, readings, slides, conversations—or other related material (to the course subject matter being taught) between the students themselves and/or other proximity parties (i.e., teachers, parents, friends), that may or may not help them further their own learning and understanding. We anticipate this sharing takes place both in and outside the classroom in other student environments.

In this paper, we attempt to answer the following questions:

- What kinds of information are students sharing, and with whom?
- What are students attitudes towards sharing academic information, specifically notes?
• Why do students choose to study alone or study together?

Based on our qualitative research we propose a set of design principles that support and promote information-sharing amongst undergraduate students. From these principles we suggest specific feature recommendations to be included in future iterations of e-textbooks.
2. **Background**

Here we present background information around the classes we observed and the students we interviewed followed by our research methodology.

### 2.1. The classes and the students

**Selecting the classes**

In December 2010 we compiled a list of courses from the UC Berkeley online course directory that we wished to specifically target and recruit for our study. We selected courses from a wide variety of subjects and disciplines and made educated guesses about class size based on the number of students who had currently enrolled for the class. We sent recruitment emails to twenty professors asking for permission to observe their lectures and interview a few of their students (see Appendix A for the recruitment letter). After two rounds of follow-up, we received permission to observe seven classes and declinations from six. We did not receive any responses from the remaining seven classes. In early January, we decided to observe Classes A, B, and C based on their suitability for the project and our collective availability to observe them. The classes were chosen in order to observe students’ information sharing behaviors and investigate their information sharing attitudes in different academic disciplines, class sizes, and competitive environments.

**The classes**

<table>
<thead>
<tr>
<th>Class</th>
<th>Discipline</th>
<th>Size</th>
<th>Grade Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>Humanities</td>
<td>70</td>
<td>Uncurved</td>
</tr>
<tr>
<td>Class B</td>
<td>Business</td>
<td>500</td>
<td>Curved</td>
</tr>
<tr>
<td>Class C</td>
<td>Environmental Design</td>
<td>120</td>
<td>Uncurved</td>
</tr>
</tbody>
</table>

*Table 1: Key characteristics of observed classes.*
Class A

Class A is cross-listed across four departments and can be used to fulfill a requirement. It is co-taught by two instructors, typically with only one of them teaching on any given lecture. The 70+ students come together on Tuesdays and Thursdays from 2PM to 3:30PM in a classroom where the students sit in fixed wooden chairs with attached-arm desks.

Although primarily driven by lecture format, there are also discussion times in lecture where the students are encouraged to share their thoughts and ask questions. On most weeks, students are given writing prompts to the assigned readings and are required to type and submit their answers using bSpace- the campus-wide course management system. Deadlines are strictly enforced and late submissions are not accepted. Exemplary submissions are shared with the class before start of lecture the following week.

Grades are assigned based on the reading assignments and participation (35%), midterm exam or paper (25%) and cumulative final exam (40%).

In the first few weeks, all students were required to attend a ‘rare texts’ tour at the Bancroft Library. Groups of up to 10-15 students could sign up for a particular time-slot.

Class A’s instructor reserved a room in an academic building before the midterm exam for the students to study together without the instructors’ presence, if they chose. We were also able to observe this study session.

Figure 1: The small physical space of Class A allows its instructors to engage their students in discussions.
In contrast to Class A, Class B is compulsory for freshmen of a particular major. The roughly 500 students enrolled in this class met on Mondays, Wednesdays and Fridays from 9AM to 10AM for lecture and signed-up for weekly, hour-long graduate student-led discussion sections. Enrollment in discussion sections are on a first-come first-served basis and limited to 30 students per section. Policies regarding student conduct in lecture and discussion section are elaborate and strictly enforced. For example, students are forbidden from using laptop computers in the discussion section and may only audio record the lectures.

Three instructors teach the five academic modules covered in the course and the students are evaluated based on their end of module exams, module papers, and discussion section participation. The top 25% of students will receive an A as their final grade, the middle 50% B’s and C’s, and finally D’s and possible F’s in the lowest 25%.

A website maintained by one of the course instructors is used to post lecture slides, the syllabus, announcements, the list of discussion sections, and contact information for all instructors. Students are also able to access historical and current score statistics for exams and papers on the website.
Class C

Figure 3: The lecture hall for Class C is dimly lit and cold. Students enter from the back of the hall, which is located by the building’s main entrance.

There are about 120 students enrolled in Class C, from a variety of majors and years. The class can be used to count towards a major but is also used by students as a free elective. Lectures are held Mondays and Wednesdays from 2PM to 3PM in a lecture hall similar to but smaller than that used in Class B. The hall is dimly lit with a large stage and projection screen at the front. Students sit in fixed single chairs with attached tablet arms.

Besides the lecture sections, students are assigned to one of the four discussion sections on Fridays, where student instructors go over the material covered in lecture. The sections are limited in size to 30 students.

bSpace is used for lecture slides, announcements and additional reading material. The discussion instructors were free to decide how the discussion material would be structured and delivered.

In the first few weeks of school, students were required to attend at least one city tour hosted by the student instructors as well as organize student-led city tours of various locations, with the only restriction being that there were to be no more than 10 people in a group.
## The students

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Class</th>
<th>Defining characteristics</th>
</tr>
</thead>
</table>
| Student 1  | Class A| - Prefers to sit in first row of class  
- Takes advantage of opportunities to discuss class material: study group, in class discussions, review of outstanding assignment submissions in class  
- Prefers to physically interact with academic material: physical notes, printed readings |
| Student 2  | Class A| - Prefers to sit in first row of class  
- Told us that grades are not important as long as the student passes  
- Takes notes with pen and paper  
- Claims to be inexperienced with technology |
| Student 3  | Class A| - Uses a word processing application on laptop computer to take notes in class  
- Completes reading assignments close to due dates  
- Became friends with another student after realizing that they are in two classes together |
| Student 4  | Class A| - Is close friends with Student 6  
- Prefers to take notes physically  
- Tends to copy lectures slides verbatim |
| Student 5  | Class A| - Takes notes with pen and paper, reasoning that technology affords distractions  
- Uses review of outstanding assignment submissions as a motivator  
- Does not actively participate in discussions |
<table>
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<tr>
<th>Identifier</th>
<th>Class</th>
<th>Defining characteristics</th>
</tr>
</thead>
</table>
| Student 6  | Class A| • Is close friends with Student 4  
• Decision to enroll in Class A influenced by Student 6  
• Takes notes physically, reasoning that technology affords distractions |
| Student 7  | Class B| • Has two jobs on campus  
• Expressed a preference to study alone  
• Believes Class B to be very competitive  
• Claims to have heard about stories of extreme competition in previous semesters of Class B |
| Student 8  | Class B| • Expressed a preference to study alone  
• Claims to be intimidated yet comfortable with talking in section  
• Takes notes physically on printed lecture slides  
• Uses Wikipedia when there are questions about material covered in class |
| Student 9  | Class B| • Claims that there are ways to study for Class B to make it “easy”  
• Has friends in class from the same business fraternity  
• Conflicted between seeing the benefits of working with other students and being apprehensive about their true motivation |
| Student 10 | Class B| • Has access to some past exams and papers  
• Believes that class material is straight forward  
• Was somewhat subdued in answers to our interview questions |
| Student 11 | Class B| • Has friends in class from the same sorority  
• Professes to using numerous studying techniques based on self-awareness  
• Frequently rewarded by parents for doing well on tests |
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<tr>
<th>Identifier</th>
<th>Class</th>
<th>Defining characteristics</th>
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</thead>
</table>
| Student 12  | Class B | • Emphasizes long term goals when talking about academic experience  
  • Self-conscious about looking professional |
| Student 13  | Class C | • Reason for taking class: last semester in school and taking class because of personal interest  
  • Has laptop in backpack but rarely used in class  
  • Tries to include all bullet points from slides in lecture notes but instructor moves too fast |
| Student 14  | Class C | • Reason for taking class: to see how her background in sociology and anthropology can be applied to city planning.  
  • Visiting student from Mills College- an independent liberal arts college for women  
  • Dealing with a learning disability  
  • Makes an extra effort to make friends in class  
  • Meets with another student to share her insights on the class readings ten minutes before each section |
| Student 15  | Class C | • Reason for taking class: interested in the field of knowledge covered by class and had once considered majoring in it  
  • Claims to never take notes in class or lecture  
  • Curious but doubtful about information shared by his peers |
| Student 16  | Class C | • Reason for taking class: curious about how physical environments impact people  
  • Significantly older than classmates due to a break in her studies  
  • A transfer student who matriculated at two other institutions prior to Berkeley |


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<tr>
<th>Identifier</th>
<th>Class</th>
<th>Defining characteristics</th>
</tr>
</thead>
</table>
| Student 17 | Class C | • Reason for taking class: plays an online video game that relates to class material  
| | | • Learns by visually diagramming important topics  
| | | • Claims to have good skills at managing people |

*Table 2: Some defining characteristics of our interviewees.*

### 2.2. Research methodology

For this project we used several qualitative research methods, including observations, open interviews, and affinity diagramming. This section covers the methods and approaches we used to gather data and how we analyzed our data.

