INFO 214 - User Experience Research - May, 2010

Mobile bSpace User Research

Alison Meier (alisonm@ischool.berkeley.edu)
David Rolnitzky (dr@ischool.berkeley.edu)
Thomas Schulchter (thomas@ischool.berkeley.edu)

UC Berkeley, School of Information

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Executive Summary

bSpace is the web-based communication and collaboration environment deployed campus-wide for use by instructors and students at UC Berkeley to share course information and facilitate group work. This research project focuses specifically on how students use mobile technology and the current bSpace website in order to determine whether or not a mobile bSpace solution would fit user needs and should be developed. Data is collected and recommendations are formed based on in-person interviews and contextual inquiry, an online survey, and a competitive analysis. Prior to the project, very little research was conducted with students who use the current bSpace website. The project was completed on behalf of the User Experience department within the Berkeley Educational Technology Services (ETS), a UC Berkeley campus unit.

Findings of the user research included:

- It's recommended that a mobile bSpace product be developed
- Nearly every respondent has a mobile phone, and there is a large penetration of smartphone use on campus
- Students are already accessing the bSpace mobile website, even though it's not optimized for mobile devices
- There was a wide spectrum of opinions on whether or not students would use a mobile bSpace product, with a large group saying they would like one, and a vocal minority strictly opposed
- Students are using bSpace most often for “transactional” uses and as a central repository. They most often use bSpace to access the syllabus, course announcements, links to articles, and grades

Background

bSpace is the web-based communication and collaboration environment deployed campus-wide for use by instructors and students at UC Berkeley to share course information and facilitate group work. bSpace is developed on top of the open-source project Sakai, a collaborative learning environment that provides course management software. Because Sakai is an open-source project, many different universities develop portions of the system. Berkeley makes decisions about which aspects to incorporate into the bSpace system on a feature-by-feature basis.

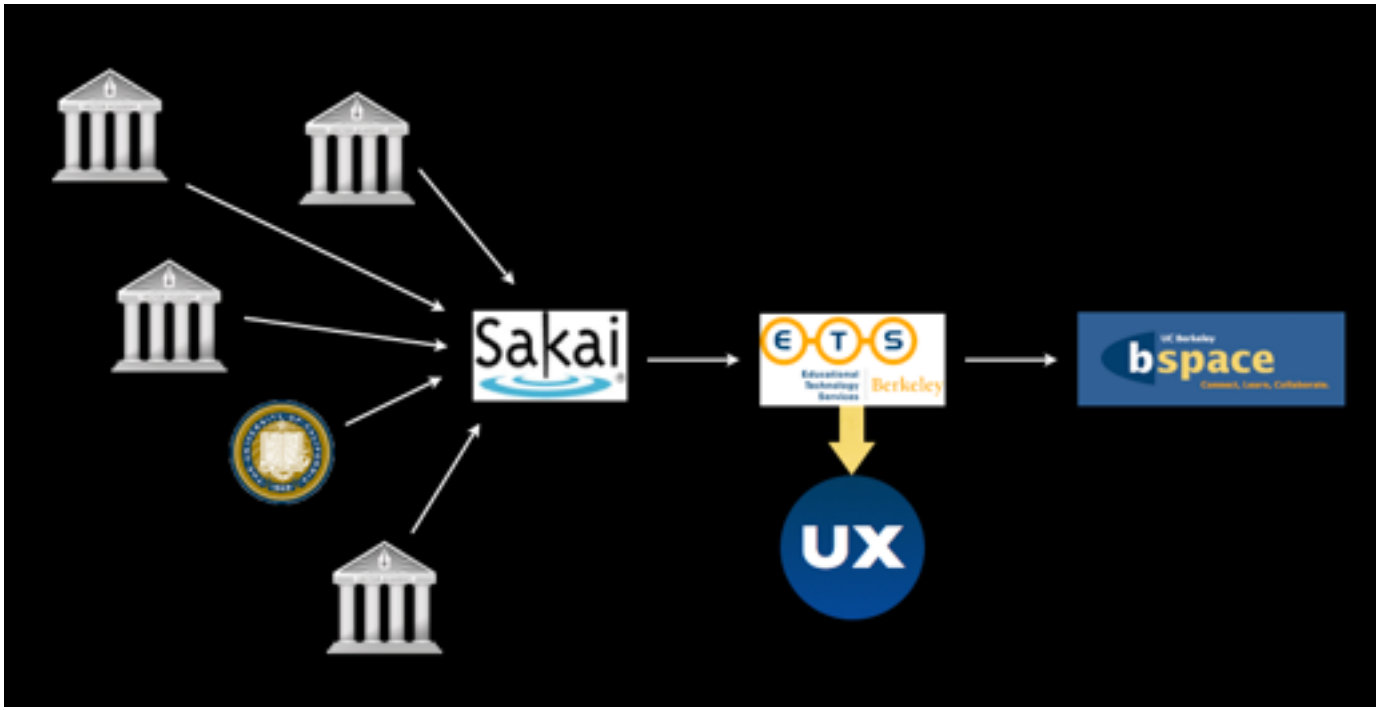

Figure 1: The bSpace development model. Numerous universities build on and contribute to the Sakai platform. The ETS User Experience team works to research technology like bSpace.

Background (continued)

There is currently a very light mobile version of the bSpace website (see figure 2). It was developed over a weekend by a developer and is not considered by ETS to be a real mobile solution. However, beyond the initial page (located at https://bspace.berkeley.edu/portal/pda), the mobile site is not optimized. After users select a menu option, they are directed to the full bSpace website, which is difficult to use on a mobile phone.

Figure 2: The current bSpace mobile website.

Project Goal

The primary research goal was to determine whether it would be worthwhile to develop a real mobile bSpace website for use with the UC Berkeley campus community.

Research Questions

The primary research questions were:

- How do students currently use bSpace?
- How do students use mobile technology?
- Would students use mobile bSpace?
- What are other schools doing in this area?

Methodology

Competitive Analysis

Because access to other course management systems requires institutional subscriptions, we did not have direct access to competitor platforms. Instead, we conducted extensive Internet research for information about competing options. We obtained screenshots of Blackboard Mobile from an existing user of Blackboard Mobile for the iPhone. We also participated in a WebEx event[1] conducted by Blackboard regarding their new iPad application and upcoming phone applications.

Interviews

Target Audience:
Our target audience consisted of students at UC Berkeley who currently use bSpace for at least one class. We aimed to interview both undergraduate and graduate students from diverse disciplines in order to understand how students with a variety of academic needs actually use bSpace.

Recruiting:
Initial interviews were conducted with three graduate students from INFO-214 (User Experience Research). These students were from various disciplines outside of the School of Information. Each student was interviewed at a place that was convenient for him or her. We recorded each interview. Following these interviews, we assessed the interview questions and made adjustments to the order and wording of questions as needed.

