

RADGRAD: IMPROVING ACADEMIC, PROFESSIONAL, AND SOCIAL  
ENGAGEMENT DURING THE UNDERGRADUATE COMPUTER SCIENCE DEGREE  
EXPERIENCE

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE  
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By

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## ABSTRACT

While it is hard to dispute that the Information and Computer Science (ICS) department at University of Hawaii at Manoa (UHM) is a diverse, supportive, and overall well-functioning community, over the last decade, recent alumni and current undergraduates have expressed several problems with various academic, professional, and social aspects of their ICS experience. Existing degree planning systems such as STAR, Starfish by Hobsons and Blackboard Planner fail to provide the specific support that an ICS student needs. Existing social networks such as LinkedIn and TechHui fail to connect students closely with professors and alumni. Current popular video games suggest several gamification features that could encourage ICS students to achieve higher goals at a healthy rate. A new system called RadGrad combines degree planning, social networking, and gamification in a specific way that caters specially towards undergraduate ICS students and gives them the support they need to succeed. By conducting baseline and post-RadGrad deployment questionnaires and interviews, by May 2017, we will discover whether or not RadGrad can be used as a tool to fix many of the ICS students' existing problems.

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# CHAPTER 1

## INTRODUCTION

There are a lot of things that can make a department like no other—exceptional people, exceptional facilities, exceptional events, or exceptional work. I may be biased, but I believe the ICS department at UHM is a department like no other—and is exceptional in all these ways. The people are exceptional—I came into this major not knowing what to expect, but the people I have met along the way have exceeded all of my expectations. I have met some of the most brilliant, the most passionate, the most interesting and the most genuine people in this department. The facilities are exceptional—the computer labs are well maintained, and the new ICSpace is a great place for members of the department to socialize and create a sense of community. The events are exceptional—within this major, there are so many opportunities to participate in events. There are workshops, hackathons, competitions, and open source projects just waiting for participants. Finally, the work itself is exceptional—again, I may be biased, but I have grown to become very passionate about computer science, and I have met many others in the department who feel the same way. Computer science is constantly changing and it is a challenge to keep up with it, but it definitely keeps things interesting.

But nothing is perfect. Data gathered from 199 ICS students from 2008 to 2016 on the Hawaii technology community site, TechHui [19], suggests that the following ten categories have constantly displeased students over the past 8 years:

1. The ICS department needs to offer classes more frequently.
2. The ICS department needs to offer a wider variety of classes.
3. The ICS department needs a better sense of community.
4. Some of the professors in the ICS department need to improve their teaching.
5. The ICS department should offer more focused areas of study.
6. ICS classes are too time consuming and take up more time than anticipated.
7. The ICS department should offer more classes that meet focus requirements.
8. ICS books are too expensive.
9. ICS courses should involve more group work
10. ICS should encourage more interaction among students.

Categories 1, 2, 5, 6, 7, and 8 suggest problems with the coursework itself and categories 3, 4, 9, and 10 suggest social and communication related problems within the department. There were also some other complaints among students on TechHui that were not as common but stuck out to me nonetheless. There were at least eight students who mentioned that they felt intimidated when they started out in ICS, due to the impressions they got from their classmates and the major overall. This discouraged them in several ways and had an overall negative impact on their ICS experience. These sentiments further suggest social problems with the ICS community, as well as with how the department is perceived outside of the community. Additionally, apart from the sentiments expressed on TechHui, several ICS alumni that I remain in contact with are currently having problems finding ideal jobs after graduation. Feedback from employers suggest that this trend may be due in part to the small computer science market in Hawaii and in part to the lack of professional experience of many students straight out of college. Statistics like this suggest existing problems with professional development within the ICS department.

As ideal as it would be, it is hard to meet the needs of all current, past and present students in a department. However, after taking student and alumni feedback into consideration, several of these problems could potentially be alleviated by creating an online platform (what could computer science students want more?) that provides students with the help they need—academically, professionally, and socially. By combining three aspects (degree planner, social network, and gamification), a new system called RadGrad could address many of the aforementioned student problems and needs.

# CHAPTER 2

## RELATED WORK

My vision of addressing ICS student problems through an online platform involves three major parts: degree planner, social network, and gamification. All three of these parts combine to create a robust, interactive, and effective system to enhance the academic journeys of current and future ICS students. In this section I discuss existing software in each of these categories, what they aim to accomplish, and why they do not fully satisfy the needs of ICS students.

### 2.1 Degree Planners

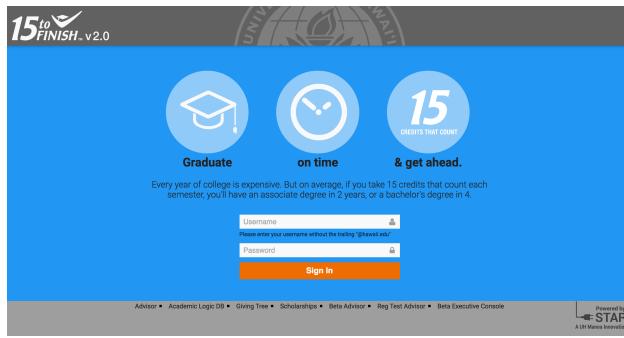


Figure 2.1: STAR homepage. *Source:* [www.star.hawaii.edu](http://www.star.hawaii.edu)

#### 2.1.1 STAR

STAR is the degree planning system currently used by the University of Hawaii system [10]. As of September 2016, the student interface provides five main capabilities: Academic Essentials, Graduation Pathway, What If Journey, Transcripts, and Scholarships.

