Teen use of mobile devices and cell phones is growing at a rapid pace. Schools today are having difficulties enforcing an acceptable level of use of these devices during instructional time in the classroom. Instead of banning these devices all together to prevent such misuses as cheating, some institutions are taking the opposite approach and trying to include them in the students’ daily activities to promote responsible use and as an aid to learning. A participatory design study was conducted with students to gather the user requirements for a mobile version of an existing course management system for Middle and Upper School students at a North Carolina private school. It will be based on Apple’s iPhone and iPod Touch platform and include features such as class assignments, resources, and school events.

Headings:

Mobile Course Management System

Educational Use of Mobile Devices

Participatory Design

User Requirements Gathering

User Interface Design
GATHERING USER REQUIREMENTS FOR A MOBILE COURSE MANAGEMENT APPLICATION

by
Barrett M. Keziah

A Master’s paper submitted to the faculty of the School of Information and Library Science of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Science in Information Science.

Chapel Hill, North Carolina
April 2010

Approved by

_______________________________________
Dr. Stephanie W. Haas
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Introduction

Terms such as G.I., Silent, Baby Boomers, Generation X, and Generation Y typically describe people born during the 20th Century (Strauss & Howe 1992, Tapscott 2008). While the exact birth years of these different generations is often debated, the newest generation, Generation Z, has been recognized as describing people born somewhere between the mid-1990s and today (Wikipedia 2010, Tapscott 2008). They make up the first group of people born in the 21st Century and have sometimes been described alongside Generation Y as the “Net Generation” or “Digital Natives” (Tapscott 2008, Prensky 2001). These students “have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age” (Prensky 2001).

Prensky’s Digital Natives definition (2001) can largely be confirmed by the results of a Pew Internet & American Life Project study which found that 95% of American teens ages 14-17 go online (Lenhart et al. 2010). That same study also concluded that 75% of American teens own a cell phone, 69% of teens have a computer, 79% own an iPod or other mp3 player, 80% of teens have a gaming console such as the Nintendo Wii, Sony PlayStation, or Microsoft Xbox, and 51% of teens own a portable gaming device such as the Nintendo DS or Sony PSP (Lenhart et al. 2010). From these results, it seems clear
that teens today are both technology savvy and eager to use mobile devices for communication and entertainment.

Unfortunately, this eagerness and attachment to mobile devices has traditionally been hindered in today’s educational systems. Many secondary schools across the country have previously adopted policies that ban or significantly restrict the use of cell phones, laptops, and other portable devices during the school day. This was a way to reduce distractions, curb cheating, and prevent inappropriate photos of class tests or other teens in locker rooms and bathrooms (Shaw 2005). However, based on the recent usage statistics and the slow realization by educators that these tools might actually serve a purpose in the classroom, schools are beginning to relax their strict, no use cell phone and mobile device policies. As one researcher puts it, they can be seen as a way to “expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by helping make teaching and learning into an engaging, active process connected to real life” (Tinio 2007).

One that is beginning to ease its restrictions is a school that, for the purposes of this paper, I will call Ravenrock. Ravenrock is an independent, co-educational college preparatory day school in North Carolina which currently enrolls over 1200 students in pre-Kindergarten through twelfth grades. They currently utilize an online course management system that is integrated within a third-party student information system. Much as universities utilize products such as Blackboard (www.blackboard.com) or Moodle (www.moodle.org), Ravenrock students in grades eight through twelve go online in this system to retrieve class-related items such as assignments, syllabi, and
grades. The school also recently completed a campus-wide wireless network rollout that will support wireless Internet access in over 13 campus buildings to over 1500 faculty, staff, and students.

In order to capitalize on the School’s new wireless system and to incorporate the popularity and benefits of mobile devices into the classroom, the School’s Chief Technology Officer wanted to investigate the possibility of having a mobile version of its course management system created. The purpose of the application would be to aid the School’s students in accessing the existing course management content on a mobile platform.

**Administrative Requirements**

The Chief Technology Officer wanted to select a single mobile platform that would provide several hardware options for the students, and the parents that would likely be purchasing the devices, to choose from. Additional criteria were that the platform include the ability to browse the web through a Wifi connection, display images and video, playback audio, and possibly act as a mobile phone as well as display the student’s personalized content from the course management system. Lastly, his decision to consistently provide a certain level of support by the technology department and faculty members in the classroom requires the School to standardize on a single platform. The potential to cause undue stress on teachers as well as students with the number of differences in function that multiple platforms introduce could ultimately negate the learning benefits the devices are capable of providing.
Mobile Platform Selection

Today’s mobile device marketplace is filled with numerous devices from a wide array of manufacturers. The two main categories relevant to this study are the mobile media devices made by corporations like Apple, Microsoft and Sony and smartphones manufactured by companies such as Apple, HTC, Nokia, and Research in Motion.

Mobile media devices include a large color screen, the ability to playback audio and video files, browse the Internet over a WiFi connection, and install custom applications from third-party developers. This group eliminates standard MP3 playback devices which may or may not have a large display and do not have the ability to install custom applications or browse the Internet. Smartphone devices include all of the features of the mobile media device with the addition that they can also make cellular phone calls.

Within these two groups, some devices include software and hardware that was designed by the same company, such as Apple’s iPhone smartphone and iPod Touch media player, Research in Motion’s Blackberry smartphones, Microsoft’s Zune media player and Sony’s PSP media player. Others have their hardware components built and designed by a single company, but rely on a third-party to provide the underlying software running the device as seen in HTC’s line of smartphones built on Microsoft’s Windows Mobile operating system.