#### 2.2.1. Grounded theory approach

Grounded theory is an inductive research technique developed by Glaser and Strauss that is used to generate theory from data rather than proving or disproving a preconceived hypothesis based on experimental results (Glaser & Strauss, 1999). It calls for careful comparative analysis of codified qualitative data as the process of theory discovery. Again, the purpose is not to verify theories, but to generate them. We chose grounded theory as our research approach because it is the best research method to use in situations where “the researcher is trying to reveal insights about user experience or construct a theoretical framework based on reality” (Razavi & Iverson, 2006). We decided to collect data from in-class observations in order to observe the kinds of information sharing activities, methods, and tools the students actually used and chose to supplement those observations with interviews in order to capture data about their attitudes and mental models of sharing.

#### 2.2.2. Data gathering

**In class observations**

We chose to act as “known observers” (J. Lofland, Snow, Anderson, & L. H. Lofland, 2005) in our respective classrooms in order to facilitate entry into sections and cooperation from potential interviewees, as well as engender some goodwill between ourselves and the instructors as honest and forthright researchers. After our classes had been finalized, we attended them every day throughout the first eight weeks of the semester. We also attended accompanying sections if the course had them. To record our observations we used LiveScribe pens and notebooks in order to take digital audio recordings and notes.
**Student interviews**

Beginning in the fifth week of the semester, we started recruiting and scheduling interviews with students in our classes. We used a combination of face-to-face and email requests and offered students nominal compensation for their time. Compensation included items like a cup of coffee and a snack or a meal, up to $10. We conducted a total of 17 interviews with undergraduates aging from approximately 18 to 26 years of age. All interviewees signed informed consent and records release forms (see Appendix B for template forms). The interviews were audio recorded and lasted between 45 minutes and an hour and a half. We used “semi-structured” interviews, allowing the participants to play “a major role in the direction the interview [took]” (Blomberg, 2009). The interview guide was loosely based around a list of questions regarding their interest in the course, their note-taking techniques, and their information sharing attitudes (see Appendix C for the interview guide).

**Other sources of data**

- Student notes
- Class handouts, including syllabi, study guides, writing tips, etc.
- Observation of study group for class A

**2.2.3. Data analysis**

![Figure 4: The authors used a large physical space to facilitate in data analysis.](image)

We transcribed the audio from the interviews and read each others’ transcripts. To help transmit the content and mood of each interview, we also wrote summaries of each interview and shared impressions verbally with each other.

To analyze the interviews’ content, we used Glaser and Strauss’s open coding technique to create a broad list of pertinent topics that were discussed in our respective interview transcripts (Glaser & Strauss, 1999). We compiled our topic lists, eliminated duplicates, and checked for conceptual consistency. Using the comprehensive list, we then extracted pertinent
quotations from each interview across all categories by grouping physical snippets onto large sheets of poster paper.
3. Findings

3.1. Information sharing ecosystem

To help us understand the information sharing culture of today’s undergraduates we adapted Beyer and Holtzblatt’s work flow model (Holtzblatt, 1998) to map the different types of information being shared by undergraduates and with whom. A work flow model is one contextual design method for defining user-centered systems by visualizing the process of work coordination (Holtzblatt, 1998). We used it as a framework for modeling information flow among students and other central figures to their academic lives, but without the goal of accomplishing a particular task or other form of ‘work.’ The flow model helped us identify which parts of the students’ academic information sharing ecosystem made the most sense for further analysis. Using Beyer and Holtzblatt’s model, we created the figure below.

![Diagram](image)

*Figure 5: The students’ information flow framework.*

People and groups are represented as bubbles, information exchange is represented using arrows between bubbles, and information objects are the physical or verbal artifacts being
exchanged between people and groups. Physical information artifacts are shown in boxes while verbal information is shown unboxed.

The model identifies the location and interaction partners where concrete academic information sharing occurs (sharing past exams and lecture notes, sharing interpretations of the material and studying together). They occur between the students and their friends and the students and their classmates. At the same time, as the model shows, the exchange of those specific artifacts between friends and classmates is accompanied by non-academic information as well. We believe that the two are inextricably connected, and, in cases we will discuss later, act as social lubricant for sharing more tangible studying artifacts like notes and past exams and inviting others to study together. For these reasons, the rest of the paper will focus on sharing that happens between students and their friends and classmates and identifying the barriers that prevent those types of exchanges as well as the factors for success.

3.1.1. Information they refuse to share

Before delving into information that is shared by students, it is interesting to note some information that the students explicitly refuse to share.

Student 7 mentioned that he would not share his grades but is constantly pestered for that information:

**Student 7:** “--I'm not gonna... Like, I wasn’t interested in sharing, but I was like ‘Oh, I did fine.’ And then they try to pry what your score was. Like, not like it’s very important, but they, they also talk like ‘Oh, I did so badly on this test.’ Like, trying to get me to say more about my score I guess. So, it kind of annoys me when people do that. But--”

In Class A, students had the option of completing a take home midterm paper or an in class exam. Those who wanted to write a paper were asked to work alone and not share any information with their classmates. Student 3, aware of this, tried to strike a balance between obtaining information to help with the paper writing process, and not going against the instructor’s instructions:

**Student 3:** “So they’re going to give that to us as an option, we’re going to look at it, decide if we’re going to do it, and if she wants to do it to, then I think we might collaborate even though they said ‘don’t work with anyone’ sort of thing, I think we may just bounce ideas, not specific ideas, but general ideas off each other, and then talk about what readings are important and to include and sort of thing.”

**Notivate:** “Ok, ok.”
Student 3: “Yeah. Because the last thing we want is to be called out for plagiarism, or any of that or for working together. So as long as we keep it general, then it should be fine.”

Somewhat of a same sentiment was obtained from Student 13, where he talks about a Computer Science class he currently takes. He has a friend in that class, who would email him on help with their programming assignments. He says the following when elaborating on how he helps his friend:

Student 13: “... I am also taking a computer science class, it's like an intro to basic coding and I have a friend in the class... I was friends with her before... and I mean... she... sometimes she’ll have trouble and email me and be like “I don’t know how to code this part” and I’ll tell her how I did it or other ways of doing it and I will totally share my strategy with her...”

But Student 13 does not share the programming code itself. Why not? He claims that it’s not as helpful, although he isn’t worried that the friend will steal his code, saying, “not because I'm afraid she is just going to copy or steal but just because code... like it's not as helpful.”

In one class, Student 12 has to frequently write ‘module papers’. Though he does share these papers for feedback with people close to him, as will be revealed later, he refuses to share these papers with a friend in class because “I don’t trust X’s work enough to have him edit my papers.”

3.1.2. How is information shared
We will use this part to briefly discuss the ways in which information is shared by the students. Note that these findings are based on Notivate’s observation and interview data, and there may be other means used by students to share information.

Of course, students talk, and this is one of the easiest ways to share information. Student 6 acknowledges this fact, saying, “Yeah, I’ve talked about it with my roommates. I mean, I talk a lot. And actually, my other course, the word and image course, we had to a reading written by the professors of the history of information.”

Then there’s the obvious use of physical material to share information, such as the passing of notes that was observed in Class A.

Many examples were given on how students share information electronically, from scanning and emailing notes, sending emails and using cloud storage to grant access to documents (such as Google Docs).

Students also use their online social networks to share information, which can quickly transition into conversations about the material, as told by one student:
Student 5: “...and I was like ‘wow this is really cool’, so I copied the link and pasted it on my friend’s [Facebook] wall, because I thought it might be interesting to him. He was like ‘Aw that’s really neat, blah blah blah.’”

We also observed students using text messages to share information. One student mentioned a creative way in using text messages:

Student 11: “...I would just like study all weekend... but I just had like all these things... but I still had the run... that weekend it just turned into, um, like texting each other questions that we had...”

Interestingly, we found very few circumstances when phone calls were used as a medium to share information, with the exception of Student 9 with his high-school mentor:

Student 9: “So, I mean, I hooked up with him then.”
Notivate: “What do you guys talk about?”
Student 9: “Everything. He’s like my dad outside of my dad.”
Notivate: “How do you like usually communicate?”
Student 9: “Call, text, email.”
Notivate: “Ok.”
Student 9: “Yeah, we’re pretty close.”