In order to reach undergraduate students from diverse disciplines, ETS emailed an assembled list of students on our behalf. The list consisted of 42 students who had agreed to be contacted by ETS to give feedback on applications and technology services. In the email, we told students that we wanted to meet with undergraduates who use bSpace for at least one class for the purposes of a "project regarding mobile phones and academic materials." We offered to meet students in their typical study environment for an interview what would take less than 45 minutes. In exchange, each interviewee was offered a $10 Tully's gift card.

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[1] Blackboard Mobile Learn - Bringing Blackboard Learn to Your Mobile Devices, April 22, 2010

Methodology > interviews (continued)

Sessions:
Six undergraduates responded to our recruitment email. We met each undergraduate at his or her preferred location. Some example locations include the engineering library, Qualcomm Cyber Cafe, and the Disabled Student's Program study room. We met students during the day during the school week to try and create a typical study session for the student. As such, we did not request that student interview subjects bring a laptop with them because we wanted to simulate the student's study habits as closely as possible.

For each undergraduate interview, one person conducted the interview and another took notes. The audio for each interview was recorded. After asking each participant to sign a consent form, the interviewer asked a series of questions (see appendix, interview questions). Interviewees were queried regarding their experience with bSpace, study habits, and mobile phone usage. We specially wanted to know 1) how they used their mobile phones for studying, 2) whether or not they had accessed the bSpace website from their mobile device, and 3) what they thought about that experience.

Midway through the interview, a mini contextual inquiry was conducted. We asked participants if they had a laptop with them: if they did not, we asked the participant to use one of the interviewer laptops. Participants were asked to walk us through how he or she used bSpace. We asked the participant to show us something that he or she had done recently on bSpace and to "think aloud" while performing the task. This provided the opportunity to see how the participants actually use bSpace in a real world setting. It also helped some participants to remember details about their bSpace workflow and specifics about the user interface.

Methodology > interviews (continued)

Participants:
In total, we interviewed nine students (see table below). Six were undergraduate students; three were graduate students. We interviewed five females and four males. The participants represented a wide range of areas of study, and their bSpace usage varied significantly. Six of the participants were smartphone owners; three were not. Of the six undergraduates, only two brought a laptop to the interview.

Participant*	Graduate/ Undergrad - Year in program	Area of Study	Gender	bSpace Usage	Smartphone ?	Laptop during interview?
01 "Jessica"	PhD - 1	Interdisciplinary (Science/ Engineering/ Education)	Female	Less than once a week	No	n/a
02 "Burt"	Masters - 2	Public Health	Male	Less than once a week	Yes	n/a
03 "Carl"	Masters - 2	Business Administration	Male	Less than once a week	Yes	n/a
04 "Jaclyn"	Undergrad - 3	Nutritional Sciences	Female	More than once a week	No	no
05 "Victoria"	Undergrad - 4	Linguistics	Female	More than once a week	No	no
06 "Jules"	Undergrad - 4	Integrated Biology	Female	More than once a week	Yes	no
07 "Donald"	Undergrad - 3	Psychology	Male	Less than once a week	Yes	yes
08 "Ingrid"	Undergrad - 3	Industrial Engineering	Female	More than once a week	Yes	no

* Participant names have been replaced with pseudonyms.

Methodology > survey

Survey

Target Audience:
Again, our target audience was UC Berkeley students. We did not specify that the students needed to be current bSpace users in order to participate in the survey (though we did ask if they were currently bSpace users in the course of the survey). We desired a wide breadth of academic disciplines and a combination of undergraduate and graduate students. We hoped that the male/female ratio would reflect the overall campus ratio.[2]

Creation:
The survey was created using the online survey tool esurveyspro.com. The survey includes 23 questions. The questions are a mix of multiple choice with single response only (14), multiple choice with multiple response possible (5), rating scales (2), and open-ended responses (2). Branching methods were used to sort respondents based on answers to particular questions (see appendix, survey question branching).

The following questions were based on similar questions from the 2009 Sakai Multi-Institutional Survey Initiative.[3]

> Question 5. Please rate your agreement with the statement:
> "I've found the following information technologies to be valuable for my course-related activities..."
>
> Question 12. What bSpace tools do you use regularly?

Pre-testing:
The survey was pre-tested by students from the INFO-214 User Experience Research course. Nine students took the survey, and five responded with comments and suggestions. The survey questions were adapted to include this feedback. The pre-test survey respondents are not included in the survey respondents total or the findings results.

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[2] undergraduate: 53% female, 47% male; graduate: 55% male, 45% female. UC Berkeley Facts at a Glance: http://berkeley.edu/about/fact.shtml

[3] http://confluence.sakaiproject.org/display/UDAT/2009+MISI+Selected+Results (UC Berkeley did not participate in this survey)

Methodology > survey (continued)

Distribution:
The survey was distributed by email to the ETS Go To Network. The Go To Network consists primarily of UC Berkeley instructors. Instructors were asked to distribute the survey to students in their classes. The survey was available online for seven days, from April 17, 2010 to April 23, 2010.

This method of distribution **cannot be considered a representative sample** because it was not distributed randomly. Despite the lack of randomness, we hoped to collect a broad sample of the UC Berkeley student population.

Respondents:
In total, 731 people responded to the survey, and 581 completed their responses. Students from a variety of academic disciplines responded to the survey, though students from business and engineering departments are overrepresented (see figure 3).

The ratio of undergraduate students to graduate students is lower than the campus ratio (survey respondents: 54% undergraduate, 42% graduate; campus: 71% undergraduate, 29% graduate)[4].

Furthermore, 59% of respondents were male (41% female), which leans more heavily to male response that the campus average (see above).