When looking at the non-smartphone, mobile media player market, the 18th bi-annual Piper Jaffray teen survey found that Apple, with its iPod line, has maintained an 87% market share, up from 84% in 2008. Microsoft and its Zune products were in second place with 3% and Sony, with the PSP, in third with only 2%. They also found
that of those teens that plan to purchase a new media player within the next year, 74% said they would choose an Apple product (qtd. in AppleInsider.com 2009). Unfortunately, these statistics do not break down Apple’s product lines to distinguish which iPod model teens were responding to as some are capable of browsing the web (iPod Touch) and others are not (iPod Shuffle). However, a smartphone industry analytics firm, Flurry, helps put the use of the iPod Touch model into perspective with a September 2009 report that states that of the 58 million iPhone OS devices (iPhone and iPod Touch) sold through September 2009, roughly 40%, or around 24 million are iPod Touch devices (The Flurry Blog 2009).

The smartphone incorporates all of the features of a mobile media player and web browser with the added benefit of cell phone functionality. As seen in Figure 1 below, a recent study by Gartner Consulting revealed that of the major smartphone operating system designers in 2009, Symbian occupied the largest market share over Research in Motion’s Blackberry, Apple’s iPhone, and Microsoft’s Windows Mobile Operating Systems (Ricker 2009). However, Symbian and Microsoft’s Windows Mobile lost market share from 2008 to 2009, while Apple and Research in Motion both grew year over year during this time frame (qtd. in Engadget 2010). One thing to note is that while Microsoft and Symbian make the underlying operating system for smartphones, they rely on third party manufacturers to design, sell, and distribute hardware devices that include a version of its platform.
In considering the various manufacturers and products in today’s marketplace, the above statistics, and Ravenrock’s own requirements, it was determined that Apple’s iPod Touch/iPhone line of devices was the clear choice as Ravenrock’s mobile platform. It is the only platform currently available that gives the parent the option of purchasing their child an all-in-one type device in the iPhone as well as providing a non-phone option in the iPod Touch from a single manufacturer. This product also provides audio/video playback, access to the Internet through its built-in Wifi connection, and the ability to display the most common document file types (.doc, .docx, .pdf, .xls, .xlsx, etc.). It also offers a feature rich development platform that allows programmers the ability to build applications for games, education, news, sports, social networking, and many others (Apple.com 2010b). This feature will allow for a custom-built application that can tap into the School’s third-party, XML-based course management system. Also, the underlying operating system is the same on both devices, iPhone OS 3.1 as of this writing (Apple.com 2010a), which allows for easier distribution of one application through the device-integrated Apple App Store. The selection of the mobile platform is
just the beginning of this development effort; determining the level of functionality needed to make the mobile application useful and attractive for students to use is the next step.

Background

Before a suitable application could be written to support access to the School’s course management system on this type of mobile device, a look at some of the trends concerning user interface development for teens and today’s Digital Natives was needed.

Andrew Large and Jamshid Beheshti worked with children on designing web interfaces for web portals (2005). Their work focused on many of the visual elements on the screen and has the potential to carry over into any application, web-based or not, that is designed specifically for children and teens. Several applicable themes emerged from their research.

**Visual Design.** Unlike adults, children “tend to dislike white, empty space on the screen, or even the use of white as a background color. They also note that children “like bright colors that immediately catch the users’ attention.” However, they warn that designers have to strike a balance between a “plain and unimaginative but functional design on the one hand, and a gratuitously colorful and animated design [that may be] a distraction from its primary purpose – information retrieval.”

**Icons.** Children are more inclined to interpret icon images literally and criticize them if they do not accurately match the associated concept. Icons should also “be carefully selected and given a text label to avoid any misinterpretations.”
Personalization. Large and Beheshti state that personalization is important in portals because “reactions to things like...colors, screen layout, icons, and animation are personal and will differ from child to child.” They also see personalization as a way to increase a portal’s appeal to wider age groups because what is attractive to one age group could be “infantile or too grown up” for another.

Navigation. Dania Bilal and Peiling Wang similarly discovered differences between children and adults in terms of information seeking behaviors on the web, information needs, pictorial representation of information, concept learning, and categorization of knowledge (2005b). They found that in search engines offering both a browsing and searching interface, web users typically preferred the searching method to find the information they were looking for. However, children were more likely to browse for information by following links than searching by keyword. In terms of a mobile course content management system, it would probably not be wise to force teen users to enter search terms to retrieve information on a small portable device with a small keyboard as it may increase the possibility of a student becoming frustrated with the interface if they cannot find the information they need in a timely manner. Instead, the wide variety of information contained within this type of application is probably best suited to a predefined and more structured information flow that can be maneuvered with single taps on the screen.

To take the structured information approach one step further, Bilal and Wang studied the information seeking behaviors of children within two search engines that were designed specifically for them. They discovered that when a child’s cognitive...
structure, or how they believe information should be organized, does not match the structure employed in an information retrieval system, children are likely to become disoriented or lost in much the same manner they would if they used the searching retrieval method. Bilal and Wang suggest directories that are designed for children should model cognitive structures into the system and incorporate different situations to accommodate children’s traversal behavior and information needs. They summarize that “an IR [information retrieval] system should be congruent with these users’ information needs, information seeking behavior, cognitive processes, knowledge structures, and expectations” (2005).

In considering these findings in terms of a mobile application for students at Ravenrock, the mobile application should be designed specifically with the students in mind. This includes structuring information accordingly and not fitting interface elements into a predefined mold or visual layout. I believe it also means that the application should allow a student to somewhat customize their own experience, including the ability to manipulate the interface to fit their information needs.

Unfortunately, it is not enough to consider just the visible elements and organization of information that goes into developing an appropriate application for children. In a separate study by Dania Bilal, she describes an “affective paradigm” that exists in user interface design and especially in user interface design for children (2005a). This affective paradigm is based on considering a user’s emotions and feelings in the design process. Emotions such as frustration, motivation, persistence, and patience all play a part in how well a system “works” to an end user. As such, Bilal
states, “emotions, which are a component of affective states, are ‘personal’ and creating system interfaces for children should be based on their affect for them...gathering children’s likes and dislikes about certain interface features may serve as a first step toward designing affective interfaces for them” (2005a).