We end this part with a quote from one student, describing his preferred means to share information:

Student 5: “Yeah. Mostly in person... I don’t talk on the phone that much, I text a lot but you can’t really communicate why something you learned in class is cool over texting.”

3.1.3. When is information shared
Information is shared at all times; with right before class, right after class, and in class being more common. There were also some interesting moments when information is shared, such as during unplanned run-ins with classmates:

Student 1: “We go to office hours and there are other students there, and we talk about other stuff that doesn’t necessarily improve our grade, but stuff we find interesting.”
3.1.4. Sharing to accomplish specific academic tasks

Throughout this paper, you will find various examples of students sharing information to accomplish specific academic tasks. In Class A, we observed two students having a conversation with one of them holding and pointing at the midterm study guide that was made available electronically by the class instructors.

The information shared is not limited to the student’s class, network of friends or school. In fact, the same Student 12 who doesn’t share his assignment papers with his classmate has his mom and girlfriend review them:

Student 12: “The module papers... I usually--write a--like a, outline, with uh, including maybe one sentence for each of the points that she wants us to touch on the module paper, and then I turn each one of those sentences into a paragraph with researched information. Then I send a copy to my mom and have her edit it. And last time I sent a copy to my girlfriend as well. She edited the stuff my mom missed.”

Notivate: “Ok.”
Student 12: “So I have two editors.”
Notivate: “Ok.”
Student 12: “That really helps.”

3.1.5. Sharing non-academic information

Most of the information shared by the students are more general in nature, not specific to an academic task. From a content perspective, the information shared could be academic in nature, or seemingly unrelated. A sample of sharing not specific to an academic task can be seen below:

Student 1: “...we talk about other stuff that doesn’t necessarily improve our grade.”

Student 3: “Even if I haven’t had friends in them at the beginning, I usually meet people. I’m in a sorority, we tend to seek each other out and see another sorority chick, I’m like ‘oh hey!’...”

We found more examples of students sharing non-academic information from our observations. One example is in Class A, where one student said “This is story time dude” to his classmate as the instructor conducted lecture. Another example is in Class B, where we heard two students talk about renting a hotel room in San Francisco as part of a fun night out and discussing room prices.

What does all this information do for the students? They are not sharing information for an exam or homework assignment but instead sharing for the sake of sharing. It seems that one of
the reasons to do this is to help the student evaluate their own understanding of the material. Students 14 sums this up by saying “And then I give him a brief summary if I get to see him. And then I try to star the most important stuff on there.”

Beyond that, this sharing of information also allows the students to build relationships in class. In one particular instance, a Notivate team member walked up to the front of the discussion section to ask if the students have formed study groups. This prompted two students to ask their classmates if they are interested in studying together.

### 3.2. Sharing notes with others

Producing quality lecture notes requires a certain level of investment from a student, and can be a critical tool for preparing for exams. We chose to focus on student-generated notes to help us gauge their attitude about sharing. Based on our classroom observations and student interviews, we describe the attitudes undergraduate students’ maintain about sharing their lecture notes with other students.

### 3.2.1. Not all notes have the same value

In order to understand students’ attitudes towards sharing notes, we first discuss the various reasons why students take notes and how valuable they perceive other’s notes to be, including their own.

#### Why students take notes

It would be naive to assume that everyone uses notes the same way. From conformity, to aiding attention and providing structure, to preparing them when it’s time to study, students gave us a myriad of reasons for taking notes:

**Student 4:** “The notes are there to refresh my memory... the notes are more so that I can pay attention in class. I like to take notes. It helps me stay focused in class. ... [and also] just in anticipation of studying, because if I’m not taking notes during [class], then I spend all my time thinking about it during lecture...”

**Student 7:** “Like, the purpose of note-taking? It helps me retain the information better, so that I can reference it, and it just gives me a way to organize everything. So then I like having it organized so that I can like, um, see like, this topic is a sub-topic of this.”

**Student 9:** “Why do I take notes? That’s actually a very good question... Primarily I take notes because I see everyone else taking notes, and I feel like I would look bad if I don’t.”


Student 12: “It keeps me paying attention to the lecture, so... I can easily get side-tracked in classes that I haven’t taken notes in, which is rare, but it keeps me involved and participating. And also, I can look, I can see what the teacher said, and by reading almost a verbatim transcript, I can remember what was going on at that time and maybe assimilate the points in a new way. So without the notes, I’m going to forget a lot.”

Student 15: “I don’t take any notes in class.”

Students reported a wide array of reasons and uses for their lecture notes. Several students expressed they took notes primarily to pay attention in class, while others enjoyed that it provided them with structure. A number of students referred back to their previous notes, but typically only before an exam, and one student honestly admitted that they usually do not even take notes.

Perceived value of self’s notes

Whatever the individual’s reason(s) for taking notes, it reflected the attributed value that was placed on the notes. In fact, the self-perceived value of their notes was one of the main factors students considered when deciding whether to share. Many students expressed that their notes were more valuable to themselves, and that their notes would not be of much value to others. Student 4 shared, “I think they’re more useful for me, than they are for somebody else... because my handwriting is kind of sloppy, and they probably have the same stuff on their paper”. This belief of value inadequacy may be a major barrier to students sharing notes with each other.

Some students maintained an unfavorable disposition to sharing notes simply because they felt notes were meant for the individual. Student 2 explained, “I take notes for myself, I don’t take notes to share. And I think that most people do that to. They don’t intend to share their notes with other people.” Many non-technology barriers to note sharing exist and will challenge educational technology evangelists who want to encourage this sharing behavior.

Perceived value of other’s notes

Some students did not place much value on other student’s notes. A number of factors were considered when evaluating another student’s notes, including the perceived work ethic of the person, the nature of the lecture, and whether the professor posted slides.

Student 3: “It really depends on the person. Some people take really great notes, and some people... they just write down crap... I usually will only ask for notes from people who I know take good notes... I’ll make sure the person gets good grades in the class, and studies, and all that stuff... and pays attention in lecture. Because a
lot of people in lecture are just cruising through websites, and not even listening to one word. So I’ll make sure the person gives a crap.”

Student 5 reiterated the criteria he looked for in a student before asking them to borrow their notes:

**Student 5:** “There is, to some extent, an issue of trusting what the person is writing down. But if it seems like the person has their shit together, then yeah, I’m willing to make that leap of faith…”

**Notivate:** “How would you assess that they have their shit together?”

**Student 5:** “Haha, good question. I guess it would have to be the quality of their notes... from also just talking to them... assessing how much they care about the class and their grade in the class.”

Many students were keenly aware of their peers and came up with various ways to assess their work-ethic and used it as a proxy for how valuable those notes would be.

### 3.2.2. Why students share notes

In this section below we discuss the common reasons why students share their notes.

#### If they know/trust the asker

Knowing peers on a personal level helps break down the barrier to sharing notes. In general the more a student knew someone on a personal level, the more comfortable they were with sharing their notes. We observed multiple examples of this in our interviews. Student 12 and his friend discussed the material they learned in class and how they could apply it to their business. Student 12 said, “After class we always reconvene and just briefly go over the, the overarching points, the biggest points in the lecture, and then talk about how it applies to how we can make money later.” This existing friendship and business partnership provided an underlying trust in their relationship, and thus facilitated the sharing of information.

In another example, Student 2 and her friend planned on sharing notes ahead of time, so they would have the flexibility to skip class. Student 2 shared, “I had a Scandinavian folklore class that a much better friend of mine and I both took and we hated it... We would coordinate not going [to class] so that we could switch off notes.” Whether it was a matter of convenience or trust, it was not entirely obvious from our observations, but having a significant friendship beyond the classroom influenced this student’s propensity to share notes with her friend.
**Extra-curricular groups**

Beyond individual friendships, there were several students who participated in social and extra-curricular groups and we observed that bonds/relationships outside of class had an impact on note sharing. Here at UC Berkeley, approximately 10% of the student body are members of the greek system (“US News,” n.d.). We observed three sorority sisters taking the same class, and despite the general competitiveness in the classroom, there was a natural camaraderie amongst them. Student 11 explained her differential dispositions towards her sisters versus other students in the class, “I just have like my two friends [sorority sisters] that I study with. Um, er we try to study with as much as we can. And then everyone else we’re just friendly toward, kinda... so it’s like you either find the people that’s like, ‘Oh, we’ll work together and get into Haas together,’ or you meet the people that see you as competition and kind of like, don’t necessarily.” These external social organizations provide a foundation for their members to work together in an academic setting as well. Of course it depends on the specific relationship between the individuals, but members of these social groups preferred propensity to work and share notes with other members.

