UC Berkeley Course Search Redesign
MIMS Project Final Report, Spring 2014
Team: Sandra Yuen Helsley and Lisa Jervis
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Overview

Background

In the fall of 2013, the Office of the Registrar at UC Berkeley launched an overhaul of the catalog publishing system. The catalog project is itself part of a larger set of changes being made to campus information systems, most notably the course management system. In addition to providing a much-needed update to the existing General Catalog website, this project presented the opportunity to redesign the search user interface on the catalog. The Office of the Registrar engaged our team to undertake this slice of the catalog project.

Current Search Tools

The tools currently available for searching for classes at UC Berkeley are deeply flawed. The General Catalog (which to its credit allows course description keyword searching and searches any course currently approved as UC Berkeley curriculum) contains no information about when a course is offered.

![General Catalog Screenshot](image1)

The Online Schedule of Classes searches only one semester at a time, has no course descriptions, and contains many fields that are either mystifying to users (e.g., Status/Last changed) or do not behave as expected (users reported that the Instructor Name field hardly ever returned correct results).

![Online Schedule of Classes Screenshot](image2)
But perhaps the most pressing issue is that the General Catalog (GC) and the Online Schedule of Classes (OSOC) are not connected to each other, and neither contains complete information desired by users. This makes for a situation in which most users must visit at least two and as many as six websites to gather the information they need to construct their schedule (see the “Current Tool Use” section under Research Findings, below, and Appendix C, Work Models, for details).

Furthermore, these search interfaces violate many widely recognized general usability guidelines (Nielsen 1993) as well as those specific to search UIs (Hearst 2009): search options are presented in the language of database fields rather than in the user’s language; users are given no help avoiding or ameliorating errors; no tools for refining a large results set are available. Many commonly needed searches—such as description keyword in the OSOC, open seats, an accurate day/time search, and requirements—are unsupported.

Goals

Our project goal is to design a new search UI that is implementable by the Office of the Registrar and significantly improves on the existing tools, most notably by presenting all the information users need in one place.

Stakeholders

Our primary stakeholder is our most frequent user: current UC Berkeley students choosing their classes every semester from among the vast array of available offerings. Academic and student affairs advisors are also key stakeholders, as course search is a significant tool of their jobs. Secondary stakeholders include prospective students, who search and browse the course catalog as part of their process of deciding whether to apply to and/or attend UC Berkeley; faculty, who depend on the catalog to present information about their classes to students; and staff in various roles who seek information they need for their jobs through campus information systems. And, of course, our client, the Office of the Registrar, who provides course information to the campus community through the General Catalog, the Schedule of Classes, and their associated search tools.

Challenges

As is clear from the list of stakeholders noted above, course search at UC Berkeley has a huge user base, with more than 25,000 undergraduate students and 10,000 graduate students, several hundred advisors, and more than 2,000 faculty. This user base has incredibly diverse needs, encompassing a first-year student finding the CCN for a section of Math 1A with open seats that doesn’t conflict with their other classes to an interdisciplinary PhD student exploring and comparing different departmental approaches to a common theme. The volume of information available through the catalog is also tremendous: UC Berkeley offers more than 7,000 courses, each with its own set of class instance information for any given semester in which it’s offered. Furthermore, course search is one function of a complex technological system—encompassing curriculum management, registration data, and class scheduling—that is itself embedded in an even more complex institutional context. Balancing competing user needs while constrained by the conditions of that context presents a significant challenge.
Process

We used a user-centered design methodology influenced by Contextual Inquiry (Beyer and Holtzblatt 1998).

First, we conducted open-ended interviews with 21 users (eight advisors, five undergraduate students in their first two years, four undergraduate students in their second two years, three graduate students, and one faculty member) from a range of majors and colleges about how they find the information they need about UC Berkeley course offerings, if and how they use the existing UC Berkeley General Catalog (GC) and Online Schedule of Classes (OSOC), what other course search tools and resources they use, and what they want from their searches (see Appendix F below for our interview guides). At this stage we also examined the course search functionality of how many other colleges and universities to draw design inspiration from those who have already tackled this type of project (see Appendix H for a list).

We then analyzed the data collected from these users and from our competitive analysis and generated work models (Beyer and Holtzblatt 1998), personas (Pruitt and Grudin 2003), scenarios (Rossom and Carroll 2002), affinity diagrams (see Appendices A-D below for these materials), and a paper prototype of several options for our major interactions. Using principles of usability engineering (Nielsen 1993) and heuristic evaluation (Nielsen and Molich 1990), we obtained feedback and evaluation data from five student usability experts who are also part of our target user base.

We then used this evaluation data to iterate on our paper prototypes and produce a medium-fidelity search screen, three versions of a results screen, and a course saving and comparison interaction. We presented this prototype to 25 users (four advisors, five undergraduates in their first two years, 11 undergraduates in their second two years, and four graduate students) from a range of majors and colleges for formative evaluation via a thinkaloud protocol (Lewis 1982) that directed them to perform several tasks designed to assess the prototype’s ability to present complete information intuitively, as well as to elicit general feedback on their opinions and experiences of the prototype, with particular attention to comparison of the different results screen options (see Appendix F). We also got informal feedback from a small group of usability professionals at a meeting of the UC Berkeley User-Centered Design Group (ux.berkeley.edu) and from Professor Marti Hearst, author of Search User Interfaces (Hearst 2009).

We made iterative adjustments to the medium-fidelity prototype over the course of this formative evaluation, and, when we had sufficient data to finalize major design decisions, began development of our high-fidelity prototype while continuing to gather feedback on the medium-fidelity prototype, particularly in the area of the save/comparison interaction.

Research Findings

Our Contextual Inquiry was wide-ranging, since searching for courses is an activity that touches many aspects of campus life: choosing a major, the registration process, course availability/impacted classes. It involves not just the systems that store course and class data but also Telebears, BearFacts, department websites, individual class websites, and more. While some of these areas are beyond the scope of our project, the interlocking nature of many of these systems and processes means that some of our out-of-scope data is nonetheless relevant to present here.
First we will address the current state of course search, then explore our users’ different (and sometimes conflicting) goals and what they want out of the new search functionality and related systems, and, finally, the direction that our research indicates that the catalog should go to continue improving student and staff experiences.

Existing Tool Use

We found that most users are quite frustrated with the existing UC Berkeley course search tools, and have developed elaborate work practices involving many different sources of information in order to satisfy their course and class information needs. The tools that both students and advisors use include the General Catalog (catalog.berkeley.edu), the Online Schedule of Classes (schedule.berkeley.edu), the websites of individual UC Berkeley departments, the Letters & Sciences Breadth Requirements lists (ls-advise.berkeley.edu/requirement/7breadth.html) and search engine (ls-breadth.berkeley.edu), the DeCal website (decal.org), the Course Threads site (coursethreads.berkeley.edu), and the Freshman and Sophomore Seminars site (fss.berkeley.edu).

Additionally, students use Ninja Courses (ninjacourses.com), ScheduleBuilder (schedulebuilder.berkeley.edu), Google, Rate My Professors (ratemyprofessors.com), CourseRank (courserank.com), and Berkeleytime (berkeleytime.com). There is one other tool of note that is widely used by a small student population: Eta Kappa Nu (HKN) is a national computer science and engineering honor society, and its Berkeley chapter provides a wealth of information to assist EECS undergraduates with course planning (hkn.eecs.berkeley.edu). Their Course Guides, written by students, include a summary of course content, an outline of the workload and time commitment involved, and advice on when to take a class and what to take next (for an example, see hkn.eecs.berkeley.edu/courseguides/CSE/61A). Detailed course evaluation data is also collected by HKN and made available. CS students report that this information is incredibly valuable to them as they plan their course of study in one of the university's most popular, challenging, and highly ranked departments.

Both students and advisors also rely on word of mouth, with the former getting significant information from friends and peers, and the latter relying on their professional networks and on announcements from departments about new classes, special topics, and the like. Department advisors, graduate advisors, and those in colleges outside of L&S rely more heavily on their own department’s internal resources (websites, advance schedules that are not yet part of the campus-wide system, etc.) than do undergraduate L&S advisors.