One method to observe the likes and dislikes of children in developmental technologies, as well as to gather the intended user’s own ideas is called participatory design. This approach, as described by Allison Druin in 1998, “respects users more as partners in the design process and, in so doing, explicitly give them a more equal and responsible role.” By recognizing differences between adult designers and children and “treating them as informants rather than as partners or simply as testers” designers are “made more aware of aspects of the use of technology that [they] were not sensitive to and that [they] need to be told of.” By working with children directly, they “could tell [developers] in their own words what they would like to see in the future.”

Participatory design is but one step within Druin’s overall cooperative inquiry design process (1999) where researchers do not just observe the children they are designing interfaces for, but instead work collaboratively with them in developing low-tech prototypes and mock-ups before any actual development or code writing begins. By using images, paper drawings, and simulations, this form of prototyping becomes inexpensive, but effective in quickly brainstorming new ideas and directions. They can also help focus discussion and act as a bridge for “collaborative brainstorming activities.” Ultimately, Druin uses these types of prototypes as precursors to more advanced high-tech prototypes that include actual programming and design because
“they prevent users [from] getting too fixated on low-level issues, such as what size a button should be, rather than asking more general questions, such as whether buttons are appropriate for the application in hand” (1998).

Purpose of Study

Developing a mobile-based application can be costly and time consuming for someone not familiar with the iPhone/iPod Touch platform. A recent search through GetACoder.com (2010), an online bidding site where end users can find freelance programmers, has several iPod/iPhone application projects listed for rates anywhere between $1,000 to $5,000, not including end-user support and ongoing software releases. In addition to the cost factor, a study by Greystripe, an advertisement provider for mobile applications, shows that just 20% of users return to run a free application again after it was downloaded (Sharma 2009). In order to ensure Ravenrock’s application can remain viable and relevant past its initial release, as well as to follow the participatory design research finding that developing an application which incorporates the ideas and opinions of end users in the design process provides greater success, focus groups will be used as the basis for a qualitative study of low-level prototypes as well as to gather user requirements for the mobile application project. They will be conducted with several groups of Ravenrock students to ensure sufficient functionality is accomplished and that only the most widely used features of their current web-based system are included in an initial release to increase buy-in and sustained usage.
Study Methods

The potential subjects for the focus groups were selected from four technology-focused student electives in Ravenrock’s Middle and Upper Schools. The four classes initially selected have titles such as: “Digital Ravens,” “Technology Foundations,” “Computer Applications,” and “AP Computer Science.” They were chosen because the students in them may be expected to have a prior affinity towards digital tools and the latest technology available to today’s youth.

The student pool represented grades six through twelve and all ages between 11 and 18 years old. However, the potential group of student volunteers represented a disproportionate number of males at 87% and females at 13%, whereas the school as a whole constitutes a more equal 51% male and 49% female population. While this population discrepancy could potentially lead to unfair differences in the expressed user requirements of males and females within an information system in terms of the recreational or entertainment value of the selected mobile device, I believe the shared educational goals of males and females are likely to be a stronger influencing factor in this study. The list of potential features in this mobile application is predominately academic in nature and should be equally beneficial to students of either gender.

In addition, while the number of participants was relatively small compared to the overall student population in the Middle and Upper Schools, at about 4%, the focus group method results require a qualitative analysis of discussion, focusing on the opinions of features and interface elements of the mobile application. The low percentage of participants, in this case, should still provide a sufficient sense of the
overall student opinion. The choice to use this particular subset of students was that they are representative of all the ages and grade levels that would benefit from this study’s outcome. Also, due to the students’ current participation in a technology-focused elective, they might be expected to have some prior awareness and interest in technology. While this quality may also prove to be a bias when compared with the larger student population, it can be offset by the fact that they may be able to contribute more usefully at this stage in the design process. Therefore, the number and selection of participants was appropriate for this type of qualitative analysis.

After approval was granted by the University of North Carolina at Chapel Hill Internal Review Board (Appendix A) and the administration of Ravenrock, consent forms for participating in the focus group sessions were distributed and signed by both parents and students (Appendix B). Each session lasted approximately 50 minutes, with 10-15 students participating in each session. The researcher provided an overview and explained the purpose of the study followed by a notice of the ground rules for protecting privacy. Next, a period for students to ask any questions they may have prior to the start of the session was allowed. Once all questions were answered, students participated in an informal survey followed by analysis and discussion of several simulated iPhone/iPod Touch screen images. An outline of the session is presented in Figure 2; please see Appendix C for a more detailed researcher script and questions.
1. Project overview and ground rules for focus group discussion.
2. Questions from students.
3. Informal Survey on iPod Touch/iPhone use.
4. Group Discussion
   a. What features of the current online system would you like to see in a mobile application?
   b. What order should the features be presented in?
   c. How should the navigation between the different features work?
   d. Potential information display options analysis.
   e. Are there any features that do not exist currently that you’d like to see incorporated?
   f. Other school related information you want included that was not discussed?
5. Wrap Up & Dismissal

Figure 2: Focus Group Session Outline
Results

Participation

Unfortunately, due to tight scheduling and a grade-level wide project, only three out of the four classes were used for this study. Despite this small setback, three different technology-focused classes were able to participate in three separate focus group sessions. Of the 34 students, representing all ages between 11 and 18, 28 (82%) were male and 6 (18%) were female. Despite the lower number of participants, the ratio of male to female students increased slightly over the projected ratios, though it was still very different from the school wide population that is more equally balanced at 51% male and 49% female.

Another difference from the proposed set of participants can be found in the grade level makeup of the students. While all Middle School grades were represented, the loss of the second Upper School class left out any ninth grade students. This also reduced the overall number of Upper School students participating in the study. However, it is my belief that the nature of the participating students from the AP Computer Science class makes them some of the most technically competent users within their division and that their opinions and ideas can still fairly represent the opinions of their peers.