**If asker was out sick or other hardship**

Empathy may be a factor in willingness to share notes with others. In our observations, several students explained how they helped out a fellow student who was out sick or had some other hardship that prevented them from coming to class and taking notes.

One student recounted how he had some ‘health issues’ and asked a classmate to send him her lecture notes, and she obliged by sending multiple lecture’s notes. Student 9 explained, “I had health issues... So like Thursday night I just asked her for all of them. She sent me like the last three that she didn’t send me, and um, yeah... I just kind of called her and asked.” It is admittedly not clear if Student 9’s classmate shared her notes because he was sick or if it was because they were friends (or both). However it serves an interesting example considering we observed this behavior in a highly competitive classroom environment (class B).

In perhaps a more clear cut example, one student chose to share his entire semester’s notes with a girl he was not friends with, after hearing about her hardship. This empathetic response was one out of compassion for his peer and a hope that someone would do him this favor if roles were reversed. This is uniquely different from just ‘helping out a friend’.

**Student 12:** “Last week, a girl approached me from my section and said that she had these...crazy circumstances the last three weeks, and I just gave her all the notes I had taken this whole semester, so.”

**Notivate:** “And did you, did you know her before?”

**Student 12:** “I didn’t even recognize her.”

**Notivate:** “Oh, ok.”
**Student 12:** “Um, yeah, I was just thinking ‘what would I want if s--if I had been stranded and couldn’t take notes?’ I’d hope to God that someone who took notes could give them to me.”

One student shared with us two very different experiences around asking to borrow lecture notes from fellow students. She began her first example by describing a period earlier in the semester when she was sick (in Class C) and one fellow student typed up their previously handwritten notes in a Google doc and shared it with her. The two students were not previously friends, and only knew each other from class. Student 16 said, “I have been sick. But like I said, there was the one student- she’s wonderful. She posted a Google doc of all of her terminology that she defined and everything.” This echoes a similar display of generosity as described by Student 12’s interview (above). Additionally, we took notice of the ‘extra effort’ her peer demonstrated in digitizing her notes for Student 16’s benefit, which we recognize as atypical.

However she provided a counter example; Student 16 recounted a different and disappointing experience from a class during the previous semester when she had broken her arm and no one in her class was willing to share their notes.

**Student 16:** “So in August I had a severe bike accident, I broke the radial head of my right arm and I am right handed, so I couldn’t write. I also had a neck injury and shoulder injury so I was in a fair amount of pain. And so for the first six weeks I was not able to write anything and I was in courses that required heavy notetaking. You know, where you have to draw graphs and you know, solve problems. And I remember at that time, I asked students in my classes... in my econ classes, if they would let me see their notes. And it wasn’t just one person, it was several people... and the answer I got back was, “well... my notes are not that neat and they are not going to be that helpful” And I was very stunned by this actually.”

These examples illustrate a common behavioral theme in which students may be more inclined to share their notes and help each other when they are sick or suffering other hardships that would otherwise prevent them from coming to class and taking notes. However, we acknowledge this is not a steadfast rule, and that there are other factors that students consider when deciding whether to share notes or not.

**3.2.3. Why students do not share notes**

While we discussed some reasons why students engage in note-sharing, our observations and interviews provided us with insight into reasons why people would choose not to engage in note-sharing. We discuss some of these reasons below and conclude with some examples of how students avoided sharing.
If the asker was ‘slacking off’

People in general are put off by free riders. It was interesting to observe several students who were opposed to sharing notes assumed that people would ask for notes because they were slacking off. Student 7 explained that “I don’t really like... sharing my notes because I feel like, if you slacked off in lecture and you didn’t pay attention to lecture, I’m not gonna give you my effort, and give you an easy way to just do well.” It is not entirely clear why they immediately arrive at this conclusion.

Once and only once

As one might expect, we observed a range of attitudes on note-sharing. Some students were very resistant to sharing their notes, while others were more open to the idea. One student followed an interesting sharing strategy involving reciprocity. They would share their notes once but then would resist sharing notes again if the other person did not reciprocate at a later time. Student 3 explained “I don’t have a problem with [sharing notes]. If it happens more than once, then I’ll have a problem probably.”

If notes are highly valued and it is a competitive class environment

Students were generally protective of their notes if they considered them to be highly valuable. This observation may suggest an inverse relationship between the perceived value of one’s own lecture notes and the likelihood that a student will share the notes with others.

Some notes are more prized than others. In class B, the instructor disclosed the test questions prior to the midterm. Student 11 articulated the value of taking notes and attending class came from of being told what questions would be on an exam: “The professors let you in on like, ‘this is going to be on the test.’ ...I don’t really have patience for people that don’t attend class and then want the advantages of attending class... If I am ten minutes late to the lecture, then I’m gonna be punished for that, but that’s my fault.” These types of advantages [e.g., guaranteed test questions], and more generally when lecture notes are so valuable, contribute to students’ reservations to sharing their notes with classmates.

We identified class B as the most competitive of the three classes we observed. It is a n undergraduate business course that is a prerequisite for applying to Haas School of Business. The perceived competitiveness of class has an impact on their decision to share notes with others. In talking about what factors go into choosing to share information, Student 9 explained, “It all comes down to whether or not they’re seeing this transaction as a way to compete or to just learn. For me, if it’s competition, uh, yeah, I’m not gonna talk to you. But if it’s just to learn, then yeah, definitely [I’ll share my notes].” This further demonstrates the significant effect the classroom environment (competitiveness) has on students’ propensity to share and suggests a more relaxed atmosphere may allow sharing of information in class.
How students avoid sharing notes with each other

Some students will deflect requests for their notes. At least one student from all the courses we observed shared this common experience. These observations suggest that students value, and are protective of, their notes and do not wish to ‘give up’ that effort freely. A pattern we witnessed was students would respond to such requests by suggesting the student to watch the webcast (recorded lecture). Student 3: “...I mean with this class, it’s easy because you can be like ‘go watch the webcast’...” Even though many classes at Berkeley are not web-casted, some students prepared their own recordings of the lecture. Student 7 recorded the lecture audio with her laptop and then “offer[ed] to send them a copy of the recording... So I don’t feel obligated to share my notes. I’ll just be like, ‘I have a copy of the recording, like, if you want it.’” This allowed students an opportunity to ‘gracefully’ decline a request that would otherwise be a potentially awkward social scenario by saying ‘no’.

One of the student we spoke with was on the ‘information-withheld from’ side of the information-sharing exchange. Student 16 was studying with a couple other students and one of them had taken the course previously three times, and did not share that she had held onto old exams. Student 16 confronted the student and describes the response: “She said, ‘Well you know, I don’t have the questions I just have the blue books so it’s not like it’s going to help anyway.’” The student chose not to share previous exams with the people that were helping her study, and offered the weak excuse that she did not have the actual exam with test questions, but rather just had her responses (i.e., bluebook) to the previous exam questions. Not offering the intel is a bit conniving, or at the very least, disingenuous. Having previous exams because the student is re-taking the course is arguably an uncommon scenario, but the result of finding out is unsurprisingly frustrating and potentially hurtful. Student 16 made a comment that “people become assholes” in reference to her study partner’s lack of camaraderie.

3.2.4. When students ask for notes

Timing is a factor in asking other students for their notes. Students acknowledge the effort required to take and share notes and some have developed intricate strategies to distance their request from that effort.

Not immediately

In general, students asked other students for lecture notes for classes that they missed, however not all would ask right away during the next class. Students were pretty relaxed about getting the notes that they missed. Our interviews suggest that the student’s lack of urgency is tied to the purpose they attribute to note-taking (generally to prepare for an exam), and the relatively low-value they place on other people’s notes.
Our interviews suggest that some students consciously choose to delay asking others for notes. Student 3 shared such a scenario about asking her friend for notes long after the lecture had taken place: “And so I’ll be like ‘I wasn’t here on March 14th, can you send me the notes from that day?’ and that’s two months ago so they won’t really care. But if you ask them on March 15th, it’s like... ‘Dude, I went to lecture. Why weren’t you there? you know?’” This suggests that as time goes on the ‘remembered’ effort in recording notes is less vivid, and thus may appear to be less ‘valuable’ and thus the author will offer less resistance to sharing.