Users must use so many different tools because no single source of information is complete. The GC provides the broadest possible look at UC Berkeley’s offerings, with basic information about every course currently in the curriculum. However, it contains no schedule information; the OSOC contains that information, but it can be searched only one semester at a time, and it does not include course descriptions. Requirements information is incomplete in both the GC and the OSOC; department websites and the L&S site are thus necessary for all users in ensuring that students meet their requirements, including prerequisites for required classes. Ninja Courses and ScheduleBuilder are popular tools not only because scheduling is a complex task with multiple variables, but also because they contain information about class/professor ratings and grade distributions. Berkeleytime is used by undergraduates for its Telebears Oracle feature, which helps them decide which classes they should sign up for using a precious Phase I slot and which ones they can probably get into even if they wait until Phase II.
All users agree that having to visit multiple sites for the proper information is a problem; it was cited as one of the most frustrating aspects of the course search process by many users. Our biggest design goal was thus to bring together as much information as possible in one interface. (We are aware that providing some information that students want, such as course and professor evaluation data, is controversial for a number of reasons; this is addressed in the following sections.)

Furthermore, awareness of the many different tools available is very inconsistent among students, making marketing and orientation to any new search tool of paramount importance. This is also more efficient (and likely more effective) than promoting some of the the speciality sites, such as Course Threads and Freshman/Sophomore Seminars, separately; in our research use of these is minimal and several student respondents reported not knowing about them until too late in their Berkeley careers.

User Goals and Information Needs

While most broadly, user goals for course search are the same—to find all the information needed to make decisions—different use cases and user roles make for significant variation among goals. The same student can even have different goals depending on where they are in their program and whether Telebears is coming up, and if so, whether it’s Phase I or Phase II. See Figure 1, below, for a diagram of the goals of undergraduate students and their advisors.

![Goal Diagram](image)

Overview: undergraduate students' and advisors' pyramid of goals. While these goals are broadly aligned, they are sometimes in conflict when it comes to the details.
Undergraduate Students

Undergraduates tend to have two modes in which they search for classes: long-term planning and semester-by-semester scheduling. Long-term planning is done at many different levels of detail, from simply revisiting their major’s requirements every semester and monitoring their progress to making a spreadsheet of each class they intend to take over four years of coursework, complete with two majors. At the semester level, they tend to be heavily focused on executing their plan: scheduling, seat availability, managing their workload, and in some cases, choosing the right professor for them (if they have a choice) and maintaining their GPA.

The long-term planning stage is when most exploration of course content takes place. Course descriptions and patterns of offering history are very salient at this stage. Once they are on their major path, students’ requirements often dictate almost all of their choices; therefore at this point their interest in course content largely manifests at the department level, as they choose a major, minor, or departments in which to do their breadth classes. Specific classes are highly constrained by scheduling and availability. At this point will they will tend to find a replacement or just not consider a class as possible for them if they see it’s not offered in the upcoming semester.

However, a significant gap in our research exists around how students discover topics of interest and choose majors in the first place. The vast majority of our respondents came to UC Berkeley with an intended major already chosen. While some students found their majors through exploration of breadth classes in their first few semesters at Berkeley, this respondent population was too small for us to draw useful conclusions about design for major exploration. This is one of many reasons we recommend further user research for more exploratory course search functionality (see “Future Work for Course Search,” below).

Graduate Students

Graduate students have obviously already chosen a field of study, and their requirements are generally more flexible than undergraduates’; their information needs are deeper in the area of course content and, in some cases, professor research interests. They tend to want to know more details about what a class will cover, and they are more willing to seek out past syllabi and contact professors if necessary to get the information they want. They will also look into faculty research interests and areas of speciality via Internet search.

They are also more concerned with unearthing all possibilities of coursework in their area(s) of interest, making keyword search a key feature. Looking at past patterns of offerings is also very compelling for graduate students, as they are willing to wait for or schedule around a specific class that is relevant to their work, or attempt to seek out the relevant faculty for independent study.

Undergraduate Advisors

Undergraduate advisors have a dual focus: making sure that students meet their major, minor (if applicable), and breadth requirements; and encouraging their students to explore different fields, choose the right major for them, and challenge themselves appropriately. In L&S, they need easy access to a broad range of information from the general to the specific: about the content offered by different departments, about course availability, and about all kinds of requirements, from breadth the majors and minors across departments. Inside of departments they have less need for information about the offerings outside of their home departments, but
they are still called upon to answer questions about breadth courses and other cross-department matters.

Graduate Advisors

Graduate advisors tend to be less involved in the details of their students’ choices and more focused on helping students navigate their progress through programs as a whole. These advisors rely more on their knowledge of their department and allied departments than they do on campus-wide information resources. However, many staff who serve in an advising role in graduate departments have additional non-advising duties that lead them to use the GC and the OSOC in other parts of their job, e.g., to assign teaching credit to faculty in their department or manage enrollment of cross-listed classes. These advisors express frustration about the accuracy, completeness, and up-to-dateness of the information available to them through these channels.

Conflicting Information Goals

In some cases, advisors’ pedagogical goals seem at odds with their students’ goals. Many advisors perceive their students to be overly concerned with professor ratings and grade distribution information, available through Ninja Courses and ScheduleBuilder, respectively. They wish that students read course description information more carefully and were more inquisitive about discovering previously unknown (to them) departments. However, students express that they do read course descriptions, but that it is often hard to find them (they are linked to but not directly available in the OSOC), and they are often too vague to helpfully illuminate the content of the class. And for seminars and special topics classes, whose subject matter changes each time the class is offered, detailed information about what a class covers is often unavailable in campus-wide tools and can be found only on a department or speciality site—but the student must know where to look.

Students’ desire for grade distribution information is also sometimes misunderstood by advisors. While some students are indeed concerned simply about their GPA, in many cases they are looking to grade and rating information as a proxy for the level of difficulty and volume of work in a class they are considering. This is particularly important for students from underperforming high schools, first-generation college students, and others who might be particularly challenged in adapting to UC Berkeley’s competitive environment (notably, advisors of these student populations are also actively seeking this kind of information, and will also use grade distribution information as a proxy for it). The goal is not generally to take as easy a class as possible but to balance their workload appropriately.

The situation with ratings information is similar: students are by and large not interested in making a by-the-numbers judgement about ease of a class but rather in trying to get a feel for the instructor’s teaching style, assessing the instructor’s level of engagement with students and with the material, and in gauging their own interest in the curriculum. They see much more value in qualitative comments from their peers who have experienced a class first-hand than they do in numerical ratings. Furthermore, they are aware that sites such as Rate My Professors attract primarily the poles—the most enthusiastic and the most disgruntled students—and would welcome a more complete picture of class and professor evaluations.

Resolving these conflicting views is a complex matter beyond the scope of this project, but some aspects of course search functionality can help: making full course descriptions easier to find, particularly for classes with rotating subject matter; making workload information more
available to students; and making complete course evaluation data available to students would all contribute. The HKN resources mentioned above offer a strong model for how in-depth course, workload, and evaluation information could be offered in a way that is pedagogically appropriate.

**Wishlist**

**Course Search Basics**

More information in one place, more flexible searching, a more understandable interface, a more appealing interface—all of these items highly desired by our user base are achieved by our design and can be implemented by the Office of the Registrar at the present time. However, some features that our research revealed are needed and desired aren’t yet possible. Our design is extensible to include these features as they become technically and institutionally feasible. Some of these features need more structured or clean data than is currently available; others need different data elements entirely. Still others are more complex and require a different level of attention from the Office of the Registrar and related campus stakeholders.

**Data Structure, Clarity, Accuracy, Completeness**

The information elements that are currently available but would benefit from greater structure, clarity, and/or accuracy are:

- **Prerequisites.** Users report significant confusion about prerequisite information, such as “Sophomore-level maturity in mathematics.” More structured data would reduce such confusion and also enable future functionality such as using prerequisite data to restrict enrollments to qualified students.