Informal Ownership Survey

An informal survey of iPod Touch and iPhone ownership was conducted at the start of each focus group session. For the purposes of this survey, it was not relevant to distinguish which particular model was owned by the student, but whether they owned
an Apple iPhone or iPod Touch. Of the 34 students who participated in the sessions, 25 of them, or 74%, owned one of the devices. As seen in Table 1, more Middle School focus group participants owned one of the devices than not. The opposite is true among focus group participants from the Upper School, where the numbers of students who did and did not own an iPhone or iPod Touch was almost equal. It is hard to determine if either of these statistics is truly representative of each division within the school separately, but when taken as a whole, it helps strengthen the decision to select Apple devices as the mobile platform of choice.

<table>
<thead>
<tr>
<th>Feature Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently, the School’s course management system offers the students access to a variety of school-related information through a web-based portal. Information includes:</td>
</tr>
<tr>
<td>• Class Schedule</td>
</tr>
<tr>
<td>• Events Calendar</td>
</tr>
<tr>
<td>• Class Assignments (Due dates for homework, quizzes, tests)</td>
</tr>
</tbody>
</table>
• Class Resources (Web links, syllabi, worksheets, etc.)
• Attendance Records
• Progress Reports and Report Cards
• School Directory

As each of these features is accessible through the XML-based Application Programming Interface (API) from the third party course management system, focus group participants were asked to determine the importance of these features with the assumption that they cannot all be incorporated in the first release of the application.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Middle School Group A</th>
<th>Middle School Group B</th>
<th>Upper School Group A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Schedule</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Events Calendar</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Class Assignments</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Class Resources</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Attendance Records</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Progress Reports/Report Cards</td>
<td>6</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>School Directory</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2: Feature Rankings

Table 2 shows the rankings given to the available features in the current online portals with 1 representing the most important feature in the opinion of participants. In all three focus groups, class assignments and resources (e.g. class syllabi) were consistently ranked numbers 1 and 2, respectively by students, as these two features allow them to keep track of their day-to-day tasks required by their teachers. The next most important feature that was consistent among all three groups was the inclusion of events, specifically, athletic events. In a school where over 80% of students participate in School-sponsored athletics, this is not a surprising request. Of note, however, was that most students said other academic events such as school plays and grade level specific activities were not important to include in this type of application. Reasons
given were that they are notified of these events through other avenues such as daily bulletins and email in the Upper School and grade level meetings in the Middle School. Alternatives were suggested by students, which ranged from not including them at all, separating academic and athletic events into distinct categories, or presenting only a subset of academic events specific to the individual end user.

Of the remaining available features, there was wide variation in the level of importance. To the Middle School-aged students, the campus directory seemed to rank high on their list, possibly due to a lower cell-phone adoption rate that can store friends and families phone numbers. Also, the class schedule feature ranked differently among group members. Most Middle School students stated that the class schedule was only needed at the beginning of the academic year mainly because they do not alter their class schedules in significant ways throughout the year. Similarly, Upper School students stated that they learn their routines pretty quickly and would not have the need to refer back to class schedules after the first couple of weeks of the new school year. However, they made the exception that the schedule may be needed at the semester break when a portion of their classes change.

**Home Screen Icon**

The first simulated application image each focus group was asked to consider was the home screen icon. This is the image/button that a user would select each time they wanted to launch the mobile application on the iPhone or iPod Touch. In Figure 3 the home screen icon uses the School’s shield logo in green on a black background. Students were asked about their color preferences for the icon (the School’s colors are
green and gold) as well as the logo selection; the green shield in Figure 3 is the School’s modern logo while Figure 4 shows an athletics logo (left) and the original school shield (right) which are also options.

![Simulated Home Screen Icon](image1)

![Additional Logo Options](image2)

While several students liked the modern green logo on black, the majority said that it should be placed on a white background. Students were concerned that the iPod Touch/iPhone background where icons are displayed is also black, and were afraid the logo would not stand out among other installed applications on their devices. An alternative that was a common suggestion in each focus group was to use the same modern shield logo but change its color to gold, another school color, with the thought it would stand out more than the green. Unfortunately, the school has a strict visual style guide which prohibits the school shield from being displayed in any other color than green. With regard to the alternative logos, all agreed that these should not be used for the home screen icon. The consensus was that the original shield was too formal and did not fit Apple’s modern themes on the iPhone/iPod Touch platform and that the athletics logo did not represent the academic nature of the mobile application.
Main Landing Screens

The second and third simulated images the students were presented with were two options for the application’s main landing page. This is the screen they would be presented with as soon as they select the application’s icon from the home screen.

![Figure 5: Landing Page Option 1](image1)

![Figure 6: Landing Page Option 2](image2)

In Figure 5 above, the application would make use of the “Tab Bar” user interface element built in to Apple’s development kit (Apple Developer Connection 2010b). This element would appear on every page to allow the user easy access to other sections of the application without the need to navigate back up a hierarchy of information to reach their next destination. As this feature is limited to four buttons plus a “More” button to access additional features, students were asked to select the items that would be “most used” to include in this area. Consistent with the earlier
discussions of the most important features to students, class assignments, resources, and athletic events were selected in each of the three focus groups as the first three buttons. The fourth choice varied among each group. Some students chose nothing at all, leaving all other features to the “More” section, while others thought this would be a good place to have a link to the school directory. There were also a couple of students that said it should not matter what is defined for this area, that they would actually prefer to have it user-customizable to their needs. This was a surprising and interesting suggestion, given this was not offered as a possibility in describing this interface element during the session.

Other discussions centered on the large empty space in the center of the screen in Figure 5 labeled “School Logo Goes Here”. It was suggested by students that this area could contain a static school logo, or possibly an RSS news feed of events specific to an individual student, or a “breaking news” section for items such as athletic event cancelations, snow days, or other emergency information. This was an interesting concept, given that the latest version of Apple’s iPhone OS includes “Push Notifications” that the school could use to deliver instant information to a student’s device without end user involvement (Apple Developer Connection 2010a).