On some occasions, even if students did get notes from others, they did not spend time to review it right away and learn the material. Just obtaining the notes is their immediate goal, while reviewing and understanding the learning material is a secondary goal that gets pushed off for later. Student 6 explained his perspective, “…I mean I have asked people for their notes before sometimes, like I get them and I don’t even look at them until the test, so I haven’t really learned it yet. Then I’m less motivated, it’s like ‘It’s already done, I’ll look at it later’.” This raises a concern for educators and designers to consider. There is a disconnect between sharing information with each other and students actually learning and absorbing the information that is shared with them. This example shows students are motivated to engage in note-sharing so they can review it on their own at a later time. The real value is derived when student’s actually sit down and interact with the notes and other study material.

**Not unless upcoming exam**

Many students did not share notes with each other until a week or so before an upcoming exam. We identified exams as triggers that cued students to interact with one another and in some instances, provided an opportunity to request and share notes with one another. Student 3 explained that the “best time to ask for notes... is right before the midterm or the final because then everyone is just trying to help each other, share with each other.” This gives an impression that students are more inclined to share notes with each other during this ‘frenzied study time’ right before the exam. However social situations are rarely this one-dimensional, and it is likely that the hope for reciprocity is another driving factor in an author’s decision to share their notes.

**3.2.5. Why students would not ask for notes**

In trying to better understand why students share notes, it is also insightful to explore why individuals would choose not to ask for notes. We discuss our findings below.

**Do not want to look like a free rider**

While we have established students may be disinclined to share notes because of the aversion to free riders, it was interesting to discover that there is an awareness amongst students who asked to borrow notes as well. Student 17 admitted that “Yes [I’ve asked for notes from somebody
else] but I feel disinclined to ask the same person twice. Especially if I haven’t given anything in return. Because then I feel like I am freeloading. I like to have reciprocity, it also keeps me accountable.” Students who have this ‘conscious’ do not abuse their fellow classmates’ generosity will help to keep this willing note-sharing culture sustainable.

**Who they will not ask**

Students were selective about people they would ask notes from. As previously mentioned, a student would avoid asking for notes from someone who gave the impression that he/she was not engaged in the class or did not care about their course grade. Much of this is related to the perceived low value of that person's notes, which would be a reflection of their apathetic demeanor towards the class.

**3.2.6. Section summary**

There were various and differing reasons why students take notes. Their individual reasons for taking notes affected how much value they placed on them, as well as influenced the perceived value they placed on others’ notes. This individualized value of notes coupled with other external factors (such as classroom environment, asker/askee relationship, timing of request, social norms, etc.) all influence students’ attitudes and propensity towards sharing their notes.

**Challenges to sharing notes**

From our findings, we learned some of the common challenges to sharing notes include:

- **Competitive classroom environment:** In competitive classes, students are less inclined to share notes
- **Free rider problem:** Many students are disinclined to share with free riders
- **Reputation and quality control:** Nobody wants notes from a student who is performing poorly in the class. And it can be challenging to assess whose notes are not worth obtaining
- **Perceived value:** the higher the self-perceived valued of notes, the less likely students are to share them

**Factors for success**

One of the key factors important for note sharing to take place is establishing a relationship of trust and reciprocity. Additionally, timing and context are important considerations to keep in mind. For example, there are key ‘trigger’ events such as exams and assignments that prompt students to reach out and request to share notes with one another.
3.3. Studying together

In this section we discuss when, why, and how students study together. We uncover some challenges that they face in this endeavor as well as some factors which help study groups to form.

3.3.1. What it means to study together

Students have different definitions about what it means to study together. For Student 1, it was an active in-person exchange of ideas, while for Student 9 just being co-located qualified as studying together. Other examples included texting back and forth, dividing the work and contributing to an online information pool like Google docs, and asking a roommate to quiz you from your own notes. For the scope of this project, we define studying together as an event where two or more students from the same course meet either in person or virtually through a technology-assisted medium to discuss, review, or otherwise synthesize material that falls within the course scope as outlined in the syllabus.

3.3.2. Why students study alone

Students cited a litany of reasons for not studying with other students, ranging from being too busy and self-organization problems to a lack of study partners to feelings of distrust and competition with other students:

Student 8: “If anybody approaches me, I’d be fine with it, but I also have a lot of stuff to do, so...”

Student 4: “We haven’t actually studied [together] for it. We end up usually doing the readings at different times. I’ll ask him about it or he’ll ask me and we’ll just do it ourselves.”

Notivate: “The two of you haven’t studied together?”

Student 12: “Our timing hasn’t organized well, so no, not in Class B.”

Notivate: “Have you approached anyone to study with?”

Student 5: “Not yet. It’s mostly...I think with this class in particular, it’s a little bit different because there is no discussion section. Generally, that’s where I’d be talking to people. Like making those connections. Discussion section generally, you’re doing some sort of work with the person next to you. So you’re already talking to them, therefore so it’s easy to go the next step, like ‘Do you wanna study?’ In this case it would be me turning to the person next to me [and saying], ‘Hey, you look like you’re looking for a study partner.’”
Student 7: “If you’re gonna do well, you need to work for it, so I guess that’s kind of why I don’t like studying with, um, people that don’t pay attention in class. And when I do study with people, um, like, not just for UGBA or other classes, um, I usually don’t but when I do, it’s, like, with people that I feel like are at my level where they are really dedicated to the class and they really want to do well. Because I know there’s people that want to do well, but they want to do it the easy way.”

Despite all of these reasons, study groups did form as students juggled their priorities, connected with classmates, and utilized group studying tactics that preserved some of their competitive advantage. Considering both the factors that led to studying in groups as well as identifying the ways in which forming groups was a good starting point for proposing solutions to overcoming the barriers that prevented students from studying together. Examining why, how, and with whom study groups form is where we will we turn next.

3.3.3. Why students study together
We commonly heard students say that they “should” or “hoped to” study with another student in the class, but rarely was this aspiration being realized even though students seemed to believe that there was some benefit to working with others. Moreover students expressed that the planning and effort required to do so was often too much to overcome. As Student 8 lamented, “I feel like once you say ‘We should study!’...the next thing that goes in my mind is like ‘Alright, when and where would I have time to go out of my way to study with somebody else?’.” We found that an impending test or deadline was the catalyst that spurred students to study together or to study with other students. As Student 3 noted, “We usually get together to study probably right before the midterm, like maybe 2-3 days before.” Student 17 reasoned “...we are all students and we are in the same thing together, so why not help each other?”

3.3.4. Which types of classes are likely to form study groups
The students we interviewed had completely different opinions about which classes were best for studying in groups. Here are some of the comments that students shared:

Student 1: “You know it’s funny. You can’t really [study with other people] for the classes I’m taking right now. But when I was taking a lot of math classes, sometimes I wouldn’t even do the study groups...because sometimes you can just go on Khan Academy and watch YouTube videos, and it’s a lot clearer than my friends could explain it.”

Student 9: “For more difficult courses, I definitely enjoy working in groups more. But if it’s something like straight-up memorizing, something like, let’s say biology, for example, all you’re gonna do is memorize things. I feel like it’s definitely more conducive to study by yourself because there’s no critical thinking involved...you
just memorize and regurgitate. For something like math...when you don’t understand why you did a problem wrong, that’s where I feel like a group setting really comes into play.”

**Student 10:** “When I do study groups it’s usually for cases when I’m not sure about my answers, and I want to see what other students got. ...Last semester for my philosophy class, the questions were very open ended, so when I did the study guide for that I usually did a study group so that I could see that my answers were matching other people’s answers.”

**Student 13:** “It depends, I mean some classes I am just really better by myself I think, but some classes it definitely helps. It’s hard to say.”

**Student 15:** “Like for me, I don’t [study in a group] much for a humanities class. It’s like, one thing about humanities, it’s that the theme is...just knowledge. I feel like you can piece together the reasoning part yourself. For classes like statistics or math or econ, there’s substantive stuff you can study for...like problem sets. And for me, that’s a lot better to study in groups.”

In general, students said that science and math courses which typically had “right answers” were better for studying in groups because “the correct answer” could be easily explained to others or actively co-discovered. Others expressed that classes like philosophy or political science which required “critical thinking” were better for studying in groups because the students could compare and evaluate each others ideas in a way that could not be achieved individually.

On the whole our interviewees could only confirm that classes which were good for group studying was a highly individualized decision. When deciding whether or not to study in groups, students considered how comfortable they were with the course material. If the student felt like he or she understood the material, the student was more likely to study alone. Conversely, if the student did not feel like he or she understood the material, he or she was more willing to study with other students, assuming that he or she also desired a good grade in the class. Most agreed that classes which only required wrote memorization were best for studying alone because they were able to study at a time which was convenient for them.

**Studying together in competitive classes**

After discovering that students decided to study together based on how well they felt they knew the material and not based on a particular subject, we then decided to look at whether students in competitive classes would study together at all. We found that students would study together in competitive classes, but with a few very important caveats.
In Class B, which was graded on a curve, Student 11 was only willing to study with one or two other students who were also in her sorority.