The screenshot shows the "Academic Essentials" tab of the STAR system. It includes sections for "Graduation Requirements Total", "System General Education Requirements", "Courses Not Yet Classified", "Adviser Notes", and "Events and Actions". The "Graduation Requirements Total" section shows requirements for "UH Requirements" (3.00), "Major Requirements" (3.00), and "Electives and Free Electives" (3.00). The "System General Education Requirements" section lists courses like KIS 102, KIS 101, KIS 104, KIS 107, and KIS 113. The "Courses Not Yet Classified" section shows "Fall 2016" and "Fall 2016" with various grades and credits. The "Adviser Notes" section contains messages from advisers. The "Events and Actions" section lists events like "Fall 2016 Request Grade Change" and "Fall 2016 Advisor Undergrad Degree Confirmed".

Figure 2.2: STAR Academic Essentials page. *Source:* [www.star.hawaii.edu](http://www.star.hawaii.edu)

### 2.1.1.1 Academic Essentials

This interface provides information about the student's academic progress, and compares it to the student's academic requirements to show how close the student currently is to graduation. This information includes credit totals, grades, and required courses. This interface also includes a section for "Advisor Notes", which is filled out during advising sessions. There is another section for "Events and Actions" which lists important student academic events such as college applications, admittance, and graduation, and student academic actions such as Deans List award. A third section is called "Educational Goals", which provides the student's "immediate goals" and "highest ed goals" on a semester-by-semester basis. This information is provided by the student through occasional assessments upon log-in to STAR. The top of the page also has a section for students with financial aid.

The screenshot shows the STAR Academic Graduation Pathway page. At the top, there are tabs for 'ACADEMIC ESSENTIALS', 'GRADUATION PATHWAY', 'WHAT IF JOURNEY', 'TRANSSCRIPTS', and 'SCHOLARSHIPS'. The main content area displays two course schedules:

- Fall 2016:** Shows courses like MATH 101, MATH 102, and MATH 103 with grades A, A, and A respectively. It also lists 'CJS Long Term' and 'CJS Minor'.
- Spring 2017:** Shows courses like MATH 101, MATH 102, and MATH 103 with grades A, A, and A respectively. It also lists 'CJS Long Term' and 'CJS Minor'.

Below the schedules, there is a section for 'Academic Events' and 'What If Academic Events'. On the right side, there is a sidebar titled 'EDUCATIONAL GOALS' with a dropdown menu showing various goals like 'Arts, Humanities, or Social Sciences (3A, 3H, or 3L)'.

Figure 2.3: STAR Academic Graduation Pathway page. *Source: www.star.hawaii.edu*

### 2.1.1.2 Graduation Pathway

This interface is provided for certain programs or exploratory or pre-major students. It shows the course information for the courses that the student has taken previously and is currently enrolled in, and shows which requirements each course fulfills. It also shows future semesters and suggests future types of classes that the student should enroll in, in order to fulfill their major requirements. This interface does not suggest specific classes, but only lists the requirement that the class will need to fulfill.

### 2.1.1.3 What If Journey

This interface is provided for undergraduates at UH Manoa. It allows students to choose a different major than the one they are currently in. The page then reloads to show the STAR homepage, altered to show the requirements of the chosen major. This shows students where they would be in the program if they were to switch majors.

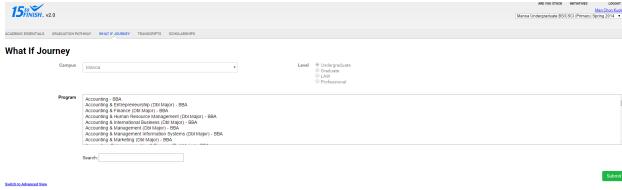


Figure 2.4: STAR What If page. *Source: www.star.hawaii.edu*

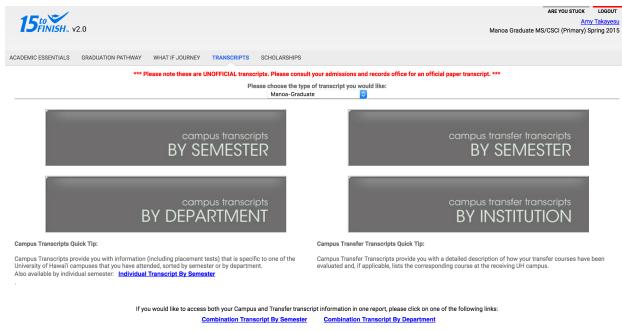


Figure 2.5: STAR Transcripts page. *Source: www.star.hawaii.edu*

#### 2.1.1.4 Transcripts

This interface allows students to access their campus transcripts by semester and by department. It also allows transfer students to access their transfer transcripts by semester and by institution.