Figure 6 is an alternative landing page example which does not make use of the Tab Bar, instead opting for a hierarchical navigation method that places main subject areas on the initial screen as links to subsequent pages that contain more specific detail. Figure 7 shows an example of how the hierarchy might work for Class Assignments.
This feature, while organizationally efficient, may not prove to be the most user-friendly as students would constantly have to navigate back up the hierarchy before proceeding to the next section. This sentiment was echoed in students’ responses especially when it was mentioned that the order of the hierarchy would more than likely be fixed given the limitations of the “Table View” interface element in the iPhone OS (Apple Developer Connection 2010d).

After the students had previewed and commented on the two options available, the question of which option would be the best was posed to them. When asked if they preferred Figure 5 over the options available in Figure 6, each focus group came to the same conclusion that Figure 5 would be the optimal design of the main landing screen for students to be able to navigate the application in the most effective way. They also liked the Tab Bar interface element which gives them, to some degree, the ability to customize the application to their liking.
Assignment Screens

In assuming students would select class assignments as the most important feature, simulated images of how these might appear were created in advance and displayed to each focus group.

Figure 8, above, represents the class assignment list and Figure 9, an individual assignment’s detail screen. Students were asked to provide feedback on each screen to determine the best layout for them. In considering the assignment list, almost every student agreed that they wanted the assignments grouped first by class, then by date, instead of having a general running list. Also, they wanted to see not only the assignments due from the present day forward, but prior assignments going back several days, though the actual number varied from group to group from a minimal
three days to as long as thirty days. Reasons for this request ranged from the case that some students are prone to turn in assignments late to helping out students who are out for several days due to illness and may need to catch up. Another interesting request that came from both Middle School groups was to color code assignments for easier recognition in a long list. They wanted to see the text field with a background color that represented a specific assignment type such as homework, quiz, or test for easier recognition in the list.

The next consideration was for the text displayed for each assignment. As seen in Figure 8, the course management system returns short due dates, followed by a class ID number and the type of homework assignment. The majority of students liked the date format but several preferred the version seen in the events screen in Figure 10 below. However, all students in all three focus groups were very unhappy with the class ID and assignment type. They, instead, wanted to see the class name spelled out which would require the assignment type to be shortened, given the space considerations on the screen. The consensus was that a four character moniker, “HMWK”, could act as a substitute for “Homework” to provide the extra room needed. A few Middle School students preferred to see the class period as the class identifier over the class name. Apparently, this was their preferred method for keeping track of classes as opposed to the more common English, Math, Science, etc.

As for the assignment detail screen, seen in Figure 9, there was no major change requested by the students with the exception that the class name and due dates were
missing from the simulated image. Unfortunately, this was an oversight when the images were created.

**Events Screens**

Another feature set that was anticipated prior to the focus groups was the inclusion of school-related events. The final set of images students were asked to comment on was a simulated events list screen and events detail screen as seen in Figures 10 and 11 below.

![Figure 10: Events List](image1)

![Figure 11: Events Detail](image2)

Here, students were asked to comment on many of the same things that they were previously shown on the assignment screens. While the simulated image in Figure 10 above shows all types of school events combined, as previously discussed, students decided that athletic events should be kept separate from their academic counterparts. Also, instead of the colored dots to the left of the event to distinguish events of the same type, consensus was again reached that the whole text field have a background
color to distinguish different types of events. For athletic events, this would include
color designations by team. For academic events, color designations would be based on
groupings such as “All School” or “Upper School” or “Fine Arts”. With respect to the
number of events displayed, students felt there was no need to continue to display
events that occurred prior to the present day. They believed this would help keep the
interface cleaner and less busy. This contrasts with their preference for the assignments
display.

Students were excited to see Google Maps integration within the athletic event
eexample (Figure 11), but requested the functionality be extended past a small image of
the events location. Luckily, the iPhone OS provides the ability to open the Google
Maps application if installed on the device or the Google Maps website if it is not (Apple
Developer Connection 2010c), making this request feasible during implementation.

Other than this request, the only other request made by a few students was to include
sport-specific or academic related icons in the event title.

**Additionally Requested Features**

The last task given to the students was to suggest any other functionality not
already mentioned or other features that might help them with their day-to-day student
activities. The following is a list of these suggestions that can be considered for future
inclusion:

- Student photos included in the on-device campus directory.
- Monthly cafeteria menu.
- Links to school-related websites.
  - Library catalog/School wiki site/club web pages
- Upper School test calendar.
- Student grades.
• Campus map.
• Campus email integration for Upper School students.
  o Ability to email their teachers and peers.
Discussion and Conclusion

When working with the students of this age group, I believe Druin’s participatory design method of using low-tech prototypes was the best decision for this study. I was able to gather a large amount of information from Ravenrock students without spending a significant amount of time and money developing a prototype application and acquiring the necessary number of Apple devices to gather user feedback. By using the simulated iPhone/iPod Touch screen images, I was able to graphically represent a physical device so that students could see a realistic version of the application. In this way I was able to focus 10-15 students’ attention towards a single projected image to focus on application functionality instead of trying to fight the numerous distractions that I’m sure would have ensued with individual devices. It is also important to note that by using this method, some familiarity was assumed on the part of the focus group participants with Apple’s mobile platform as well as its interface.