**Student 11:** “I just have two friends that I study with... and then everyone else we’re just friendly toward... Because so many people know that half of everyone that applies to [the undergraduate business program] as an undergrad gets rejected, so you either find the people who are like ‘Oh, we’re work together and get into Haas together,’ or you meet the people that see you as competition.”

Student 7 was able to study for Class B’s first exam with her roommate, but explained that it was because they were not directly competing:

**Student 7:** “I don’t think my roommate would have studied with me if we were taking the same test together. It’s just—she only helped me study because she’s not in my class. And she’s my best friend, too, so...” [laughs]

**Notivate:** “Why do you say if you were taking the class at the same time, you don’t think you would have studied together?”

**Student 7:** “Um, I think, just the way [Class B] is structured, it’s just, you can’t help but be kind of suspicious... I’ve heard so many horror stories like, ‘Oh, this person erased this other person’s test.’ or, yeah... It’s just all these stories and they’re actually true. Like that one’s happened to a girl, so...everyone’s like really on their guard.”

We heard very different opinions about studying together in competitive classes from students who were not enrolled in Class B. A student from Class A said that she would not be deterred from studying with others in a curved class.

**Student 3:** “I’d say that it doesn’t really affect [whether I want to be in a study group] because event if I’m working with one two individuals... they are my competition on the curve, but at the same time, it’s like everyone is my competition so you still want to know what your competition knows.”

However, she also said that she would limit studying to one or two other students, as a way to mitigate the number of students who would also benefit from the study group and to spy on her competitors. Keeping study group partners to a few individuals whom they trusted and knew well was especially important for students who chose to study together in competitive classes.

### 3.3.5. When study groups form

As mentioned before, students needed a good reason like an exam or other significant deadline to study together, but the timing of study group requests was also a factor. Student 14 had
made three friends in Class C since the semester started, and by the time we interviewed her, she had already asked her new friends if they wanted to study together for the midterm exam, but they hadn’t agreed to study together yet.

We were perplexed as to why her friends had not agreed to study with her since other successful study groups were formed for just this reason. What was different about this request was that Student 14 suggested studying together to her friends three weeks before the midterm exam. In this case, we think she simply asked too early. Student 14 admitted this herself when she said “Yeah we kinda work day-by-day.” Several other students confirmed thinking about the timing of requests to study together:

Student 3: “We usually get together to study probably right before the midterm, like maybe two or three days before.”

3.3.6. How study groups form
From the study groups we observed and heard about through our interviews, we created three categories based upon who was doing the organizing:

- Student-initiated study groups
- Instructor-initiated study groups
- Social and organizational study groups

Either a single student in a class would offer to initiate and organize a study group, the instructor reserved a meeting place for the students to use for studying as they wished, or the student was part of an extracurricular group like a sorority or business fraternity that regularly organized group studying opportunities on their members’ behalf.

Student-initiated study groups
One student in Class C told us about his experience initiating an online group study document of exam terms and their definitions.

Student 17: “I just went up to the discussion class, [and said] ‘I want to start a Google doc, if you want to pitch in, sign up,’ so it was totally voluntary. And a lot of people were receptive to that.”

He meticulously curated the contents of the document, preferring that team members send him definitions to format first and only gave them read access to the doc. He said that working with a group to define the study terms was a time-effective “way of circumventing doing all the readings.” He lamented that “we have three times as much to read as our parents a generation ago, and have we gotten more time? No.”
He also talked about his other motivations for doing so:

**Student 17:** “I am really good at organizing people. Not really telling them what to do, even though I get tempted. Especially in Berkeley, people are really sensitive to being told what to do. So it’s like a really fine line between dictating exactly what they need to do and giving them enough freedom to do it within that realm.”

One student in Student 13’s political science class last semester sent around a sign-up sheet to organize a review session. That student’s initiative was extremely helpful. Student 13 raved about it, “They got everyone’s email, they emailed everyone, saying when is the best time to meet, coordinated it all, got a room. Really really helpful.”

**Instructor-initiated study groups**

The instructor for Class A reserved a classroom for three hours one afternoon to provide time and space for the students in the class to review the midterm study guide together if they chose to do so. Nine students showed up over the course of three hours, and six students stayed for most of the allotted time and actively participated in the study discussions. With the exception of one pair, we believe that the students were not already friends.

The instructor-initiated study group removed the burden of finding a study time and space for the students to gather.

**Extracurricular social study groups**

Student 11 is a member of a sorority, and she said that every week there were ‘study tables’ at her sorority house where members could work on homework and study individually. Besides being awarded housing lottery points and free snacks for attending, the study tables also provided the sorority sisters a convenient opportunity to invite another sister to work together on a problem set or study for an exam for a class that they were taking together, as long as they moved to a different room in the house.

**Student 11:** “It’s from seven to eleven ... and it’s in the kitchen and they’re serious about it staying quiet, so it’s usually a productive time. ... The kitchen is the quiet ‘you do your own work’ [space] and then if I have ... a problem set that I want to talk to someone [about] ... then you go out into the TV lounge and you can go over your work there.”

Student 9 is part of a business fraternity and he said that in addition to his own studying, he studied with his fraternity siblings for Class B together the night before the exam.

For both of these students, the extracurricular organizations that they belong to provided a built-in network of study partners.
3.3.7. Study partners and group size

Whom students chose to study with was an important consideration in deciding whether to study alone or with others. Student 3 explained the process: “It’s kind of this networking thing that you do in class. You meet one person, they have friends, you have friends, you kind of put your friends together.” But studying with unfamiliar students was not unheard of either. Class A’s instructor-initiated study group and Student 17’s study document were open to anyone who was interested.

Although the depth of relationships between study partners varies. Student 7 described a potential study partner in her section as “the girl I kind of know.”

For students that are not already friends with others in the class, finding good study partners is partly a matter of luck. In Student 1’s words, “Sometimes the first day of class you meet somebody and hit it off right away and you start hanging out and stuff, and other times you don’t talk to anyone the entire semester.”

Student 15 told us that the evaluation of potential study partners takes place over the course of the semester through observing other student’s level of preparation and commitment to the class.

Typically, study groups of two to five students formed, and as they grew, the probability of conflicts would rise. One large study group we heard about was particularly hectic and disorganized. As the group grew, the number of students who did not contribute increased. Student 13 described his experience when his study group of five grew to more than ten— and not only did some new members not contribute, but one member in particular was quite disruptive to the overall group’s progress.

Student 13: “It seemed like we spent more time arguing than we did working.”

If the level of conflict had not reached it’s peak at the end of the semester, Student 13 said he would have emailed the original five members separately to restart the study group.

3.3.8. How students study together

After the work of deciding when, where, and with whom to study is done, students in study groups still needed to negotiate who will be the session leader, what material to study, how to get started, and how to deal with free-riders. For the majority of this section, we used our in-person observations of Class A’s midterm study group.
Determining group leaders
Generally the study group initiator is the de facto group leader and arbiter of the group’s direction. In Class A’s instructor-initiated study session, two students predominantly shared the responsibility of asking the group for questions and deciding when to move to the next study term. Those two students were also the first two to arrive, which made them the de facto leaders. Even though they did not organize the meeting, they were the first to begin studying and had already devised a plan for covering the material which the others could follow. The responsibility of group leadership may be why some students are reluctant to initiate study groups.

Deciding what material to study
Study guides provided crucial guidance for what material to study and how to begin. Student 13 shared a story about one of his recent study groups that struggled to start until he created an impromptu guide:

   Student 13:  “We didn’t know how to get started at first. So actually, I got up on the blackboard and drew a California timeline so we had everyone sort of go around the room and contribute to fill in a part of the timeline and that really brought everyone together. After that we just started moving on and talking about all the different themes and concepts.”

In Class A’s instructor-initiated study session, the students moved sequentially through the study guide items. The group leader asked the group what their definition was for the given term, then one student would answer, and the other students would build upon it or ask each other clarifying questions. There was very little direct disagreement or contradiction, and they shared page numbers, definitions, the time-stamp from webcasts and what they remembered from lecture and the readings quite freely.

Dealing with free riders
In Class A’s instructor-initiated study session, students who did not actively participate in the discussion did not remain in the study session for long. New students joining the group would not interrupt the studying in progress to introduce themselves, but would just try to find the group’s location in the study guide. After orienting themselves, the new-comers either began contributing to the discussion or followed along silently. We noticed that three students who did not verbally participate only stayed for a short time. They voluntarily left rather than continue to benefit from their classmates’ effort without contributing their own knowledge and interpretation of the material.