- **Seat availability.** Users report significant confusion about why classes with available seats also often show a waitlist. They want to better understand why this is and how it affects them. A stopgap solution is to include a tooltip explaining that some classes have seats reserved for specific student populations and including information on how the waitlists are processed. The more specific to the individual class this information can be, the better. Secondarily, many users recognize and regret that this information is out of date; even a small lag in updates to it has a significant effect on students at Telebears time.

- **Special topics courses description information.** Students are often eager to take these classes, which have rotating content. However, the specific topics are often unavailable through centralized campus information tools (and even, on occasion, department websites—one graduate student referred to “secret classes” in his department). All course search users would greatly benefit from timely and accurate content information for these classes.

- **Textbooks.** Currently, textbook information is displayed only as a link off of the OSOC, and is present for only a fraction of classes. However, Cal Central is using a form of this information that pulls a list onto their own site; this functionality should be duplicated in the implemented course search tool, and instructors should be encouraged to provide this information earlier and more often.

- **Format.** More structure would enable more informative at-a-glance display of lecture, discussion, and lab information

- **Notes.** This field, displayed in the OSOC, contains information that is redundant with many other data elements depending on its contents (breadth requirements, special topics information, course restrictions, and more). If all the other data elements called for were structured, accurate, and complete, this field could be eliminated.
Information elements that are currently unavailable for course search systems and results display that should be provided—and for which information is currently available in some format and/or from some source—are:

- Course prerequisite paths, i.e., what other courses a given course is a prerequisite for.
- DeCal classes, which can only only be accessed at the DeCal website; it is our recommendation that DeCal be treated as a department in the search we have designed.
- Special curricular programs such as Course Threads, Berkeley Connect, and Freshman/Sophomore Seminars; these classes are all currently available through the GC and the OSOC, but it’s difficult (as with FSS classes) or impossible (as with Berkeley Connect and Course Threads) to identify them as such.
- Major and minor requirements; users should be able to generate as search results for courses that are part of the requirements for a given major or minor.
- Links to past course sites/syllabi.

Institutional and System Complexity

Some highly desired features require preparation even more complex than restructuring data. The most important finding in this category relates to integration between campus information systems such as Telebears and the Degree Audit Report.

Students would like to:

- Get personalized search results tailored to their major and what they have completed so far.
- Save course information for later decision-making, including long-term planning that would necessitate using CalNet authentication to store data in accounts.
- Select classes from search results and select them for registration.
- Select classes from search results and add them to ScheduleBuilder or Ninja Courses for schedule comparison.

Advisors would like to:

- Produce personalized search results tailored to their students’ specific requirements and what they have completed so far.
- Access the same view of any tool that their students have access to, rather than having to wait for students to log in while present in their office.

The other finding in this category relates to course evaluation/instructor rating data, and grading information. These findings are discussed in detail above, but it is worth noting here as well that the availability of more information about courses and classes—including evaluations and grades—in a centralized information system is something that many users of course search functionality see as highly valuable to them.

Course Search–Related

Some of our research findings relate to items outside the scope of the course search project and even the entire catalog, but are nonetheless related to the activities of searching for courses and classes.
More Standardized Department Websites

Many users are frustrated by department websites and the inconsistent (and often difficult to find) information about requirements and upcoming classes. If there were a common format and structure to department sites, users would likely find them more easily navigable and the important information they contain much more findable and usable.

Improved Advisor Tools

In addition to items mentioned above, advisors articulated the need to see other kinds of information centrally as well.

- Advisee schedules for multiple students at once.
- The ability to see average GPA or SAT scores alongside course grades; this would be especially helpful when working with first-generation students or students from underperforming schools.

Improved Registration Process

In addition to integration between course search functionality and Telebears noted above, significant information about user experiences with the registration process came to light in the course of our research:

- Students find multiple confirmation screens frustrating.
- Students and advisors dislike that the system does not alert upon registration for classes with overlapping final exams.
- Advisors would like automatic enforcement of prerequisites. They would rather the system hold a certain number of seats that are designated for instructor-discretion exceptions and block students without the prerequisites from registering; this is seen as preferable to letting students register for classes they’re not prepared for.
- Students would like to know ahead of time if a class is application-only so they don’t use up a Phase I Telebears slot for it.
- Advisors report that when students are dropped from classes or undergo other very important changes to their schedules, they are notified with emails that lack specific information or a sense of urgency; they report that emails stating that “Your class schedule has changed” are too easily overlooked by students.

Future Work for Course Search

While our work prioritized basic search functionality, other ideas surfaced in the course of our research that merit further attention from a research and design team. We did not pursue these ideas to any significant degree, but our Contextual Inquiry suggests that such further attention would point the way to useful additions to course search tools. There are three main areas to consider: course suggestion functionality, major/field suggestion functionality, and major path navigation help.

For course suggestions, advisors would like to see an algorithm that encourages students to discover courses off the beaten path, bring more obscure topics to light, and provide a starting place for first-year students to learn about majors to consider. Thus a popularity-based algorithm (e.g., students who liked course X might also like course Y) could be counterproductive. There is also a longing for the capacity for random discovery; this is something that advisors feel they and students have lost in the move from a printed catalog to an online catalog. A course suggestion algorithm could seek to replace some of this serendipity. And, given issues with waitlists and seat
availability, it would be best if a suggestion engine favored classes with open seats. The possibility of a suggestion functionality that is more human-curated than machine-generated also came up, with a team of staff nominating courses along different dimensions of value and interest to students.

Major suggestion functionality could involve students answering questions about their interests to generate a profile, and/or include an analysis of what they have already taken (e.g., “You’ve done a lot of these kinds of classes, try this major”). Major path navigation could involve assisting students in assessing their progress toward a declared major, assessing their readiness to declare a specific major, and/or alerting them to fields they have been laying the groundwork for with their completed coursework. Visualizations would be an especially interesting avenue to explore in this area—such as the prerequisite diagrams at HKN or major progress bars—as these might prove a useful alternative or supplement to existing requirements lists and DARS functionality.

Design

Below we present our design decisions, including constraints and each stage of our prototypes, along with information about our iterations and decision-making process.

Design Constraints

Our design process and results encompassed a number of constraints. As a team of two, we knew we had to keep the scope of our project very tight in order to produce a quality design. While many possible features came up in our initial research (see “Wishlist” and “Future Work for Course Search” above), we knew that we could not attempt to pursue them all. Furthermore, while there is broad desire for the schedule-management tools included in Ninja Courses and ScheduleBuilder to be integrated into an official course search functionality, we considered that outside of our scope as well. Our design focuses on major course search interactions and the screens necessary to support them. Following the guidelines and research presented in (Hearst 2009), this includes a basic search screen presenting a simple and minimal interface to users if that is all they require; advanced search functionality hidden from users until they request it; results with the ability to refine in place with faceted classification; a basic save functionality; and a basic comparison screen.

Next, we chose to focus on functionality that does not require a login, both to accommodate prospective students and members of the general public, and also because at this stage, while campus systems seem to be moving toward greater integration, there is not currently any benefit to be realized in tying search to CalNet credentials.

We also chose to design primarily for the desktop rather than mobile. Though we designed to enable a responsive implementation, we felt that, given the volume of information that we have to present, a mobile-first design strategy would not be optimal. Furthermore, although we expected our research to reveal a strong desire for mobile access to course search functionality, very few respondents mentioned it as a wishlist item. There are two possible reasons for this. The first is that, for use cases involving planning for the long term or even one full semester, users are switching back and forth among course search and their lists and plans—something that is difficult to do on a mobile phone under the best of circumstances. The second is related to the current tools’ minimal level of mobile-readiness; it’s likely that users don’t even conceive of course search as something they could do on their phones because their current process involves
visiting so many sites and opening up so many tabs. It’s also likely that after this new tool is built and rolled out, mobile search will become more common and thus lead to an increased need to optimize the design for mobile. However, at the present time, nothing more complex than a basic search form and results display is necessary to meet the existing needs, and this can be accomplished via a responsive implementation.