When considering the overall student responses, the most interesting part of the focus groups was how very similar the student’s responses were to Large and Baheshti’s work with children and web portals. In regards to the Visual Design aspect of the simulated images, students quickly noted they did not like the large amount of white space seen in the main landing screen mockup (Figure 5). In every group, it was their preference to fill the space whether it was with an additional school logo or some type of “urgent campus news.” Another example was in the numerous comments on allowing some form of personalization within the application. Whether it was for the number and types of events to display, the order of icons within the tab bar interface
element, or the fact they wanted to color code events and assignments as a grouping method, each set of students wanted to be able to give that personal touch to their use interface. This should not be totally surprising given the number of ways students customize today’s technological tools. Cell phones, web portals (Facebook, Yahoo, iGoogle, etc.), and even computer desktop wallpapers, all allow an individual to customize the interface to suit a user’s needs and personalities. It is only logical this would extend to a mobile application that can, in theory, be used many times throughout a student’s day just like any other web portal.

With regard to student participation, the 50 minute sessions were almost too short to cover all of the ideas that students had for this type of application. Though there were a few students that had very little to say during the sessions, just about every student contributed in at least some form. Of course, there were a few outspoken students in each group as well. These two or three students tended to dominate the conversation and even after covering the prepared material, these students from both the Middle and Upper Schools wanted to stay after the allotted time to discuss their ideas further. While smaller focus group sessions would probably have helped to overcome these two distinct types of student, given the amount of time it would have taken away from the teachers’ instructional time would have made this nearly impossible to accomplish.

**Future Work**

Future work on this application will include development of a first-release beta during the spring and summer of 2010 with a release date to students in the fall
semester of 2010, pending Apple’s App Store approval process. The goal is that the first release will include many of the features students discussed during the focus groups. A few of these include separating athletic and academic events, the addition of an RSS feed into the main landing page, and integrating interactive Google Maps into events with locations not on Ravenrock’s campus. Of the items suggested near the end of the focus group that had not been previously discussed, static features such as a campus map and links to other school related resources (online library catalogs, school website, monthly cafeteria menus) will probably make it into the initial release due to their simplicity.

Unfortunately, some items may not make the initial release as some of the requested features, while not highly technical in nature, come with certain administrative ramifications. Including grades online and integrating the School’s household directory into a device that can be easily lost or stolen comes with certain privacy and security concerns that must be discussed with school administration before implementing into an official version. In addition, some of the more technical, yet highly requested features, such as customization of color choices, will probably come at a later date once basic functionality can be accomplished.

Further developments will occur throughout the first academic year to correct any applications bugs and slowly add new features. A dedicated email mailbox will also be established with Ravenrock before the official release to accept feedback and suggestions from end users. After a complete academic year of use, in the spring of 2011, a survey can be developed and distributed or an additional round of focus groups
conducted by the Technology Department of Ravenrock. They will be used to help judge the application’s adoption rate among the Middle and Upper School populations to determine if sustained support and development of the application is warranted.

Overall, this experience with Ravenrock’s students was a huge success. Their willingness to participate, stay focused, and share their ideas about technology with someone who does not normally interact with them on a daily basis was highly commendable. The amount of excitement they showed for this application and its potential to aid them in organizing their academic lives was very encouraging to me as the researcher and developer. It is my belief that the School’s selection of Apple’s iPhone and iPod Touch devices as the mobile platform of choice will be well received and used in great numbers by Ravenrock’s more than 800 Middle and Upper School students.
Acknowledgements

This study would not have been possible without the enthusiastic and overwhelmingly positive participation of Ravenrock’s Middle and Upper School students. Also, I want to thank the school’s administration for allowing me to conduct this study during my regular work hours on campus. And last, but not least, to Bill Chissoe, Bill Rothe, Kathleen Christopher, and Gary Duggan; thank you for letting me interrupt your very busy class schedules to work with your wonderful groups of students.
References


Appendix A: University of North Carolina – Chapel Hill IRB Notice

To: Barrett Keziah  
School of Info and Libr Science  
From: Behavioral IRB

Authorized signature on behalf of IRB

Approval Date: 1/13/2010  
Expiration Date of Approval: 1/12/2011  
RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)  
Submission Type: Initial  
Expedited Category: 7.Surveys/interviews focused groups  
Study #: 09-2371

Study Title: Gathering User Requirements for a Course Management Mobile Application

This submission has been approved by the above IRB for the period indicated. It has been determined that the risk involved in this research is no more than minimal.

Study Description:

Purpose: To gather user requirements for a mobile based application that interacts with a pre-existing classroom management system for students in grades 6-12.

Participants: 45 students selected from 4 technology focused classes at a North Carolina private school representing each grade level from 8th grade to 12th grade.

Procedures: Students will answer user requirements questions.

Regulatory and other findings:

This research, which involves children, meets criteria at 45 CFR 46.404 and/or 21 CFR 50.51 (research involving no greater than minimal risk). Permission of one parent or guardian is sufficient.

Investigator’s Responsibilities:

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator’s responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

When applicable, enclosed are stamped copies of approved consent documents and other recruitment materials. You must copy the stamped consent forms for use with subjects unless you have approval to do otherwise.

You are required to obtain IRB approval for any changes to any aspect of the study before they can be implemented (use the modification form at ohse.unc.edu/forms). Any unanticipated problem involving risks to subjects or others (including adverse events reportable under UNC-Chapel Hill policy) should be reported to the IRB using the web portal at https://irbs.unc.edu/irb.

Researchers are reminded that additional approvals may be needed from relevant “gatekeepers” to access subjects (e.g., principals, facility directors, healthcare system).

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 49 CFR 26 (CFR), where applicable.

CC: Stephanie Haas, School Of Info And Libr Science  
Mardia Tabor (School of Information and Library Science), Non-IRB Review Contact

IRB Informational Message—please do not use email REPLY to this address
Appendix B: Parent & Participant Consent Forms

University of North Carolina-Chapel Hill
Parental Permission for a Minor Child to Participate in a Research Study
Social Behavioral Form

IRB Study #: 09-2371
Consent Form Version Date: January 9, 2010

Title of Study: Gathering User Requirements for a Course Management Mobile Application

Principal Investigator: Barrett Keziah
UNC-Chapel Hill Department: School of Information and Library Science
Email Address: bkeziah@email.unc.edu

Faculty Advisor: Dr. Stephanie Haas
Email Address: shaas@email.unc.edu

Study Contact telephone number: 919-302-2355

What are some general things you should know about research studies?
You are being asked to allow your child to take part in a research study. To join the study is voluntary. You may refuse to give permission, or you may withdraw your permission for your child to be in the study, for any reason. Even if you give your permission, your child can decide not to be in the study or to leave the study early.