For many students the presence of free riders in study groups and group projects in general left a negative impression behind and discouraged students from wanting to participate in study
groups again in the future. Student 13 described an example in a Political Science course where several free riding students joined and damaged the productivity of the entire group, making note of one person in particular who “was just arguing over and over on this one problem” and made the original group members extremely frustrated. However, the class ended before the group felt compelled to ask that student to leave or to exclude the student from the group.

3.3.9. Section summary

Challenges to studying together

Studying with other students is an arduous process, best summed up by Student 15 who said:

**Student 15:** “I feel like the problem is...planning for people to study with...it’s like an overall process, you know? Like last semester, we didn’t really start studying together until...probably the middle of the semester. In the beginning it was kind of awkward to find people to study with, and then after we kind of knew each other it’s like ‘Hey, you wanna study? Are you free Saturday night? Because I need to.’”

There are several barriers students need to overcome in order to form study groups. Briefly, they are:

- Making time to study with others
- Finding study group partners and collecting their contact information
- Arranging a time and place to meet

Additionally, properly timing the study group request is an important factor to consider.

Once the administrative details have been taken care of, whether by an instructor, a student, or an extracurricular organization, there are still challenges to manage during the study session itself. These include:

- Deciding what material to study and how to start
- Negotiating roles, in particular, who will lead the study group
- Figuring out a studying process
- Managing the in-person interactions, especially how to handle free riders
Factors for success

Several of the challenges to studying together were resolved by virtue of an instructor-prepared study guide or having copies of previous years’ exam. It allowed students to gauge approximately how much time they needed to spend studying, what the scope of the material to be studied was, and how to equally divide the work amongst the study group partners, if desired. In Student 13’s case where there was no study guide, Student 13’s timeline provided the same structure needed to give himself and his fellow classmates an entry point to the material.
4. Design Implications

Here we discuss the design implications of undergraduates’ information sharing attitudes and behaviors on the design of new educational technologies and share our recommendations to encourage information sharing in the classroom. Some of our design principles are technology-driven, others are not. We first present our design principles and from these principles, propose specific e-textbook features to support information-sharing among undergraduates.

4.1. Design principles

Based on our findings, we propose the following educational technology design guidelines that endeavor to support the sharing of academic information. Keep in mind that these may not apply to all academic settings.

The tool should support interpersonal information sharing, but students should have control over their personally identifying information

Students are adept at managing relationships in a competitive school environment where they are wary of being dragged down by bad students and free riders. Our findings consistently show that students share notes and study with other students whom they know and trust; however, this process requires the students to get to know each other through slowly and carefully disclosing personal details. Just as they are able to selectively share information in real life, we want to preserve the same feeling of control over this interaction so as to make students comfortable using these tools.

Students should be able to choose when, how, and with whom they share their notes and other academic content

Not all students feel comfortable sharing their notes and other academic content with everyone and they consciously choose with whom they share information. Even though students typically share with friends or peers with whom they have a trusting relationship, relationships can change over time. Several students consciously chose to limit sharing with close friends, but others cited the competitive environment as a strong deterrent to sharing (Student 7, Student 9). We also want to allow for one-time exceptions for students to help their peers who are sick or suffering other hardships. Additionally, if they want to share notes with a person via
email, their annotations (or any other non-note information) should not also be automatically viewable by the other person. For all the aforementioned reasons, it is critical that students have control over how they share information.

**The tool should facilitate in-person study sessions**
Recognizing that the value is not found in information artifacts alone, but rather in the discussions between learners, educational technologies should support these conversations. Practically speaking, it would be helpful to have student’s be able to pull up their individual notes and easily interact, share, manipulate and exchange easily. The aiding technology (tool) should in no way create a barrier to this process. It should be as easy as a student pulling out his notebook and showing his classmate.

**‘Design out’ distraction whenever possible**
In all classrooms we observed, technology distracted students to some extent. A collage of Facebook pages, LOLcatz, and craigslist ads could plainly be seen on several students screens. Some students consciously chose to take handwritten notes and avoid using their laptops, citing that the Internet was a major distraction. Even a number of those students without laptops were still likely to receive and respond to text messages during lecture. As many benefits that new technologies can offer, there come unintentional drawbacks along with them. While not always possible, designers should strive to reduce potential distractions whenever possible.

**The tool should be easy to use**
Students’ lives involve more than school; the undergraduate experience in America is meant to be a time of personal enrichment and exploration which they achieve by involving themselves in many different experiences. Often they become members of extra-curricular organizations, and some work one or more jobs. Yes, students are busy, but for good reason. Educational tools should not take time away from students’ personal growth due to steep learning curves or usability problems.

**4.2. The course information landscape**
Although our recommendations are focused on the e-textbook platform, it is critical to understand where it exists in relation to the course information landscape and acknowledge that the textbook is not the only component of a class. Course content and structure also come from other things like the syllabus, the instructor’s lectures and slides, tests and assignments, supplementary material from the Internet, and content produced by the students themselves (blogs, wikis, forums, assignments, group project deliverables, etc).
The figure below is a map of the components of the course information landscape. Each of these components adds different types of information to the academic information landscape. It is possible to design e-textbook features that are meant to improve information sharing on their own, but we also wanted to include features that could enable information sharing opportunities in conjunction with other landscape components and present them in a way that was practical and actionable for e-textbook designers.

*Figure 6: The course information landscape.*
4.3. Proposed features

Stand-alone features
The following features could be implemented as stand-alone features in an e-textbook to encourage academic information sharing among students. Some of them rely on an Internet connection, but since e-textbook readers also rely on Internet connections to deliver new content to their owners, we consider this a given.

i. Feature: Self-tests

Self-tests are comprised of questions about the textbook material using any number of formats, such as multiple choice, short answers, essay, matching, etc. As we discovered from our research, studying with others was often motivated by a student’s lack of confidence in the material. Providing students with timely feedback will help them self-evaluate their study methods and whether or not they might want to study with other students.

ii. Feature: Reveal chapter meta-data

This feature was inspired by Student 4 and Student 6 who consulted with each other regarding how long it took the other to complete course readings and assignments. We suggest exposing the cumulative amount of time the student spent reading the chapter, meta-data for each chapter such as the average time needed to read the chapter, and which students were “experts” based on time spent reading the chapter and performance on built-in assignments and exercises. Comparing one’s own performance in the built-in exercises and assignments against the aggregated scores could help students gauge their understanding of the material and point them to the students with a good grasp of the material for assistance. This kind of meta-data acts as a self-assessment aid similar to the self-tests.

iii. Feature: Chapter ratings system

This feature would allow students to rate chapters as a whole, using a zero to five stars rating system and unstructured comments, for example. This kind of meta-data would act as a proxy for in-class study companions who tell each other where to focus their efforts. Again, we are hoping that peer-provided ratings provide students an open-forum for sharing tips about the
chapter as a whole even if they do not wish to share their personal annotations, and, in combination with the “chapter expert” meta-data, can help students find other students whom they can contact for help if they have questions.

iv. Feature: Digitize hand-written notes

This feature is meant to help students who take notes on paper share their notes without having to transcribe them. The feature would use Intelligent Character Recognition (ICR) to digitize photographs of a student’s hand-written notes. This feature would also need access to the reading device’s camera and the Internet so that the student could share them via email. We believe that support for this kind of feature is beneficial because so many students we observed still took notes on paper and we want to make sharing notes as painless as possible for the sender. Students with “bad handwriting” may also personally benefit from this feature.

v. Feature: Contact importing

This feature would allow students to import their contacts from their email, Facebook, Twitter or other address books. This feature is intended to avoid forcing students to rebuild or recreate their existing online social networks within Inkling. Our findings show that students prefer to share information and ideas with peers they already know so we want to make it easy to find and contact those people. This is in line with our ‘ease of use’ design principle, primarily because students are busy and have an expectation that technology is suppose to make their lives easier, rather than more cumbersome.

vi. Feature: Post-class notes donation

This feature is intended to allow students to share their notes at the end of the semester after they have completed the course. The intention behind this is to allow students to contribute or ‘donate’ their notes to future classes, taking advantage of the fact that ‘competitiveness’ is no longer a barrier to note-sharing.