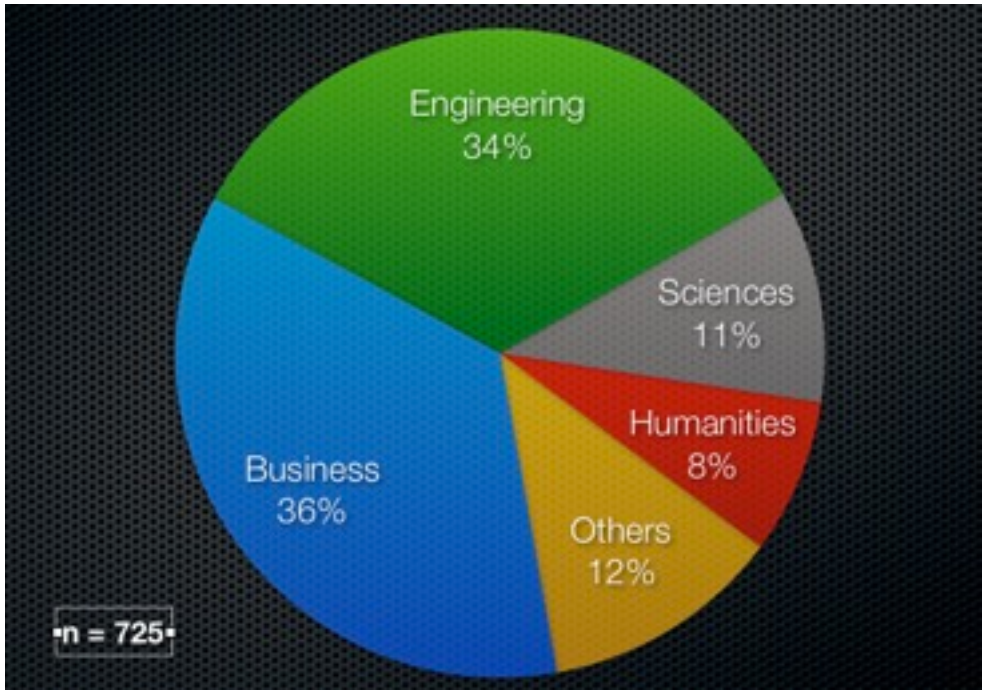

Figure 3: Percent of survey respondents by discipline.

[4] UC Berkeley Facts at a Glance: http://berkeley.edu/about/fact.shtml

Methodology (continued)

Interview and Survey Data Analysis

In order to determine key findings from the interview and survey results, we performed a variety of tasks to analyze the qualitative and quantitative results.

Portions of each interview were transcribed. The notetaker from each interview session gathered key quotes and summarized main concepts. The interview conductor reviewed the notetaker's summary and added any additional findings. From these interview summaries, each team member pulled out key ideas. We then wrote what we each believed the the key ideas were on sticky notes. We collectively gathered our sticky notes and created an affinity diagram (see figure 4) to find key themes and concepts.

Figure 4: Affinity diagraming after the interviews in order to find key themes and concepts.

For the qualitative survey results, we performed lightweight data analysis. Percentages of responses out of the number of question responders were calculated. We also did some cross-tab analysis by hand (the survey tool did not provide automatic cross-tab functions).

Methodology > data analysis (continued)

In order to synthesize the almost 500 open-ended survey responses (responses for questions #22 and 23), a tagging and coding system was developed. Survey responses were split into separate phrases if the comment included multiple kinds of comments. Each phrase was then coded with a sentiment/type of speech tag and a concept tag. If a single phrase related to multiple concept tags, the phrase was listed twice with two separate tags (see figure 5). After the open-ended responses were coded, the tags were analyzed for frequently occurring sentiment and concept pairs. Key comments were then gathered to illustrate each sentiment/concept pair.

ID	Statement	Sentiment/Type	Concept Tag
17a	It would be good to have announcements available in real time and on-person at all times,	positive	functionality
17a	It would be good to have announcements available in real time and on-person at all times,	positive	information - timeliness
17b	but it still wouldn't replace any heavy lifting tasks (i.e. word processing, test taking, etc) that would still require a PC	negative	mobile phone - limitation

Figure 5: Sample qualitative coding from open-ended survey questions.

Competitive Analysis Findings

Blackboard Mobile Applications

Blackboard is the largest commercial platform for course management; it also has the most widely used mobile offering. Currently Blackboard offers a mobile application called Blackboard Learn for iPhone and iPod touch users. The Blackboard Learn application has been available since March 2009. The application is free for anyone to download from the iTunes store but only registered Blackboard users can log in to the site. According to Blackboard, the application allows users to "receiv[e] updates and alerts on grades, assignments, tests and other information from courses as well as groups and organizations."[5]

From analyzing the available screenshots of the Blackboard Learn application as well as iTunes reviews of the current application, we learned that the Blackboard Learn application provides a local application for the initial menu screen (see figure 6 in appendix). Once a user progresses past the opening menu, however, the application links to the typical Blackboard website through the Safari browser that is not optimized for the mobile device.

Students appear to be dissatisfied with the current mobile application. The current version of the application has 10,711 1-star ratings (1 being the lowest out of a scale of 5) out of 14,877 total ratings (see figure 7 in appendix). One iTunes reviewer complained, "This is nothing more than a glorified set of links back to your particular colleges [sic] site. You have to login via safari each time you want to get updated information which makes the whole application useless in the first place. I could have just as easily made a bookmark in safari and gotten the same functionality."[6]

Blackboard has perhaps heard users' complaints and is planning to release a new application called Blackboard Mobile Learn, June 16, 2010. The application will be available for Android, Blackberry, iPhone, and iPod touch. An iPad application has already been released (see figure 8 in appendix).

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[5] "New Blackboard Learn for Apple iPhone Application Lets Users Take Learning on the Go" (Press Release, March 26, 2009), http://www.blackboard.com/Company/Media-Center/Press-Releases.aspx?releaseid=1270202

[6] hypnoswakes, July 6, 2009

Competitive Analysis Findings (continued)

The Blackboard Mobile Learn iPad application interface includes a smooth drag-and-drop functionality based around a common "dashboard." Each of the user's courses is accessible from a menu. From the dashboard, users can access to the course management capabilities within the native application (rather than opening content in the browser itself). For example, a user can view an assignment description directly in the application and has the option to open attached files directly (see figure 9 in appendix). Users can also create content directly in the native application (see figure 10 in appendix).

Of course this interface design and ease of use is quite different on an iPad than a mobile phone. Blackboard has not released information about the phone version yet, so it is uncertain how much of this functionality will be represented on other devices.

Blackboard also currently offers an additional mobile application called Blackboard Mobile Central (see figure 11 in appendix). Blackboard Mobile Central provides a central place for university-specific applications such as campus maps, directory listings, news releases, and sporting event information. This application works with Blackberry, iPhone, and iPod Touch (see figure 12 in appendix).

Other Mobile Applications

Another open-source platform, Moodle, has an add-on option called MOMO[7] (see figure 13 in appendix). This is an independent add-on that is not affiliated with Moodle. Moodle site administrators must install a MOMO extension for their course site. In order to use this add-on, individual users must install the MOMO client on their phones, which runs on Java. Even though the add-on have been available since at least May 2008, there seem to be few, if any, real courses using the option.

[7] MOMO: http://www.mobilemoodle.org

Competitive Analysis Findings (continued)

Some universities have created their own course management systems with corresponding mobile options. MIT, for example, has created its own course management system called Stellar.[8] MIT has also created its own mobile site[9] and iPhone application[10] (see figure 14 in appendix). The mobile application allows users to access news and announcements from Stellar, but not full course management access.

Interview and Survey Findings

From the interviews and the survey, several key themes have emerged. We will report those findings in three parts: student use of bSpace, student use of mobile technology, and insights on mobile bSpace.

Student Use of bSpace

Feelings toward bSpace:
Approximately 75% of survey respondents reported that they are "satisfied" or "very satisfied" with their overall experience with bSpace. Usability issues with the current implementation notwithstanding, this number represents a high degree of acceptance of the platform. The main reason for students' appreciation of bSpace is that it provides central access to resources that are needed for studying and coursework. Many survey respondents complained that not all courses used bSpace, forcing students to log on to different services. Despite these issues, the current amount of consolidation seems relatively high: 73% report three or more courses on bSpace this semester.