Another important constraint comes from our broad user base and even broader array of use cases. This led to a fair amount of contradiction in the user testing. The proliferation of information needs that arise from student, staff, and community users at all stages of their information-seeking tasks means that what is just right for some users is overwhelming for others. A simplified view that would accommodate those prone to overwhelm and disclose each additional chunk of information progressively would be experienced by others as excruciatingly click-heavy. This might even be true of the same user at different times; close to registration time, students have often chosen their classes and just want to look for CCNs, locations, and open seats; but earlier in the semester when they are planning, they want descriptions, prerequisites, and requirements as well. We chose to err on the side of completeness and minimizing extra clicks, at the risk of presenting users with unnecessary information.

Visually, we were constrained by the timeline of the larger catalog overhaul project being done by Office of the Registrar. Our original intention was to include more finished visual design elements in our prototype, but as certain catalog design decisions were still pending at the time the visual design would have taken place, our functional prototype is confined to interaction and information presentation only, and does not speak to the final visual design of the course search functionality.

Last, and certainly not least, the currently available data, both in content and format, does not always accommodate optimal functionality. We have struck a balance here as well, designing for the basic current data model while including some elements that require improvement to or addition of individual data elements. Elements not yet available because of data issues are included in our design in a modular manner; they can be omitted for the initial implementation and added as they become available. (See Appendix G for a complete list of necessary fields.)
Design Decisions and Artifacts

As indicated in “Process,” above, we iterated through several different kinds of prototypes and evolving our design through user feedback. Images from all stages are below, accompanied by brief explanatory narrative of major design decisions.

Paper Prototypes
The search screen was relatively straightforward; the initial research was very clear about the necessary fields, and the feedback we got at this stage related mostly to questions about autosuggestion functionality and other features that are difficult to represent on paper.

Our first iteration of a search screen.

Advanced search screen in progress.
The research was not quite as clear on the results display. We knew that, in the aggregate, the most important information to display was a course’s department, title, description, and units, and scheduling and availability information. Breadth requirements also represented an opportunity. For our paper prototype, we produced three versions of a results screen: a table view with a minimal set of filters to refine results, a vertically organized view with details opening downward, and a vertically organized view with details appearing on the right. One of the vertical views included a full set of facets. Each version had slightly different arrangements of information in the details pane.

Results option A: main view and details view. Note scant filter dropdowns at the top of the results.
Results option B: main view and details view.

Results option C: main view and details view. Note the use of facets for results refinement.
Feedback on these three views led us to add the full set of facets to all results views and to expand the amount of information available in all details panes.

Results option A: after feedback.

Original comparison screen.

We did not produce a paper prototype of a saved screen, assuming (erroneously, as it turns out) that the best design would be almost identical to whatever results view we developed.
Medium-Fidelity Prototypes

After we had gathered significant feedback on our paper prototype, we produced several screens with Balsamiq, incorporating the feedback and fleshing out our design. Search screen iterations involved adding significant help text and adding to the advanced search options offered. Results screens were standardized as to the amount and type of information displayed in their details panes.

Basic search screen.

Advanced search options (opens below the basic search screen when “View Advanced Options” is clicked).
In the realm of results, we initially eliminated option C because we felt it offered only a small difference from option B. We tested options A and B with users—notably, our initial version of A had the facets on the right, not the left as pictured below. Users tended to prefer B, but those who preferred A generally felt more strongly. Through a feedback session with the UC Berkeley User-Centered Design group, a loose group of campus staff skilled and/or interested in user-centered design, we discovered that users were likely to overlook the facets when they appeared on the right.

(Arch) original results A, main view.
(Almost) original results A, with a course details pane open.

Results B, main view.
Results B, with a course details pane open.

After moving the facets to the left on option A, results were more evenly split; many users liked the sortability and compactness of option A; others responded well to the spaciousness and white space of option B. Surprisingly, a fair number of users asked if we had considered a version of B with details appearing below the header block rather than on the side. We decided to reinstate option C to present to those users.
Further probing of the benefits and flaws of all options revealed that there was one clear problem holding option A back: the columnar space constraint, leading to a truncation of the course title and moving the breadth requirements badge and some important scheduling
information to the details pane. We changed the height of the table rows to incorporate the full course title and the additional requirements and scheduling information.

The results were dramatic: preference for option B dropped off to almost nothing; new complaints surfaced about the cramped nature of the side details pane and users expressed...
appreciation for the white space of options A’s details presentation. We stopped presenting option B and instead focused on refining A and moving on to the save and compare screens.

The number of users keeping lists and spreadsheets of courses led us to ideas about how we could ease the manual nature of that process. Users had also expressed a desire to compare certain information about classes side by side.

![Original saved courses screen.](image)

The interaction here is to select items for comparison and then click the “Compare Selected” button, which would take you to another page (below). We added the Export function because, until campus information systems are integrated enough to allow users to save courses to their CalNet accounts, storage of the items on this list would be persistent only as long as a browser session (or, for users on HTML5-ready browsers, perhaps slightly longer if local storage were used).
Original comparison view. Note the inclusion of details only, with no calendar, and the need for a drop-down list at the upper right to add more items to compare.

The feedback we received on the comparison screen was extremely negative. Although users appreciated the way that the info blocks are lined up with each other so that they could read across the page and see the same information for each class, they were overwhelmed by the bulk of the information presented and expressed a strong desire for a calendar view. Many users reported that they could see no personal use case for the comparison interaction as we had designed it.

Since one of our major design goals was to minimize the number of separate screens users would have to visit during their course search and related activities, we were reluctant to add another click to another page to include a calendar. We decided to add the calendar underneath the saved list, (diminishing the screen space allotted to the list itself and adding a scrollbar for long lists), and use a toggle for switching between calendar and details.
Revised saved courses screen.

Comparison calendar view as part of the revised save/compare interaction.

We also defaulted some of the comparison information blocks to be closed rather than open, to reduce the density of our presentation and combat the sense of overwhelm that users were reporting.
Feedback on this was positive compared to the original version, but users didn’t like having to scroll down to see the calendar, and the details presentation still felt quite overwhelming. During a feedback session, one of our prototype testers suggested that we place the calendar on the upper right of the screen. We took the suggestion and, after more iteration, settled on a final design.

Final saved courses screen, before items are selected for comparison.
Final saved/compare screen, after three items have been selected for comparison.

This keeps the saved list and the comparison interaction on one screen while keeping the calendar consistently visible. The color-coding helps orient users quickly, and those who are not interested in the comparison details need never scroll down to see them. While the details themselves can still be overwhelming, we felt that the only way to eliminate overwhelm completely would be to eliminate the details themselves, which would deprive a subset of users of a strongly desired feature. As always, our goal was to balance the conflicting needs of users appropriately.
High-Fidelity Prototypes

The functional prototype, available at http://groups.ischool.berkeley.edu/course-search/, showcases our design by supporting five searches called for in our scenarios along with a range of ancillary interactions, including faceted refinement; a new, compact method of presenting multiple lecture and discussion instances; and the complete set of information elements users need when searching for courses at UC Berkeley. The code is publicly accessible at http://github.com/wordium/course-search.

Also included on that website are a significant number implementation annotations. Due to its prototype nature, quirks remain in what we have built; we would hate to have such quirks mistaken for design elements. The prototype annotations are our way of clarifying the behavior that our design calls for.

Finally, our prototype consists largely of interaction design. The look and feel, while as close as possible to that of a finished product given our constraints and the pending visual design decisions on the Berkeley Bulletin, needs attention from a visual designer who can match it to the main Bulletin site after that visual design is complete.
The advanced search screen.
### The basic results screen with no details showing.

### The results screen, showing a details pane for a currently offered class.
Implementation Concerns

As previously noted, we have included in our design some data elements that are not yet easily available from current campus information systems. The design is modular in the respect that these elements can be omitted for the initial implementation and added as they become available. The Office of the Registrar is strongly encouraged to consider the need for these data elements as the catalog and curriculum management projects move forward, and to make modifications to data models and data collection practices as necessary to ensure that these elements are available in the format necessary to effectively incorporate them into search and display as recommended by our design. Full details on these data elements can be found in “Wishlist,” above.