Syllabus-dependent features

The following features could be implemented with the additional awareness of the course syllabus. As we mentioned before, the course syllabus contains time-sensitive information like class meetings and assignment and exam due dates. If the syllabus was not easily electronically available, perhaps this feature could be extracted from a digital photograph of the syllabus using Optical Character Recognition (OCR), or less ideally, by a student who entered the data by hand. Unfortunately, we do not think these features could be realized without this scheduled information.
vii. Note-taking reminders

If the e-textbook is integrated with the class syllabus and the student misses a class and does not take any notes that day, this feature would send an email or text reminding the student to get notes from another classmate. The student could either choose to contact someone and ask for their notes immediately after they receive the reminder, add it as an item to their to-do list and ask later, or ignore the message. This flexibility helps students pick the best times to ask for class notes and is sensitive to the value students place on the quality and workmanship of their notes.

viii. Exam reminders

As we discovered, not all undergraduates did a good job at keeping track of upcoming exams of keeping track of upcoming exams. A few of our interviewees asked us when their upcoming exam was going to be held. To address this oversight and provide students with enough time to organize a study group, we propose a feature that sends an email or text reminder when an exam is one week away. Of course, the number of days in advance could be configured, but we would recommend no sooner than ten and no fewer than two days before the exam as the ideal time-frame to organize a study group since these were the time-frames which our interviewees told us they started studying for their exams.

Roster-dependent features

The features below could be built with access to the course roster or fellow e-textbook users’ personal profiles and could help address problems we uncovered around meeting fellow classmates and collecting contact information.

ix. Study Partner Recommendations

This feature could be implemented in conjunction with the import contact integration feature to help recommend study partners. This feature would create a list of potential study partners from the course or section roster. It would be best implemented if the e-textbook were also integrated with the course roster, syllabus, and online homework submission interface, if possible. The algorithm would try to match students against the factors which our interviewees indicated were most important when choosing study partners: level of commitment to the course measured by punctuality of assignment submissions, current grade, and attendance if available. These attributes would not be published on the platform, only used by the matching algorithm. We think that a feature like this would help students overcome the challenges of finding other students who possessed similar work ethics with whom to study. If these
attributes were not available, it could use data provided by students in their e-textbook profiles or usage statistics, but would produce less powerful recommendations.

x. **Electronic study group sign-up sheets**

This feature would transform the surface of the e-textbook to an electronic notepad, allowing the e-textbook owner to pass around the device and collect names and email addresses from interested classmates. Other students could input their contact information via touchscreen keyboard or stylus. The sign-up sheet could be designed to do a little bit of data validation, like requiring both a name and an email address or phone number. An electronic study group sign-up template that was integrated with the student's contacts or class roster could help alleviate the data entry even further. It might also be helpful if there were a scheduling utility like Doodle to help the interested students choose a time and integration with their university's online group study room reservation system. In-person study session location support may be more tricky if students are not part of the same campus. We think this could be a popular feature based on the complaints we heard from students regarding the administrative burden of arranging study groups.

**Study guide-dependent features**

The feature below could be implemented with access to an instructor-provided study guide.

xi. **Smart Study Guides**

If the e-textbook had access to an instructor-provided study guide, this feature would use natural language processing to compare the study guide to the student’s notes. For each question or key word, the smart study guide feature would add links or pointers from the study guide to the section(s) of the student’s notes where the relevant information is found. If the smart study guide could not find relevant information in the student’s notes, the feature would flag that item in the study guide for the student to research further. This feature might encourage students to share their notes in order to uncover the greatest possible coverage of the study guide questions in a quick, automated way. If the study guide could not be accessed through automated means, the e-textbook could provide an upload utility to add it to the textbook. We do not, however, recommend adding this feature if the only way to access the study guide would be by manual entry by the student. Then the feature would fail for reasons of inconvenience.
5. Conclusion

The path to successfully designing a feature that encourages sharing of information in an e-textbook platform is complex and largely unexplored. Our data shows that sharing of information is treated as a trade, with value attached to the information being shared. Potential e-textbook features need to consider the current social norms and environment in which undergraduate students currently share information if they hope to be useful and adopted. Students expressed a sensitivity to the types of information they would share and with whom, indicates a desire that they be in control of their sharing actions even when they are facilitated by electronic media.

Our research took a detailed look into the attitudes and behaviors of a few undergraduates at an elite public university. However it is our hope that the patterns we observed are not idiosyncratic events and extend to a more general number of university classrooms. Future studies may want to consider looking at a broader range of institutions and student populations, as well as other platforms and devices.

We hope our recommendations provide e-textbook designers with insight into what types of features could be developed to empower students to more successfully share information with each other.
Bibliography


Appendix A

Recruitment Letter

Dear Professor [X]:

We are graduate students here at UC Berkeley’s School of Information and are conducting a qualitative research project about educational technologies (including course websites, bSpace, and e-textbooks) and student-centered learning. From this project we hope to better understand the underlying motivations behind how students share information and eventually, propose some design requirements to help educational technology foster information sharing among students.

You are receiving this email because we would like to include a variety of classroom sizes and disciplines in our research project and feel that your course on ___ would provide a unique classroom perspective.

What we are asking of you...

We would love the opportunity to:

Observe your class lectures and class sections (if any). We are particularly interested in the students’ perspectives and wish to be as non-disruptive as possible.

Conduct short interviews with a few students once or twice during the first eight weeks of the semester. After the first eight weeks we will stop observing and will begin analyzing our data.

This research will be our final project towards the completion of the Masters of Information Management and Systems degree at the UC Berkeley School of Information while also working with the Center for Next Generation Teaching and Learning here on campus (http://ngtl.ischool.berkeley.edu/). Our faculty advisor is Jenna Burrell (http://people.ischool.berkeley.edu/~jenna/).

We are happy to send more details via email or meet with you in-person to further explain the project.

Sincerely,
Marco Cozzi
Niranjan Krishnamurthi
Emily Wagner
scl@lists.berkeley.edu

UC Berkeley School of Information
www.ischool.berkeley.edu
Appendix B

Statement of Informed Consent

A group of students in the School of Information at UC Berkeley are conducting studies to understand the information sharing behaviors of undergraduate students.

If you volunteer to participate in this study, you will be observed during group study sessions and/or interviewed about your information sharing practices. Your interactions may also be digitally recorded on video, audio and/or with still photographs.

This research poses no risks to you other than those normally encountered in daily life. All of the information from your session will be kept anonymous. We will not name you if and when we discuss your behavior in our assignments, and any potential research publications. After the research is completed, we may save the anonymous notes for future use by ourselves or others.

Your participation in this research is voluntary, and you are free to refuse to participate or quit at any time. Whether or not you chose to participate will have no bearing in relation to your standing in any department of UC Berkeley. If you have questions about the research, you may contact Marco Cozzi (mcozzi@ischool.berkeley.edu), Niranjan Krishnamurthi (niranjan@ischool.berkeley.edu), Emily Wagner (emily@ischool.berkeley.edu), or Professor Jenna Burrell at 510-642-7584 or jenna@ischool.berkeley.edu. You may keep a copy of this form for reference.

If you accept these terms, please write your initials and the date here:

INITIALS ___________________ DATE ___________________
Records Release Consent

As part of a student project on undergraduate information sharing, we may make photographic, video and/or audio recording of your actions or speech. We would like you to indicate below what uses of these records you are willing to consent to. This is completely up to you. We will only use the records in ways that you agree to. In any such use of these records, your name will not be identified. Please initial all those statements that you agree to:

The records can be studied by the student team for use in reports.  

The records can be shown to subjects in other interviews.  

The records can be used in scientific publications.  

The records can be shown at meetings of scientists interested in the study of human-computer interaction (HCI) and information sharing.  

The records can be shown in presentations to the public.  

I have read the description and give my consent for the use of the records as indicated above.

Name (printed):  

Signature:  

Date:  

Appendix C

Interview Guide

What’s your major (and year in school)

What got you interested in this class? Why did you decide to take this course?

What do you think about the material so far?

What do you think about the course website (if there is one)?

How do you think you learn the material best?

How do you usually complete your assignments for this class?

How do you prefer to work on the homework/papers/problem sets?

How well do you know the other students in this class?

Do you have any friends in this course?

If you do, do you study together? Why or why not? How often? For assignments or exams (or both)? Do you have any other comments?

How important is feedback from other students for your work in this class?

Are other students able to view your work in the class?

How do you feel about this?

How comfortable are you with speaking up in class?

What motivates you to speak up in class?

How comfortable are you with sharing information with others in your class?

In your opinion, what is the purpose of taking notes?

What tools and methods do you use to take notes? (with pen/paper, audio recording device, laptop, netbook, something else?)
Walk me through the steps of what you do with your notes (open Google Docs/MS word/notebook paper)

Do you look at them later? When/why do you look at them? How frequently?

What do you do if you have a question about the material?

How do you know when you’ve studied enough for a test?

Do you ever communicate about the course outside of class? With whom? What do you talk about? What tools do you use?