[8] http://stellar.mit.edu/

[9] http://m.mit.edu/

[10] http://m.mit.edu/about/iphoneapp.html

Interview and Survey Findings (continued)

Students don't love bSpace, but they value it. The many complaints about its usability are somewhat offset by the acknowledgment of its utility.[11]

> "It just puts everything in just one place… so, that's pretty good."

> "I wouldn't know what my homework was if there was no bSpace."

Frequency of Use:
Most respondents make intensive use of bSpace. 27% of survey participants access the site "several times a day," and only 5% report accessing bSpace less than "a few times a week." Almost all respondents commonly access bSpace from home on a personal computer (92%), while 50% of respondents also regularly access the site from their personal computer while on campus. One seventh of all respondents report using campus facilities to visit bSpace on a regular basis. **In conjunction with the frequency of bSpace access, we can conclude that on-campus use of bSpace is a significant part of students' experience.**

[11] Though outside of the scope of our focus on mobile bSpace, the most frequent complaint we heard from students was about setting up tabs at the beginning of the semester. They find them to be cluttered and difficult to use, and annoying that they are not updated each semester automatically without manual intervention. In addition, you can only have so many showing at once, and they have to be manually arranged. Multiple interviewees also mentioned that the help documentation for setting up new tabs is quite confusing.

Interview and Survey Findings (continued)

Features Used:
Asked which features of the platform they access on a regular basis, students reported a fairly limited use of the functionality that bSpace offers (see figure 15).This probably has more to do with instructors' choices than with students' preferences. Whoever administrates a particular course site can configure it to display a subset of bSpace's features. The five most used features are either very or fairly common:

- Resources (78.5%)
- Announcements (77.9%)
- Assignments (76.2%)
- Syllabus (64.2%)
- Gradebook (50.3%)

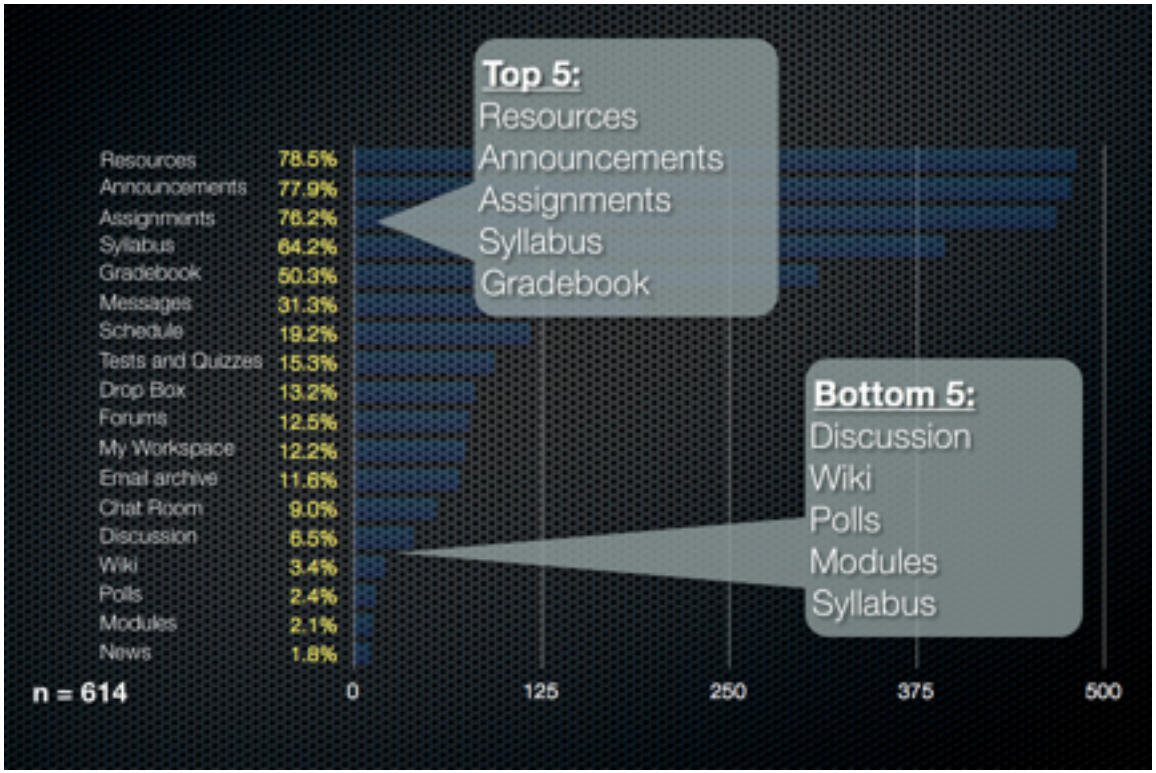


Figure 15: What students are using most frequently on bSpace.

Interview and Survey Findings (continued)

Below the top five there is a sharp dip in usage. The least common features (Discussion, Wiki, Polls, Modules, News) hover around 4%. The kinds of interactions that students have with bSpace are mostly related to one-point, short timeframe tasks.[12] The nature of these tasks is transactional and workflow-related rather than immersive and sticky. **Although most students access bSpace fairly frequently, they are not likely to spend a lot of time there.**

Student Use of Mobile Technology

Ubiquity of Mobile Phones:
Mobile phones are in widespread use on campus. Out of 625 respondents, only three reported not having a mobile phone. Almost two thirds are smartphone users (62%). Roughly the same percentage reports doing email and accessing the Internet on their mobile phones, these being the most prevalent uses after calling and texting. To ensure that the high percentage of smartphone users is not purely a product of the skew towards business and engineering students, we controlled for departmental affiliation. Despite the slightly varying numbers (e.g., 47% of students from the humanities report having a smartphone) the overall penetration is high. **Smartphones are a common tool among Berkeley students. On the other hand, there is a sizable portion of non-smartphone users though that do not have readily available Internet access on their devices for various reasons (e.g., cost associated with data plans, skepticism about ubiquitous Internet access).**

Already Accessing bSpace from Mobile Devices:
At least 25% of survey respondents have already accessed bSpace from a mobile device.[13] To put this in perspective: Participants were asked to reflect on their last week and to estimate how often they had needed information available on

[12] This is also true for Assignments, as interviewees frequently reported that the creation of assignment content is carried out in other applications (word processors, Google docs, etc.) and merely uploaded/copy-pasted into bSpace.

[13] This question had 187 positive out of 315 responses total. It was asked relatively late in the survey and had not been answered by a majority of respondents (436). Thus, the exact number of users who have accessed bSpace on a mobile device cannot be reliably reported. The 25% figure was calculated out of the total number of people who took the survey, whether or not they answered this question (25% = 187 positive answers out of 731 total survey respondents). 25% seems like a remarkable number, and it may be significantly lower than actual use.