It is further recommended that the development team engaged by the Office of the Registrar for this project include significant software engineering and database design expertise. Although it’s our understanding that the search will take place over a pre-existing database, and we have not conducted a full exploration of any back-end systems, we expect that the challenges presented by 1) the volume of UC Berkeley course and class data, 2) the presence of legacy databases alongside new/in-progress systems, 3) the need to think ahead to further integration projects, and 4) the constraints that database implementation will have on the potential future feature development combine to demand this deep expertise.

A more pedestrian matter to consider is the placement of the course search functionality within the main navigation bar of the catalog site. “Courses” currently links to a complete course list, a feature that likely should be maintained; however, that would likely be an intuitive place for users to find course search. However, our user testing did not extend to the Bulletin nav bar; we recommend user testing to determine the placement of course search within it.

Finally, our research revealed significant inconsistency among both student and staff users in their familiarity with course search tools. Students will often use Google rather than going straight to a specific resource they expect will meet their information need. Therefore, we recommend that upon deployment a plan be made for search engine optimization of the course
search page, a campus-wide awareness campaign, and training/orientation for students and advisors.

Recommendations for Future Design and Development Work

As noted in “Research Findings” above, our Contextual Inquiry revealed a wealth of potential features to help users navigate major requirements, understand prerequisite chains and the pedagogical paths they dictate, discover new fields of study, and more. Pursuit of these ideas fell outside the scope of this project, but the opportunity they represent should not be ignored. A future design research team could doubtless contribute greatly to the UC Berkeley community if they were to explore these topics fully and design and test features to satisfy the needs they discover.

Conclusion

In the fall of 2013, our team joined with the UC Berkeley Office of the Registrar to assist with the overhaul of the course catalog by designing a new search interface to replace the existing search functionality on the General Catalog and the Online Schedule of Classes. Searching for information about course offerings—whether done by an undergraduate with an approaching Telebears appointment, a high school student wondering what opportunities lie ahead, an advisor seeking to give the best possible guidance, or a future PhD candidate looking for the right perspective on a research question—is an activity that is fundamental to campus life. Over the course of four months we gathered experiences and feedback from 46 users and several university-affiliated usability professionals; iterated over many prototype screens; and critically examined countless design decisions. By designing a new and improved course search functionality that brings together all the information users need in one place, we hope we have made a contribution to campus life that serves the UC Berkeley community well.

Works Cited


Appendix A: Personas

The Planner: Theresa Lee

- “I know what I’m majoring in and will declare as soon as possible”
- Has a four-year plan spreadsheet painstakingly assembled from the many info sources necessary
- Details
  - 19 year old sophomore
  - Intended: CS major in L&S, minor in music
  - Lives in residence halls
  - Technology: laptop, smartphone
  - Short-term goals: take courses from her plan, make changes as necessary due to scheduling/space issues
  - Long-term goals: stick to the plan
- Scenario tasks
  - Trying to find prerequisites offered this semester that satisfy the plan
  - Revisit and revise long term plan as needed

Theresa has always been an organized student. She maintains a four-year plan in a spreadsheet, which she uses to track the courses she has already taken and those she still needs to take. She knew she wanted to major in computer science (CS) before she started at UC Berkeley, but it wasn’t until she took a music class her first year that she decided to do a minor in music as well. Theresa has a small circle of friends; she met most of them during her first year of school. She is the older of two children, and calls home on a weekly basis.

Theresa’s short-term goals are to complete her lower division prereqs as outlined in her plan. She is completing her AC requirement this year, but her composition requirements were waived because of AP classes she took during high school. Between CS and music, she is hoping that she can find appropriate classes to complete her other breadth requirements. Her friends know her interests, and have recommended classes they have found which she might like, but she has only considered one or two of them so far.

Theresa’s long-term goals are to refine her plan as needed, and complete her upper-level requirements so she can graduate. She isn’t sure what she wants to do after graduation, but has considered graduate school and has talked to one of her professors so she could learn more about that option. She is planning on finding a summer job, and has factored that into her plan.

Theresa spends a lot of time on her phone, and is a heavy social media user. She uses her laptop to access her course information, and has the L&S and music department websites bookmarked, though she goes there often enough that they are in her browser history. She uses Ninja Courses primarily, as well as department websites, to find the courses she needs this semester. She has looked at ratings, with mixed results. Most of the classes she has in her plan only have one professor, so professor ratings are not as helpful. She does look at course ratings when building her plan, but they have only a minor effect on her decisions.
Grade averages are similarly useless for required courses, but she has used them to help her decide which classes to take in the same semester and which to split up to manage her workload. She also uses them when she’s choosing electives: she already takes a ton of hard classes, so why take another when she can find a fun one instead?

Theresa finds it frustrating to track degree requirements across multiple sites, and wishes there was some way she could see those requirements on one site only.

The Seeker: Carl Martinez

- “I’m keeping my options open”
- Doing some exploration with a few potential majors in mind
- Details
  - 18 year old freshman
  - L&S undeclared, deciding between two or three major options
  - lives in residence halls
  - Technology: laptop, smartphone
- Short-term goals: find classes that fit multiple paths, fill schedule for this semester, complete breadth requirements
- Long-term goals: decide on a major, figure out upper-level classes
  - Has talked to his advisor and his parents; has some ideas
  - Wants some way to compare different majors, or to see if classes he finds interesting would lead him to a specific major
- Scenario tasks
  - Trying to find electives which can fit multiple potential four-year paths
  - Find classes with open seats for when his late Telebears time means that his first choices were full

Carl has a number of interests, but isn’t sure which one he wants to pursue as a major. With some help from an advisor and after some conversations with his parents, he has spent some time looking at different department websites to gather more information about some potential choices. Some of the other students he knows from the dorms have plans for their degrees, and while he feels some pressure to choose a major early, he is trying to keep his options open. He feels that it is difficult to switch majors later, so although he knows it’s possible to do so, he would rather make the right decision the first time around.

Carl keeps a list of a few courses in a text file on his laptop. Each course on the list satisfies a requirement that is part of all three of his potential major paths. His short-term goals for his first year are to find a schedule he can build with those classes, and complete his L&S breadth requirements.

He puts priority on exploring different classes, but also on building a schedule that he likes. His Telebears time has prevented him from getting first choice in some classes, but feels that any classes he has missed out on this year can be taken in subsequent years. He is also in a DeCal...
class, which he found after the semester had started. He also is planning to take a Freshman Seminar is related to one of his potential majors.

Carl’s long-term goals are to decide on a major (or double major!) that would make him happy, and to figure out a course plan to satisfy graduation requirements. As he currently looks at multiple department websites to find his information as he does his research, it would be great for him if there was a way to compare different major paths, or to see if classes he finds interesting would lead him to an appropriate major.

The Utilitarian: Andrew Hall

- “I’m executing my plan”
- Details
  - 22-year-old senior
  - Public Health major, Political Science minor
  - Lives on Northside with three friends
  - Works part-time at a company he interned at after junior year; intends to return full-time after graduation
  - Technology: laptop, smartphone, tablet
  - Frustrations: missing out on a class because of professor sabbatical
- Short-term goals: find classes that fit his schedule, meet his requirements, and are interesting enough to take
- Long-term goals: graduate and join the workforce
- Scenario tasks
  - Completing breadth and elective requirements by finding classes that fit his constrained job schedule. May be following others/peers for suggestions.

Andrew is a 22-year-old senior majoring in Public Health. He lives near campus in an apartment that he shares with three friends. Currently, he works part-time at a company in San Francisco, commuting on Mondays, Wednesdays and Fridays. He was there full-time over the summer after junior year, and intends to return full-time after graduation.

Andrew has completed all of his lower-division requirements and all of his breadth requirements. He is getting ready to graduate, and is finishing off the upper-division classes that he picked out as a sophomore. Some of the classes he has taken have deviated from his plans, due to various course time changes or a professor being on sabbatical. He missed out on a couple of classes he wished he could have taken, but he has been happy with his overall experience.