Research studies are designed to obtain new knowledge. This new information may help people in the future. Your child may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you and your child can make an informed choice about being in this research study. You will be given a copy of this permission form. You and your child should ask the researchers named above any questions you have about this study at any time.

What is the purpose of this study?
The purpose of this research study is to gather user requirements for a mobile-based version of the School’s online course management system, also known as the student portal.

Your child is being asked to participate in the study because he/she is a member of a technology-focused class.

How many people will take part in this study?
If your child is in this study, your child will be one of approximately 45 people in this research study.
**How long will your child’s part in this study last?**
Your child’s participation in this study will last approximately one hour during their regularly scheduled class time.

**What will happen if your child takes part in the study?**
Participating students will be asked to discuss their vision for how a mobile-based application that interfaces with the school’s online portals should look and function. No questions will be directed to your child individually, but instead will be posed to the group. Your child may choose to respond or not respond at any point during the discussion. The focus group discussion will be audio taped so we can capture comments in a transcript for analysis.

**What are the possible benefits from being in this study?**
Research is designed to benefit society by gaining new knowledge. You may also expect your child to benefit by being in this study because he/she will be actively involved in the design process for a real technology that is applicable to their coursework.

**What are the possible risks or discomforts involved from being in this study?**
We do not anticipate any risks or discomfort to your child from being in this study. Even though we will emphasize to all participants that comments made during the focus group session should be kept confidential, it is possible that participants may repeat comments outside of the group at some time in the future. Therefore, we encourage your child to be as honest and open as he/she can, but remain aware of our limits in protecting confidentiality.

**How will your child’s privacy be protected?**
Audio taping will be used during the focus group session so that transcripts can be created for further analysis. During the focus group session, your child does not need to reveal his/her true name, and may use a fictitious name if he or she so chooses, however, no personally identifiable information will be recorded as part of the transcription process. We also ask that your child agree to not reveal anything learned from group discussions or other activities in order to protect the privacy of others participating.

At the conclusion of the focus group session, all audio tapes will be stored off campus under lock and key by the researcher and will be destroyed at the conclusion of the study. Furthermore, participants will not be identified in any future report or publication about this study.

**Will your child receive anything for being in this study?**
Your child will not receive anything for taking part in this study.

**Will it cost you anything for your child to be in this study?**
There will be no costs for being in the study.

**What if you or your child has questions about this study?**
You and your child have the right to ask, and have answered, any questions you may have about this research. If you have questions, complaints or concerns, you should contact the researchers listed on the first page of this form.
What if you or your child has questions about your child’s rights as a research participant?
All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you or your child has questions or concerns about your child’s rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

Title of Study: Gathering User Requirements for a Course Management Mobile Application

Principal Investigator: Barrett Keziah

Parent’s Agreement:
I have read the information provided above. I have asked all the questions I have at this time. I voluntarily give permission to allow my child to participate in this research study.

Printed Name of Research Participant (Child):

Signature of Parent Date:

Printed Name of Parent:
The people named above are doing a research study.

These are some things we want you to know about research studies:
Your parent needs to give permission for you to be in this study. You do not have to be in this study if you don’t want to, even if your parent has already given permission. You may stop being in the study at any time. If you decide to stop, no one will be angry or upset with you. Sometimes good things happen to people who take part in studies, and sometimes things we may not like happen. We will tell you more about these things below.

Why are they doing this research study?
The reason for doing this research is to gather your ideas for an iPhone/iPod Touch application that would let you view your class assignments and other school information.

Why are you being asked to be in this research study?
You are being asked to be in this study because you are taking a class that is technology based.

How many people will take part in this study?
If you decide to be in this study, you will be one of about 45 people in this research study.

What will happen during this study?
This study will take place at the School and will last approximately 50 minutes or one class period.

During this study you and other classmates will be asked several questions on what information you would like to see in the application and how you think the application should work. You will also be audio recorded during the study so that we will be able to remember what was said during the class period.
**Who will be told the things we learn about you in this study?**
Only the person leading the study will ever hear the audio tapes. Your teachers and parents will not know what you said or didn’t say during the time spent in the study.

**What are the good things that might happen?**
People may have good things happen to them because they are in research studies. These are called “benefits.” The benefits to you of being in this study are that you will be helping to develop an application that will help your fellow students access their homework and other school information on their iPhone or iPod Touch.

**What are the bad things that might happen?**
Sometimes things happen to people in research studies that may make them feel bad. These are called “risks.” There no known risks for participating in this study, but you should report any problems to the researcher.

**What if you or your parents don’t want you to be in this study?**
If you or your parents don’t want you to be in this study, you will have the class period as a study hall to complete other assignments or class work.

**Will you get any money or gifts for being in this research study?**
You will not receive any money or gifts for being in this research study.

**Who should you ask if you have any questions?**
If you have questions you should ask the people listed on the first page of this form. If you have other questions, complaints or concerns about your rights while you are in this research study you may contact the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

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**Title of Study:** Gathering User Requirements for a Course Management Mobile Application  
**Principal Investigator:** Barrett Keziah

If you sign your name below, it means that you agree to take part in this research study.