Interview and Survey Findings (continued)

bSpace without having access to a computer.[14] While 58% responded "never"; the remaining 42% found themselves in this situation at least once over the course of a week. 6% reported that this had happened more than three times.
From the interviews and comments on the survey, it seems clear that many students prefer not carrying a laptop with them all the time. 3% of respondents claimed that a mobile phone was their main mode of access to bSpace. **Mobile phones are the one device that almost everyone carries. Even under conditions of sub-optimal usability, a good portion of students are occasionally accessing course information from their phones.**

> "I don't carry my computer to class because it is too heavy, but I always have my phone."

Smartphone Devices:
The three most important contenders in the smartphone platform space are well represented on campus. Although the iPhone dominates with about 54% usage out of smartphone users, Blackberry (20%) and Android-based phones (9%) are also strong. Palm and Windows Mobile-based phones are less common. **The variety of platforms in use suggests a platform-independent solution if a mobile version of bSpace was to be built.**

Insights on a Mobile Version of bSpace

Regarding the attitude towards a mobile version of bSpace, we could identify three distinct groups of students and describe them as follows:

- Vocal opponents—a small fraction who reject the idea out of principle
- Indifferent skeptics—a large portion of students who do not object to a mobile version of bSpace out of principle but either don't feel targeted by it or have concerns about practical aspects of it
- Endorsers—an equally large portion of students who see benefits to the idea of a mobile version of bSpace or even unequivocally call for it

The main arguments within each of these groups are explained below.

[14] Note that most respondents had accessed the regular bSpace site rather than the actual mobile site. Few knew that a mobile option existed and expected that their mobile browser would automatically redirect to a mobile version if it were available. This indicates that it would be important for a true mobile site to automatically redirect in order to encourage use.

Interview and Survey Findings (continued)

Vocal Opponents:

A mobile version of bSpace would further blur the line between school and life; it will encourage bad behavior with instructors

This is a view that was expressed both in our interviews and in the open-ended survey responses. There are three aspects to it. First, some respondents fear that school-related alerts will be pushed on them, further exacerbating the already felt information overload. Second, some suggest that the availability of a mobile version of bSpace would encourage professors and instructors to change things on short notice, expecting that everyone will be informed. Third, some students feel too connected to technology in general and want to avoid spending too much time using mobile phones.

> "I don't like how distracting mobile technology is, so I limit its impact on my life wherever possible."

A mobile version of bSpace gives an unfair advantage to those who can afford smartphones

A common point of caution was that smartphones and monthly data service plans are currently associated with high costs that many people cannot afford. Should a mobile bSpace become the "standard," some students worry it would be expected that students can access the site anywhere, effectively forcing them to get a smartphone or face a disadvantage.

> "Many students do not have data plans on their phones and [this] would give an option that could provide an unfair advantage to those whose financial abilities can provide them with 24/7 bSpace access regardless of their location."

The university should not pour money into a mobile version of bSpace in times of budget restrictions

This sentiment comes in two varieties: There are those who oppose investments in a technology they deem unnecessary anyway, and those who would prioritize the improvement of the current bSpace before tackling a mobile version.

> "Given the current budget crisis, it would be seriously inefficient to start [the mobile bSpace] program."

Interview and Survey Findings (continued)

Indifferent Skeptics:

No smartphone, no use for a mobile version of bSpace
Although many of the respondents expressing this view can see benefits to others, they personally don't expect to benefit from it since they are not smartphone users.

> "I don't have a smartphone, so it seems pointless to me."

Current use of bSpace doesn't translate to mobile
Many respondents raise doubts that bSpace can work on a mobile phone. For some, the current site seems "too heavy" to run well on a mobile device, others point to specific functionality that mobile phones do not support in an efficient way. One of the most common points is the suitability of mobile devices to display documents. Interestingly, a sizable number of respondents in the endorser camp report that they are already actually using their mobile phone to view documents on a regular basis. Much depends on the particular device and the user's willingness to sacrifice ease of use for the advantage of being able to read anywhere.

> "I don't need [mobile bSpace]. I usually need [bSpace] to access documents to print or read and smartphones can't do this and are too small."

Computers are everywhere on campus
Many respondents find the current availability of computers in either department facilities or libraries sufficient for their working needs.

> "I do not think that this would be useful because when you are on campus you are always close to a library which has computers."

Interview and Survey Findings (continued)

Endorsers:

Advantages of the mobile phone over a laptop
As mentioned before, many students have their mobile on them no matter where they go. The same is not true for full-blown computers with access to the Internet. Of those that support the development of a mobile version of bSpace mention that it would be especially handy to be able to "look up things quickly." The nature of most interactions with bSpace (see Features Used, pg. 18) would apparently translate to a mobile context.

> "It would be nice to look at the phone and see 'Oh, what do I have to read this week?"

Explicit call for more mobility and ubiquity
Beyond occasional access to information nuggets, many students also express the desire to work on the go. The expectation of being able to be productive with a smartphone extends to coursework at least among those who are seasoned users.

> "Too many occasions where I want to access educational materials on the go, but am unable to do so currently (in an efficient manner) unless I get to a laptop."

> "I think it would be very useful to have a mobile bSpace site because then students can truly access course materials anywhere."

Availability of time-critical information

Many respondents had criticized professors' tendencies to make last-minute announcements and changes, broadcasting them through bSpace. Unlike the opponents who feel like mobile bSpace would exacerbate this problem, the endorsers embrace the possibilities of a mobile version of bSpace as a way to deal which such short notice messages.[15]

> "It would be a great idea, as sometimes people need access to up to the minute announcements about classes."

[15] It is notable that bSpace already distributes announcements by email, so students with smartphones are already able to access announcements.

Interview and Survey Findings (continued)

Better usability
Naturally, those who are already accessing bSpace using their mobile phone would enjoy an optimized user experience.

> "I currently access the full site from my mobile but must zoom in and out many times for viewing. [A real mobile site] would be useful because it's hard to use the normal bSpace site on a mobile phone."

Recommendations

The following recommendations reflect our learnings from all three parts of our inquiry. Wherever applicable, we reference data from the studies.

Should a Mobile Version of bSpace Be Considered?

The answer is: "Yes, with a few caveats."

There's a large enough audience that would find mobile access to bSpace useful. A portion of students are already accessing bSpace on their mobile phones, and it's not a pleasant experience. Although there is a vocal minority opposed to the proliferation of mobile technology on the Berkeley campus for economic reasons, it can be projected that a project to build a mobile version of bSpace will benefit an increasing number of students who have access.

Mobile solutions for course management are currently in a nascent stage. As far as we can judge, the only serious competitor in this space will be Blackboard with its commercial application.