Most of the classes Andrew is taking this year fulfill his upper-division elective major requirements; he chose them by reading the description of each course on the department website, and he has also spent some time looking at syllabi from previous years. Some classes he is taking because he likes the teaching style of the professor. He has looked at some ratings information for professors and classes, but mostly he has operated on what he knows about the major, some of which is based on conversations with friends who are also in his major.
Because Andrew is working, scheduling around his job duties is very important to him. He has used Ninja Courses to find the right time for lectures and discussions, to keep his Monday and Wednesday afternoons and Fridays free. His short-term goals are to find the right balance between workload, schedule, and completing his electives in order to graduate.

The Focused Explorer: April Kennedy

- “I know what I care about and want to find as many classes about it as possible.”

Details

- 26-year-old first-year PhD student in City and Regional Planning in the College of Environmental Design
- Lives off College Avenue with one roommate
- Technology: laptop, tablet, smartphone
- Short-term goals: finding relevant classes, finding professors teaching interesting topics
- Long-term goals: do research, write a stellar dissertation
- Frustrations: finding classes outside of her department that fit her interdisciplinary interests and research needs

Scenario tasks

- Some exploration to find relevant classes for this semester, based on topic
- Find classes in all semesters based on a theme (e.g., design, research methods)

April is a 26-year-old graduate student who recently started at UC Berkeley. She lives in a small apartment just off College, with one roommate who is not a student. She recently moved to Berkeley, and is looking forward to working with a couple of researchers on campus.

April knows what she is interested in studying, but is open to exploring new avenues in and around her area of specialty. She likes to learn as much as possible, and would especially like to find classes that will give her a new perspective on her area of research. Her area of concentration in graduate studies is a continuation of some work she did as a senior in her undergraduate years, and partially related to the job she had before returning to school.

Although she is required to take two specific courses in her first year, April is interested in finding graduate-level classes outside of her department as well. She has spent a little bit of time finding professors teaching classes relevant to her area of study, but finds it difficult to explore other departments.

April uses the General Catalog to find courses related to a specific theme, but is limited by course title and description searching, which is not always helpful. Her long-term goals include finding more classes which are relevant to her studies, and identifying the specific topic of her dissertation.
The Advisor: Monica Scott

- “I need to use the right tools to help my students find the courses they need.”
- Details
  - One of many undergraduate advisors in L&S
  - Has been in this position for more than three years
  - Commutes from Albany
  - Sees students daily
  - Technology: desktop computer, tablet, feature phone
  - Short-term goals: see students, answer questions, find courses that fit student needs
  - Long-term goals: stay on top of degree requirements relevant to her college, keep track of programs that students might find interesting but not know about, encourage students to go off the beaten path and discover new fields
  - Frustrations: How hard it is to keep on top of major requirements is hard when department websites all keep everything in different places; having to go to so many different places to find what she needs
- Scenario tasks:
  - Help students discover majors and find requirements
  - Educate students on how to search for what they want
  - Find courses to recommend to specific students for purposes such as breadth, preparing to declare a major, and filling a gap in units

Monica’s student caseload keeps her very busy, usually seeing half a dozen students per day and up to 15 at the busiest times of the year, right before Telebears slots open and during the first few weeks of each semester.

She is dedicated to her work, but between student meetings and keeping on top of all the relevant information coming her way, she doesn’t have a lot of time to spend delving into course offerings, even though she knows it would benefit her and her students.

She wants to encourage exploration, but sometimes has trouble conveying to students why a field such as, say, Celtic Studies might be worth a look when everyone seems to be interested in CS and Haas. Her life would be a lot better if she didn’t have to chase information down in so many different places all the time—and it would be a whole lot easier to train her students on good course search strategies, too!
Appendix B: Scenarios

Find Major-required classes offered in the upcoming semester
Relevant to the Planner and the Utilitarian

Every semester Andrew monitors his major progress and double-checks what he needs to take to stay on track in the upcoming semester.

As-Is

Andrew goes to his home department’s website and makes the clicks he needs to find the list of major requirements. He reads the information again (for what can feel like the millionth time) and makes a note of the requirements he hasn’t filled. He goes to Ninja Courses and starts entering the department code and course numbers. Some of the ones he expected would come up are, it turns out, not being offered in the coming semester. He puts the ones that are being offered into a a schedule and looks at the results. Some of them clearly won’t work for him, but he needs to take two out of a possible four. He opens a new tab for each course course description and clicks between the many pages before making his choices.

To-Be

Andrew goes to the Course Search interface. Since the add/drop deadline for the current semester has passed, the default search is for the upcoming semester. Since that is already filled in, all he has to do is click open the Advanced Search options and enter the first few letters of his major in the the Major field; a few departments come up as autosuggestions. He picks the right one and clicks "Search." Looking over the list of results, he checks off the classes he has not yet taken and clicks "Compare." On the comparison screen, he looks at course descriptions and details side-by-side in a single screen and makes his choices.

Find classes that meet breadth requirements
Relevant to the Seeker, the Planner, and the Utilitarian

Theresa knows that due to her challenging major and minor combo, she needs to be organized and make all of her classes count. She’s determined to stay on top of her breadth requirements so there are no surprises or unexpected constraints in her senior year.

As-Is

To include breadth requirements in her four-year plan (see the scenario below), she uses the L&S Breadth search engine. She chooses her first semester, Fall 2014, from the drop-down menu, figuring that there should be some interesting things to consider right away. She then moves on to the requirements field, seeing that she can only search for classes that meet one requirement at a time. How frustrating—she wishes that she could see results for all of the requirements at once. She goes through the requirements one by one, scanning the results for things that look interesting and opening new tabs for each course description. She finds a lot that she’d be happy to take, but for the purposes of long-term planning she knows that the upcoming semester’s offerings won’t necessarily be consistently available in the future. So instead of slotting classes into specific semesters of her long-term plan, she makes a list, noting the requirement that each class meets. Figuring that that a lot of classes are generally offered in either the fall or the spring, she also notes the semester and then goes through the same process using Spring 2014 (because of course Spring 2015 is not up yet). A few hours and many browser tabs later, Theresa has a
strong list of possible classes that she’ll look into for specific scheduling options when each semester’s schedule becomes available.

To-Be

She goes to the Course Search page, chooses “All” in the Semester drop-down, and then clicks on Advanced Options. Under “Breadth Requirements,” she checks all the boxes except those that she knows her major and minor will cover. She clicks search. She uses the facet filters to choose departments she is most interested in. From these narrowed results, she can scroll through the list and see which classes meet which requirements. As she clicks on the classes she’s interested in, she can read course descriptions and see their offering history so that she can make educated guesses about when they might be offered during her time at Cal. It takes her about an hour to put together a list of prospects that gets added to her four-year plan, and she’ll check the specific scheduling options when each semester’s schedule becomes available.

Find classes on a theme
Relevant to the Focused Explorer

April has dual research interests, in transit/walkability and gentrification, and although there are a few classes addressing this in her home department at the College of Environmental Design, she knows that other disciplines such as public health, economics, and maybe others address topics relevant to her as well and she’s interested in getting as many different perspectives as possible.

As-Is

After asking her advisor and some of her classmates, none of whom have any good recommendations for these specific topics, she uses the keyword search in the General Catalog. After using course descriptions to identify a few classes that fit the bill, she goes to each offering department’s website, locates their schedule for the upcoming semester, and finds that only one of the classes is being offered. She has no idea if the others will be offered later or if they are just part of the long-ago historical record of Berkeley. Frustrated by the process—already she’s spent a precious hour digging through individual department sites in search of their schedules—and suspecting that she is likely missing some offerings, she turns to Google and runs through her list search terms paired with “UC Berkeley.” She finds a blog post by a professor in the History department with a list of classes related to issues of global and regional population density and its changes over time. One of the classes is exactly what she is looking for, so after checking the department site and seeing that it’s not offered, she emails the professor to ask if he might be offering it again in the future. The professor emails her back to say yes, it’s very likely that he’ll offer it the semester after next and that she would be welcome to take it. However, April is still uncertain about not only that class but about whether she had identified all possible classes that cover the topic she thinks would be most useful to her work.

To-Be

She goes to the Course Search interface and enters her keywords. Her search brings up a list of results that she can sort by semester of next offering; for courses that are not on any available schedule, she can see its offering history to try and gauge the pattern. She can read course descriptions and, for a few of the courses, follow a link to a class website.
Find classes to fit with a set job schedule
Relevant to the Utilitarian

Andrew’s Telebears Phase 1 appointment is tomorrow. He knows that next semester he will be working at his off-campus job all day Friday and Monday and Wednesday afternoon, so scheduling is a major concern.