---

Sign your name here if you want to be in the study ___________________________ Date ____________

Print your name here if you want to be in the study ___________________________
University of North Carolina-Chapel Hill
Assent to Participate in a Research Study
Adolescent Participants age 15-17
Social Behavioral Form

IRB Study #: 09-2371
Assent Form Version Date: January 9, 2010

Title of Study: Gathering User Requirements for a Course Management Mobile Application

Principal Investigator: Barrett Keziah
UNC-Chapel Hill Department: School of Information and Library Science

Faculty Advisor: Dr. Stephanie Haas
Email Address: shaas@email.unc.edu

Study Contact telephone number: 919-302-2355
Study Contact email: bkeziah@email.unc.edu

What are some general things you should know about research studies?
You are being asked to take part in a research study. Your parent, or guardian, needs to give permission for you to be in this study. You do not have to be in this study if you don’t want to, even if your parent has already given permission. To join the study is voluntary. You may refuse to join, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this research study. You will be given a copy of this consent form. You should ask the researchers named above any questions you have about this study at any time.

What is the purpose of this study?
The purpose of this research study is to gather user requirements for a mobile-based version of the School’s online course management system, also known as the student portal.

You are being asked to be in the study because you are a student in a technology-focused class.

How many people will take part in this study?
If you decide to be in this study, you will be one of approximately 45 people in this research study.
**How long will your part in this study last?**
This study will take place at the School and will last approximately 50 minutes or one class period.

**What will happen if you take part in the study?**
Participating students will be asked to discuss their vision for how a mobile-based application that interfaces with the school’s online portals should look and function. No questions will be directed to you individually, but instead will be posed to the group. You may choose to respond or not respond at any point during the discussion. The focus group discussion will be audio taped so we can capture comments in a transcript for analysis.

**What are the possible benefits from being in this study?**
Research is designed to benefit society by gaining new knowledge. You may also expect to benefit by being in this study because you will be actively involved in a design process that is applicable to your coursework.

**What are the possible risks or discomforts involved from being in this study?**
We do not anticipate any risks or discomfort to you from being in this study. Even though we will emphasize to all participants that comments made during the focus group session should be kept confidential, it is possible that participants may repeat comments outside of the group at some time in the future. Therefore, we encourage you to be as honest and open as you can, but remain aware of our limits in protecting confidentiality.

**How will your privacy be protected?**
Audio taping will be used during the focus group session so that transcripts can be created for further analysis. During the focus group session, you do not need to reveal your true name, and may use a fictitious name if you so choose, however, no personally identifiable information will be recorded as part of the transcription process. We also ask that you agree to not reveal anything learned from group discussions or other activities in order to protect the privacy of others participating.

At the conclusion of the focus group session, all audio tapes will be stored off campus under lock and key by the researcher and will be destroyed at the conclusion of the study. Furthermore, participants will not be identified in any future report or publication about this study.

**Will you receive anything for being in this study?**
You will not receive anything for taking part in this study.

**What if you have questions about this study?**
You have the right to ask, and have answered, any questions you may have about this research. If you have questions, complaints, or concerns, you should contact the researchers listed on the first page of this form.

**What if you have questions about your rights as a research participant?**
All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.
Title of Study: Gathering User Requirements for a Course Management Mobile Application  
Principal Investigator: Barrett Keziah  

Participant’s Agreement:  
I have read the information provided above. I have asked all the questions I have at this time. I voluntarily agree to participate in this research study. 

________________________________________________ _________________  
Your signature if you agree to be in the study  Date 

________________________________________________  
Printed name if you agree to be in the study
Appendix C: Focus Group Guide

Agenda

1) Welcome & Purpose
2) Rules Overview
3) Questions from Students
4) Informal Survey on iPod/iPhone Use
5) Review features of current online course management system and school website.
6) Group Questions
7) Wrap Up & Dismissal

Welcome & Purpose

Thanks for agreeing to participate today. My name is Barrett Keziah, a graduate student in the School of Information and Library Science at UNC Chapel Hill.

The purpose of the focus group today is to gather your opinions and suggestions for an iPhone/iPod Touch application that would provide you with mobile access to your campus classes, assignments, and other resources. I want to find out what you think would be the most important features you would like to see included as well as how it should be presented to you. Lastly, I’d like to find out what you’d like to see included in future releases of the program.

You have been chosen for this focus group because you are taking a technology-related class where you use the current student portals on a daily basis. I also wanted to give you the chance to participate in the process of developing this new application for the school. With that in mind, there are no wrong answers today. Please feel free to speak openly.

Rules Overview

I will be recording this session to help me remember what all was said during our time, but I will not let anyone else, including your teachers hear the tapes after this is over.

I also want to ask that you respect your classmates’ privacy and not talk about what each other said after you leave.

Questions from Students

Are there any questions before we start??

Informal Survey

Now I just want to start by conducting an informal survey. Who currently owns an iPod Touch or iPhone? If you do not have one of these products, do you own some other type of smartphone? If so, what it is?

Those that own an iPod or iPhone, do you currently have any apps installed? What types of apps do you have? Are they mostly games?
Group Discussion Questions

Now we’ll go into the main part of today’s group session. This will be an informal brainstorming discussion and I encourage you to give me as much feedback as you can and please speak freely, but we’ll only be able to spend about 10 minutes per question.

1. Reasons the iPod/iPhone Platform was chosen.
2. What features of the current online system would you like to see in a mobile application?
   a. Remind them of features in current student portal.
   b. Determine which are most relevant for a student “on the go”.
3. What order should the features be presented in?
   a. Most used
   b. Alphabetical
   c. Other?
   d. Which one would be the most efficient or make the most sense to you?
4. How should the navigation between the different features work?
   a. Show example layout images.
      i. One better than another?
5. Are there any features that do not exist currently that you’d like to see incorporated?
   a. Other school related information you want included (Athletics, News, Directory, etc…)
6. If time remains…
   a. Is there anything else that you would like to add that might make this application more user friendly that I might have left out?

Wrap Up & Dismissal

Thanks for participating today. I just want to remind you that I will not share anything you said today with anyone outside of this room. You should also remember not to discuss today’s conversations with each other or your friends in order to protect each other’s privacy.