Recommendations (continued)

Design Considerations:

When considering a mobile version of bSpace, a couple of key insights should be carried over into the design process.

Make it lightweight:

Ease of access will be paramount for the adoption of any mobile solution. Given the current limitations of both devices and the networks that service these devices, low data transmission rates are a design constraint. Wherever possible, compress data and de-emphasize graphic presentation.

Prioritize most utilized elements:

Aligned with what we learned from users' current behavior on bSpace, these are the activities that most students could see themselves performing on a regular basis:

Activities	% who would use regularly
Viewing course announcements	68%
Viewing assignments	65%
Accessing grades	61%
Receiving real-time updates and notifications	60%
Links to download articles & other info	53%

Recommendations (continued)

Note that, contrary to what users in the "indifferent skeptics" camp had said, a slight majority of users would appreciate links to materials and downloads. As the capabilities and screen sizes of smartphones increase, an early investment in this feature could be worthwhile.

In general, users don't expect (and some strongly speak out against) a replication of the current bSpace to a mobile platform. The feature set should reflect what makes sense on a mobile device: short, transactional access that competes with different contexts and applications.

The motto should be: do less and get it exactly right.

Radically optimize for mobile:

Designing a mobile version of bSpace will mean departing from the desktop mindset in terms of limited screen space and different interaction models (e.g., like gesture based interfaces). Instead of simply "miniaturizing" the desktop version, the interface should be truly optimized for mobile devices.

Don't discriminate against platforms:

In the current landscape, it seems to make sense to develop a mobile web application that runs on all major mobile browsers, or to consider a cross-platform deployment solution for native applications.[16] It is unlikely that one platform will emerge as dominant, and efforts to reach as many students as possible will greatly increase the acceptance of such an investment on campus.

[16] For example, http://pyxismobile.com/

Appendix

Interview Questions

Demographic questions
What is your major?
Which year?

Student study habits
Where do you tend to study?
What materials do you typically have with you when you study?
What kinds of materials do your professors use for giving information about schedules, assignments, and resources?
Where/how do you tend to access course information? Computer, smart phone, paper?

Use of IT in the classroom
What information technology tools do your courses currently use (e.g., blogs, document sharing, online surveys, wikis, etc.)?
If you use any of these tools, which do you find particularly useful, if any?

Current bSpace usage
Please tell me about your current use of bSpace.
How many of your courses are accessible on bSpace? Which ones?
What are the primary activities that you use bSpace for?

[Contextual Inquiry section]
What I'd like to do now is a method called contextual inquiry, where you walk me through how you would normally use bSpace. Is this OK with you? Do you have laptop with you? [If not, use mine.] I'd like to observe while you interact with bSpace. If you could narrate (think aloud) as you do it, that would be great.
Can you walk me through how you would typically use bSpace?
Can you show me any other tasks that you have done in the last week?
What do you like about bSpace?
What do you not like about bSpace?

Mobile phone usage
What kind of mobile phone do you use?
What do you use your phone for?
Can you tell me about the applications you use most often?
Are there any other services you use on your mobile: location, SMS search, public transit?
Do you ever or have you in the past used your phone in your work for school? If so, how?
Did you know there was a bSpace mobile option?
If yes, how did you know about the mobile option?
Have you ever accessed bSpace from a mobile device? If so, please tell me about it.
Wrap-up
What else would you like to add that I haven't asked you yet?

Appendix

Survey Results

1. What is your major or focus area? (if multiple, check all that apply)		% of Respondents	Number of Respondents
	Engineering	34.05%	271
	Humanities	7.79%	62
	Science	10.68%	85
	Business	35.93%	286
Details	Other (Specify)	11.56%	92
	Number of respondents		***725***
	Number of respondents who skipped this question		***6***

2. What year are you in school?		% of Respondents	Number of Respondents
	1st-year undergraduate	13.22%	96
	2nd-year undergraduate	8.82%	64
	3rd-year undergraduate	18.18%	132
	4th-year undergraduate	12.40%	90
	5th-year undergraduate	0.96%	7
	Graduate student (master's)	29.75%	216
	Graduate student (PhD)	11.71%	85
Details	Other (Specify)	4.96%	36
	Number of respondents		***726***
	Number of respondents who skipped this question		***5***

3.
What is your gender?

	% of Respondents	Number of Respondents
Male	59.45%	431
Female	40.55%	294
Number of respondents		***725***
Number of respondents who skipped this question		***6***

4.
What items do you typically have with you when you do school work (whether or not you actually use them)? (check all that apply)

	% of Respondents	Number of Respondents
Books	15.63%	476
Notebooks	16.85%	513
Class handouts on paper	16.19%	493
Printouts of readings	10.77%	328
Laptop	18.85%	574
Desktop computer	2.04%	62
Cell phone	18.03%	549
Details Other (Specify)	1.64%	50
Number of respondents		***641***
Number of respondents who skipped this question		***90***

5. Please rate your agreement with the statement:
"I've found the following information technologies to be valuable *for my course-related activities...*"

	I have never used this	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Number of Respondents
My instructors' personal website	23% (148)	5% (32)	9% (58)	18% (115)	28% (180)	15% (96)	629
Multimedia (e.g., podcasts, video of lectures)	20% (126)	2% (17)	6% (39)	17% (112)	34% (217)	18% (116)	627
RSS news feeds (e.g., New York Times feeds)	47% (295)	3% (24)	14% (89)	23% (150)	8% (53)	2% (15)	626
Learning management systems (e.g., bSpace)	0% (6)	1% (8)	2% (16)	10% (64)	44% (277)	41% (258)	629
Blogging tools (e.g., Blogger)	48% (301)	8% (55)	15% (99)	20% (127)	6% (39)	0% (5)	626
Collaborative document sharing (e.g., Google Docs)	11% (70)	2% (17)	3% (20)	13% (84)	37% (234)	32% (204)	629
Group calendar (e.g. Doodle, Yahoo calendar)	22% (142)	2% (15)	5% (37)	19% (124)	31% (196)	17% (112)	626
File storage systems (e.g., IFS)	44% (276)	2% (14)	4% (31)	20% (125)	19% (120)	9% (59)	625
SMS text messaging (e.g., text messages sent via cell phones)	20% (131)	7% (48)	9% (62)	20% (126)	27% (175)	13% (88)	630
Social networking websites (e.g., Facebook)	17% (108)	11% (75)	17% (108)	26% (165)	20% (128)	7% (47)	631
Instant Messaging (e.g., AOL IM, iChat)	19% (121)	8% (51)	9% (58)	20% (131)	31% (197)	11% (72)	630
Online quiz / test systems	24% (152)	6% (42)	10% (63)	23% (147)	28% (178)	6% (42)	624
Student response systems (e.g., clickers)	36% (226)	8% (53)	11% (69)	22% (143)	17% (111)	3% (24)	626
Online surveys (e.g., SurveyMonkey)	14% (91)	5% (37)	8% (56)	28% (180)	32% (206)	9% (60)	630
						Number of Respondents	***632***
						Number of respondents who skipped this question	***99***