As-Is

He goes to the Online Schedule of Classes, because he remembers seeing fields there to search by day and time. He tries entering a few combinations, but something like MW 9-12 returns only six classes, none of which are right for him. He tries a few other things and realizes that his results are exactly what he entered, rather than classes within his constraints. He wonders why he can’t enter a range of times and get results that fit within them. He would be happy with anything that met on Monday and/or Wednesday morning. Then he searches again, this time entering TuTh in the day of the week field, since those are his open days. This gives him a lot to look at, and as a bonus he can re-do the search and look only in his major and minor department to ensure that he can cover his last elective requirements, but he knows he’s missing out on some MW morning classes that would work. He keeps a list of potential classes that he’ll put in Ninja Courses later so he can more easily read the course descriptions and figures that he’ll search for Monday and Wednesday classes later. In the end he runs out of patience with the cumbersome search process, and registers for back-to-back classes on Tuesdays and Thursdays. He’s excited about some of them and relieved that the others don’t sound too boring and won’t mess up his work schedule.

To-Be

He goes to the Course Search page and clicks on Advanced Search. He clicks on the calendar icon, which pops up a weekly calendar grid. He shades the grid with the times he is available to attend class and clicks the “Set schedule preferences” button. Then, back at the full Advanced Search screen, he can set further criteria based on requirements, keywords, departments, or open seats—or he can browse everything. He clicks the search button and sees only results that work with his chosen schedule constraints. The results are presented very compactly, and he can easily expand any given listing to see its full description, instructor, enrollment/waitlist information, etc., and he can refine the results to his major and minor departments. He selects a balanced a schedule from the classes that he’s excited about and meet his last requirements, with one MW morning class and a long break on Tuesdays and Thursdays that he can use to eat lunch and prep for his last class of the day.

Find backup classes with open seats
Relevant to the Seeker

Carl’s first semester is about to start, and he’s worried about some of his classes. The titles and descriptions had sounded interesting during CalSO, but now he wonders why he thought so. He’s wondering what he’ll do if they turn out to be boring, or either too easy or too hard. He regrets not scheduling in more flexibility for shopping around. He wants to see if he can add some interesting classes to give himself an out if he needs it.
As-Is

He goes to the Online Schedule of Classes, but finds out he can’t use that search for open seats. He remembers something telling him about searching for open seats through the L&S Breadth search engine, so he goes there. He doesn’t really care about breadth requirements right now—he wants to check out a lot of different fields, so he figures that covering the breadth won’t be a problem for him—and feels frustrated that he has to pick a requirement in order to use the search. Why can’t he just look for anything with available seats? He picks Philosophy and Values, and makes sure he’s searching on available seats. He browses the results, opening new tabs in the General Catalog in order to read course descriptions along the way. Then he restarts his search and picks Physical Science. It’s a little tedious, and frustrating that he’s missing out on non-breadth classes, but at least it’s less time-consuming than checking for available seats manually in the Online Schedule of Classes. He’s keeping a list of course numbers on a piece of paper so he can enter them in Ninja Courses later and see what fits his schedule.

To-Be

He goes to the Course Search page and enters some search terms based on conversations he had with one of his favorite high school teachers. On the results page, he clicks “Refine your search” and then chooses “Available seats” and “Lower division” from among the options. He scrolls through this smaller and more manageable set of results, reading course descriptions and clicking on “save to options list” along the way.

Make long-term plan

Relevant to the Planner

Theresa has known since her sophomore year of high school that she wanted to study computer science at Berkeley, so as soon as she was accepted into L&S, she started planning her four-year path. She started by making a Google Docs spreadsheet, with one page for major requirements and interesting major electives, one for interesting breadth requirements, and one for a semester-by-semester list of classes. When she added a music minor in her first semester, she added another page to her spreadsheet to track its requirements.

As-Is

She started at the CS department website, where she pored over the requirements information. She followed the links from the CS informational page to the CS course page and then to the General Catalog to determine if she was prepared enough to enroll directly in the classes she would need to declare her CS major, or if she needed to take care of other prerequisites first. By working backwards from her goals, and with as many as ten course or class information or search tabs open at once, she filled in the spreadsheet with a semester-by-semester plan to meet her major requirements. Then she went through the same process with the music minor requirements. She then tackled her L&S breadth requirements, noting with relief that between the major and the minor she had Arts and Literature and Physical Sciences automatically covered. She used the L&S Breadth search engine via the process described in the scenario above to identify interesting classes that would meet her requirements and complement her plan, and entered them into her breadth page and, after further scheduling research via the Online Schedule of Classes and some guesswork about the future, into her semester-by-semester grid. After each semester she adjusts her grid if she has to change her plan due to being unable to get into classes, or if things are not scheduled in the way she expects.
To-Be

She still starts at the CS and Music department websites, but instead of having to follow two links to the General Catalog and the go from there to the Online Schedule of Classes for current semester details, she can go to the Course Search page and search for her required classes and see on one page: course description, prerequisites (with a link to that course’s listing as well), and schedule information, including the offering history so that future semester offerings can be reasonably predicted. Making her four-year-plan spreadsheet has gone from a time-sucking and frustrating experience to a relatively smooth and pleasant one.

Find classes that open doors to multiple majors

Relevant to the Seeker

It’s the end of his first semester, and Carl doesn’t know what he wants to major in. While he has a while before he can declare, all of his dorm-mates and classmates seem to know exactly what they want. But he’s still torn. He loved History in high school, but his film class this semester makes him think about Media Studies, and the way everyone’s talking about app development makes him curious about Computer Science. And his dad wants him to choose something practical, like Economics. And what about the fields he has still never heard of? What if he wants to major in one of them?

As-Is

Carl spends way too much time poring over the major prerequisite sections of departmental websites. He makes a list of major-prerequisite classes that sound interesting, figuring that if he likes a prereq class that bodes well for liking the major. But he doesn’t want to box himself in. He hates spreadsheets, but forces himself to make one, so he can see which classes will prepare him for multiple majors, so he’s not off track no matter what decision he wants to make later. He then goes to Ninja Courses to check descriptions and prerequisites for the classes he has identified, adding to his spreadsheet as necessary. By the time he’s done, he’s bleary-eyed and has a disorganized list of potential classes that when he looks at it a week later, he can’t figure out what it means he should do next.

To-Be

Carl goes to the Course Search page and clicks on “Explore Major Paths.” He checks the boxes next to Media Studies, Economics, and History; he also chooses “major prerequisites only.” His results are a list of classes marked with badges: MS, ECON, and HIST. Some of the classes have other badges as well, indicating that they are prerequisites for other majors. He scans the list and identifies several classes that pave the way for more than one major (and also has some ideas for new majors he could check out).

NOTE: This is a scenario meant to offer a look at what future-development functionality might do. While the problem presented here emerged from our research, the solution presented is not fully designed and has not been user-tested.
Appendix C: Work Models

Course Search Sequence Model

- Want to search for classes
  - So many tools, user must make decision each time
  - Search
    - Results are not what was expected
    - Search again
      - Important information not presented in chosen tool
      - Open new tabs/switch tools
        - Search tools inappropriate for other stages of process
        - Copy information to another tool through a manual process

Note: this process is highly generalized and significantly incomplete, but it does highlight major pain points for users.
Course Search Cultural Model

- College/graduate division requirements
- Major/program requirements
- Peers
- Ratings & reputation
- Family
- Advisors
- Breadth requirements
Appendix D: Affinity Diagram

Our affinity diagram doesn’t fit neatly on a page; we’ve reassembled it here as best as possible. Post-its are color-coded: blue represents advisors, green represents graduate students, and undergraduates are represented by yellow (juniors and seniors) and pink (freshman and sophomores).