6. Have you used bSpace before?	% of Respondents	Number of Respondents
Yes	99.37%	628
No	0.63%	4
Never Heard of It	0.00%	0
Number of respondents		***632***
Number of respondents who skipped this question		***99***

7. How would you rate your overall experience with bSpace?	% of Respondents	Number of Respondents
Very Dissatisfied	1.76%	11
Not Satisfied	8.96%	56
Neutral	15.52%	97
Satisfied	63.52%	397
Very Satisfied	10.24%	64
Number of respondents		***625***
Number of respondents who skipped this question		***106***

8. How many of your current courses use bSpace?	% of Respondents	Number of Respondents
None of them	3.84%	24
1	7.36%	46
2	15.84%	99
3	26.56%	166
4 or more	46.40%	290
Number of respondents		***625***
Number of respondents who skipped this question		***106***

9. How often do you access the bSpace site?	% of Respondents	Number of Respondents
Several times a day	27.46%	170
About once a day	29.40%	182
A few times a week	37.80%	234
A few times a semester	4.52%	28
Never	0.81%	5
Number of respondents		***619***
Number of respondents who skipped this question		***112***

10. From where do you most often access the bSpace site? (Check all that apply)	% of Respondents	Number of Respondents
From the library, using a library computer	6.53%	84
From the library, using my personal computer	12.44%	160
From campus outside a library, using computer facilities	7.54%	97
From campus outside a library, using my personal computer	24.11%	310
From home, using my personal computer	44.48%	572
Details — Other (Specify)	4.90%	63
Number of respondents		***621***
Number of respondents who skipped this question		***110***

11. In the last week, how many times did you need information on bSpace but didn't have access to a computer?	% of Respondents	Number of Respondents
Never	58.93%	363
One to three times	35.39%	218
More than three times	5.68%	35
Number of respondents		***616***
Number of respondents who skipped this question		***115***

12. What bSpace tools do you use regularly? (Check all that apply)		% of Respondents	Number of Respondents
	Announcements	15.96%	478
	Assignments	15.63%	468
	Chat Room	1.84%	55
	Discussion	1.34%	40
	Drop box	2.70%	81
	Email archive	2.37%	71
	Forums	2.57%	77
	Gradebook	10.32%	309
	Messages	6.41%	192
	Modules	0.43%	13
	My Workspace	2.50%	75
	News	0.37%	11
	Resources	16.09%	482
	Polls	0.50%	15
	Schedule	3.94%	118
	Syllabus	13.16%	394
	Tests and Quizzes	3.14%	94
	Wiki	0.70%	21
Details	Other (Specify)	0.03%	1
		Number of respondents	***614***
		Number of respondents who skipped this question	***117***

13. Do you have a mobile phone?	% of Respondents	Number of Respondents
Yes	99.52%	622
No	0.48%	3
Number of respondents		***625***
Number of respondents who skipped this question		***106***

14. Is your mobile phone a smartphone?	% of Respondents	Number of Respondents
Yes	62.28%	388
No	35.47%	221
Not sure	2.25%	14
Number of respondents		***623***
Number of respondents who skipped this question		***108***

15. What kind of phone do you use?	% of Respondents	Number of Respondents
BlackBerry	20.05%	81
HTC HD2	0.50%	2
iPhone	53.96%	218
Motorola Droid	5.20%	21
Nokia E63	0.00%	0
Nokia E71/E71X	0.74%	3
Nokia N900	0.25%	1
Palm	3.47%	14
Samsung Moment	0.50%	2
Samsung Omnia	0.50%	2
Details Other (Specify)	14.85%	60
Number of respondents		***404***
Number of respondents who skipped this question		***327***

16. Which of the following activities do you use your phone for? (Check all that apply)		% of Respondents	Number of Respondents
	Accessing the web	16.25%	371
	Email	16.60%	379
	Phone calls	26.94%	615
	Texting	25.01%	571
	Download and using apps	13.71%	313
Details	Other (Specify)	1.49%	34
	Number of respondents		***622***
	Number of respondents who skipped this question		***109***

17. Do you use any apps *specifically* to aid your learning?		% of Respondents	Number of Respondents
	No	69.23%	216
Details	Other (Specify)	30.77%	96
	Number of respondents		***312***
	Number of respondents who skipped this question		***419***

18. Have you ever accessed the bSpace site from a mobile device?		% of Respondents	Number of Respondents
	Yes	59.37%	187
	No	40.63%	128
	Number of respondents		***315***
	Number of respondents who skipped this question		***416***

19. How did you first find out about the bSpace mobile website?	% of Respondents	Number of Respondents
From a professor or GSI	5.79%	11
From a classmate	1.58%	3
From doing a search on my mobile device	16.84%	32
From a link on bSpace	1.05%	2
Not sure	43.16%	82
Details Other (Specify)	31.58%	60
Number of respondents		***190***
Number of respondents who skipped this question		***541***