Activities
Goals
Appendix E: Data Fields for Results Display

Because of the nature of our data (e.g., not all courses have prerequisites), there is no one place in the prototype where all of the included fields are guaranteed to be displayed (this is in contrast to the search screen, where all fields are clearly displayed). Therefore it is useful to include here a complete list of data elements called for in the results display. The format of this data is implementation-dependent, so is not specified.

Course data (relevant to all courses)
- Title
- Department name (full and abbreviated)
- Course number
- Cross-listing information (if applicable)
- Units
- Description
- Format
- Prerequisites (if applicable)
- What courses it’s a prerequisite for (if applicable)
- Corequisites (if applicable)
- Restrictions (if applicable)
- Offering history
- Note (from the Online Schedule of Classes, if applicable)
- Whether the course is part of a Course Thread, Berkeley Connect, Freshman/Sophomore seminars, etc. (if applicable)
- Campus or L&S Breadth requirements met by the course (if applicable)
- Course evaluation information
- Grade distribution information

Class instance data (relevant to a specific instance of a class offered at a particular time)
- Whether the instance is a lecture, discussion, or lab
- Semester
- Days
- Time
- Location
- Instructor(s)
- CCN
- Seat information
  - Max
  - Enrolled
  - Waitlist
  - Available
- Final exam time (if applicable)
Appendix F: Interview Guides

Undergraduate Interview Guide

- The purpose of our study is to learn about the tools and methods that people use to find courses to enroll in. We will use the information we gather to inform the design of a new cross-department course search functionality.
- We are talking to UCB undergraduate and graduate students, as well as department advisors and career counsellors.
- We’ll start with asking a few basic questions about you, then we’ll be asking you to explain how you search for classes and asking questions as we go along. Feel free to tell us what is on your mind at any time.
- Participation is completely voluntary, and you can stop the interview at any time. Nothing about this process or your participation has any bearing on any of your classes or grading (or for faculty/staff: evaluation of job performance).
- Consent forms

- Basic info
  - year
  - major(s)/minor(s)
  - when did you decide on your major?
  - when did you declare it?

- Contextual inquiry: Show me what you did when searching for classes most recently
  - Did you talk to anybody else? (e.g., friends, teachers, mentors, family?)
  - What are the most important factors for you in deciding to take a class?
  - How closely do you look at syllabus information, if at all? How hard/easy is it to find that info?
  - Do you look for grade distribution information?
  - Timing
    - How much time do you spend searching?
    - How far in advance do you start?
    - When do you generally finalize your schedule by?
  - Do you mostly look in your home department, or outside?
  - What are your frustrations with how you currently search for classes?
  - What do you wish you could do that you can’t do?

- Do you take DeCal or Berkeley Connect classes?
  - If yes, how did you find out about them?
Graduate Student Interview Guide

- The purpose of our study is to learn about the tools and methods that people use to find courses to enroll in. We will use the information we gather to inform the design of a new cross-department course search functionality.
- We are talking to UCB undergraduate and graduate students, as well as department advisors and career counsellors.
- We’ll start with asking a few basic questions about you, then we’ll be asking you to explain how you search for classes and asking questions as we go along. Feel free to tell us what is on your mind at any time.
- Participation is completely voluntary, and you can stop the interview at any time. Nothing about this process or your participation has any bearing on any of your classes or grading (or for faculty/staff: evaluation of job performance).
- Consent forms

- Basic info
  - department/program
  - masters or PhD, year

- Contextual inquiry: Show me what you did when searching for classes most recently
  - Prompts/clarifications as needed:
    - What are your frustrations with how you currently search for classes?
    - What do you wish you could do that you can’t do?
    - Who do you talk to about choices?
    - What are the most important factors for you in deciding to take a class?
    - How closely do you look at syllabus information, if at all? How hard/easy is it to find that info?
    - Do you mostly look in your home department, or outside?
    - Timing
      - How much time do you spend searching?
      - How far in advance do you start?
      - When do you generally finalize your schedule by?

- Are you a GSI? (if yes, below Qs)
  - Do you look at other course listings when planning your syllabi?
  - What info are you looking for?
  - Is the info generally available?
  - What would make it easier for you to get what you need for syllabus development from course search?
Advisor Interview Guide

- The purpose of our study is to learn about the tools and methods that people use to find courses to enroll in. We will use the information we gather to inform the design of a new cross-department course search functionality.
- We are talking to UCB undergraduate and graduate students, as well as department advisors and career counsellors.
- We’ll start with asking a few basic questions about you, then we’ll be asking you to explain how you search for classes and asking questions as we go along. Feel free to tell us what is on your mind at any time.
- Participation is completely voluntary, and you can stop the interview at any time. Nothing about this process or your participation has any bearing on any of your classes or grading (or for faculty/staff: evaluation of job performance).
- Consent forms

- Basic info
  ○ What’s the student population you serve?
  ○ What’s your role?
  ○ How long have you been doing this work?
  ○ How frequently do you interact with students/potential students?

- If they search the catalog, Contextual inquiry: Show me what kinds of searches you do
  ○ Prompts/clarifications as needed

- If they don’t search the catalog or if these aren’t covered naturally during CI
  ○ What do you need to know about classes and the catalog to do your job well?
  ○ What frustrates you about the current way this information is available to you?
  ○ What do you wish you could do that you can’t do?
  ○ What do you wish you could easily do or learn from a course search that you can’t do or learn now?
Appendix G: Prototype Evaluation Protocol

- We are Lisa and Sandra, and we are both master’s students at the School of Information. This study is a part of our thesis project.
- The purpose of this study is to get feedback on some potential course search user interface designs that will be passed on to the Office of the Registrar.
- We are talking to UCB undergraduate and graduate students, as well as department advisors.
- We’ll start with asking a few basic questions about you, then we’ll be asking you to complete a few tasks on a computer.
- Participation is completely voluntary, and you can stop the interview at any time. Nothing about this process or your participation has any bearing on any of your classes or grading (or for faculty/staff: evaluation of job performance).
- Compensation: $5 gift card to Yogurtland
- Consent forms
- Recording: voice, screen → will be kept on a flash drive in a locked locker

Basic info
- year, major(s)/minor(s)
- when did you decide on your major?
- when did you/will you declare it?
- current tools

Prototype Intro
- Going to show a search user interface, a results screen, and some other course search features
- Will prompt you with questions and tasks.
- This is a mockup, so not everything is interactive, and you will likely encounter some things you want to click on, but can’t. Not testing you, testing the prototype.
- Visual elements, like colour, font, bolding--these will be improved
- Please try to think aloud--tell us what’s on your mind, and walk us through your thought process.

Search UI
- Let’s say you are looking for a course for this fall. Walk us through what you would do to search for it, with this screen.
- Task: how to find a course which is 2 units
- Task: how to find a class which meets between 10am and 2pm on Mondays
- What do you expect from "Majors"?
- Requirements OK?

Results
- Go back to basic mode only. Put in “modern” in the title keyword, and hit Search
- Task: find the instructor for Math 172
- Task: Find the locations of Anth C262B discussions
- Task: Find the seat availability for Astronomy 3
- Task: Find the offering history for Anth 151
- Close any open course details, and browse the list. Anything here you might be interested in taking?
- Let’s say that you already have some courses saved in your list, but you want to add another and compare. Save Arch 100 and go to your Saved Courses
- Comparison
  - Compare Arch 100, Anth 151, and Anth C262B
  - How do you feel about how the information is laid out?
  - What are you looking at to compare courses?
  - Is anything missing?
Appendix H: Other Course Search Tools Explored

- Brown University course search (courses.brown.edu/)
- MyEdu.com
- Missouri University of Science and Technology Explore Degrees/Explore Courses (catalog.mst.edu/#text)
- Stanford Bulletin Explore Courses (exploreCourses.stanford.edu/)
- New School Course Catalog (www.newschool.edu/ucc/courses.aspx)
- Boston University (www.bu.edu/academics/search/)
- University of Phoenix degree search (www.phoenix.edu/programs/degree-programs.html)
- Harvard University (coursecatalog.harvard.edu/icb/icb.do)
- Coursera (www.coursera.org/courses)
- EdX (www.edx.org/course-list)
- UC Berkeley English Department (english.berkeley.edu/course_semesters/29)