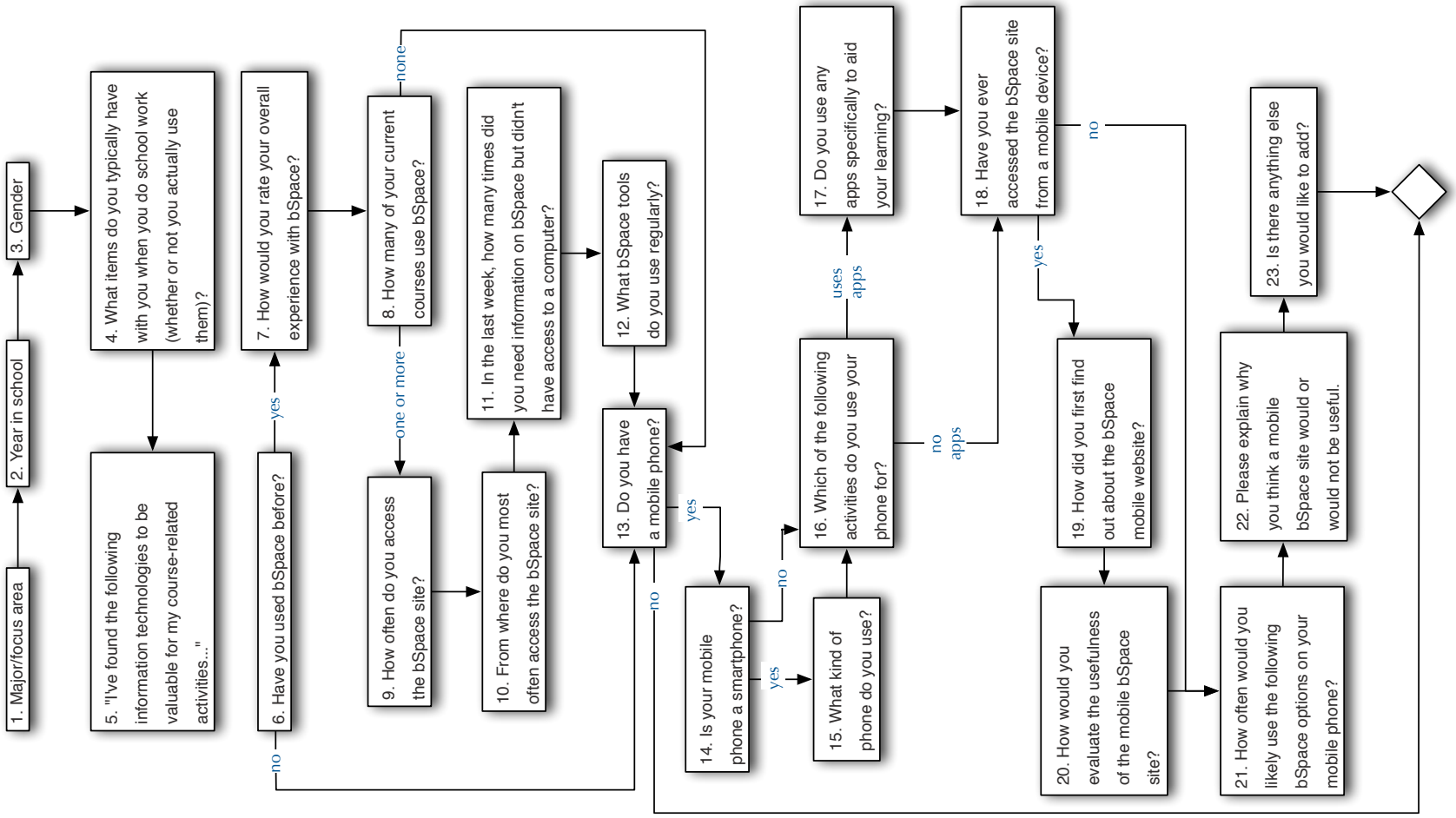
20. How would you evaluate the usefulness of the mobile bSpace site?	% of Respondents	Number of Respondents
Not useful at all	6.29%	11
Not very useful	12.00%	21
Neutral	47.43%	83
Somewhat useful	19.43%	34
Very useful	14.86%	26
Number of respondents		***175***
Number of respondents who skipped this question		***556***

21. How often would you likely use the following bSpace options on your mobile phone?

	Regularly	Occasionally	Never	Number of Respondents
Viewing the course syllabus	23% (141)	37% (228)	38% (232)	601
Viewing assignments	40% (248)	24% (149)	34% (209)	606
Communicating with classmates	13% (77)	26% (158)	60% (356)	591
Accessing your grades	24% (147)	36% (222)	38% (233)	602
Viewing course announcements	44% (269)	23% (144)	31% (189)	602
Receiving real-time updates and notifications	39% (234)	21% (129)	39% (236)	599
Finding course locations	12% (76)	37% (222)	50% (298)	596
Links to download articles or other information	21% (130)	31% (188)	46% (280)	598
View and participate in polls	10% (63)	28% (167)	61% (364)	594
Take tests and quizzes	7% (47)	19% (115)	72% (431)	593
			Number of Respondents	***607***
			Number of respondents who skipped this question	***124***

Appendix

Survey Branching



Appendix

Figures

Figure 6: Current Blackboard Learn mobile application.

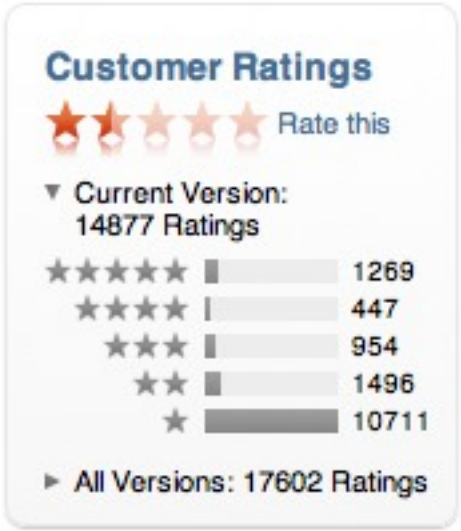


Figure 7: Blackboard Learn application ratings on iTunes (as of 5/8/10).

Appendix (continued)

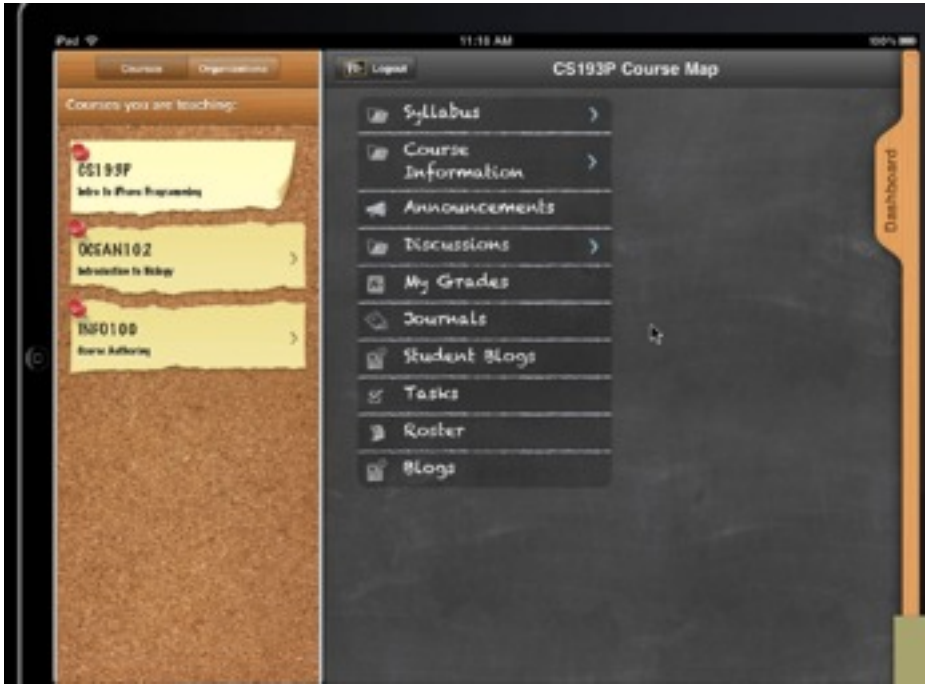


Figure 8: Blackboard application for iPad.

Figure 9: Blackboard application for iPad, viewing an assignment.

Appendix (continued)

Figure 10: Blackboard application for iPad, creating content.

Figure 11: Blackboard Mobile Central.

Appendix (continued)

Figure 12: Blackboard Mobile Central for Blackberry.

Figure 13: Moodle mobile add-on, MOMO.

Appendix (continued)

Figure 14: MIT's iPhone application.