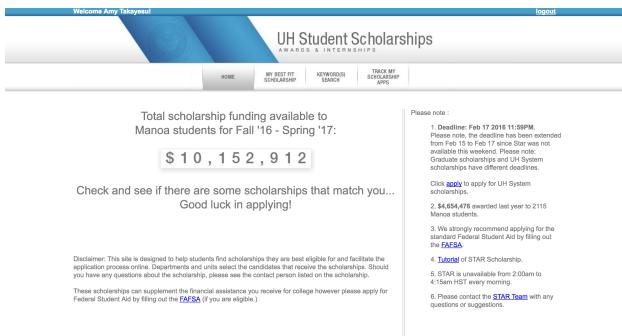


Figure 2.6: STAR Academic Scholarship Home page. *Source: www.star.hawaii.edu*

Welcome Amy Takeyusu

UH Student Scholarships  
AWARDS & INTERNSHIPS

HOME MY BEST FIT SCHOLARSHIP KEYWORD SEARCH TRACK MY SCHOLARSHIP APP

**W. Wesley and Hiromi Peterson Student Support Endowment\***

**Description:** Professor W. Wesley Peterson was one of the founders of the Department of Computer and Information Sciences (CIS) at the University of Hawaii at Manoa. He was a member of the Association for Computing Machinery and a fellow of the Institute of Electrical and Electronics Engineers. Peterson was also a member of the IEEE Information Theory Group. Hiromi Peterson is a teacher of Japanese language at Punahoa School. She has written several Japanese language books and teaching textbooks "Adventures in Japanese" for teaching Japanese language at the secondary school level.

**Purpose:** The purpose of this fund is to provide an annual award or scholarship to be known as the "Peterson Award/Scholarship" to a student enrolled in a degree program in the Department of Computer and Information Sciences at the University of Hawaii at Manoa College of Natural Sciences for the purpose of encouraging and recognizing excellence in research and scholarship.

**Basic Criteria**

Campus: Main	Level: Undergraduate or Graduate	Need Based: any
College: Colleges of Arts & Sciences	Standing: any	Min GPA: 3.0
Major: Computer Science, Informatics, Computer Sciences	Residency: any	Gender: Any

**Additional requirements:** Application criteria for choosing a recipient (eg. excellence in research, excellence in teaching, etc.)

A scholar in both categories will be recommended by the CIS dept. awards committee & approved by the CIS Chair each year.

CAMPUS: Main  
LEVEL: Undergraduate  
COLLEGE: Colleges of Arts & Sciences  
MAJOR: Computer Science  
STANDING: any  
RESIDENCY: HI Resident  
GENDER: Female  
NEED BASED: any

**My Best Fit Auto-Search**

Figure 2.7: STAR Academic Scholarship Best Fit page. Source: [www.star.hawaii.edu](http://www.star.hawaii.edu)

Welcome Amy Takeyusu

UH Student Scholarships  
AWARDS & INTERNSHIPS

HOME MY BEST FIT SCHOLARSHIP KEYWORD SEARCH TRACK MY SCHOLARSHIP APP

**Mr. & Mrs. Abraham M. S. Goo Scholarship Fund for the Sciences\***

**Description:** Shin Quon and Abraham Goo both graduated from McKinley High School and went on to receive their undergraduate degrees in engineering from the University of Hawaii at Manoa. Abraham Goo served as a radio operator-pilot during World War II and later earned a degree in engineering. He took a position with Boeing and eventually became a supervisor of the aircraft maintenance department. He was involved in research and development unit in charge of the B-1 (staith) bomber. The Goo family has been giving back to the community through donations to the University of Hawaii at Manoa.

**Purpose:** The purpose of this fund is to provide scholarships to assist academically able and financially needy students who are pursuing a degree in a scientific field of study at the University of Hawaii at Manoa.

**Basic Criteria**

Campus: Main	Level: Undergraduate or Graduate	Need Based: Yes
College: any	Standing: any	Min GPA: 3.0
Major: Civil Engineering, Mechanical Engineering, Electrical Engineering, Computer Science, Physics, Mathematics	Residency: HI Resident only	Gender: Any

**Additional requirements:** Financial need, not necessarily as determined by federal guidelines. Pursuing a degree in a scientific field, such as engineering, computer science, physics, chemistry, mathematics, etc. Minimum cumulative grade point average of 3.0. Previous graduates of McKinley High School. If no qualifying graduates of McKinley High School can be found, then the scholarship may be awarded to a qualified graduate of a Hawaii public high school.

SEARCH TEXT: computer science  
 Limit results to Manoa:

**Search for Scholarships**

Figure 2.8: STAR Academic Scholarship Keyword Search page. Source: [www.star.hawaii.edu](http://www.star.hawaii.edu)

### 2.1.1.5 Scholarships

This interface allows students to find scholarships by either using a keyword search or by selecting the “My Best Fit Scholarship” tab, which presumably gathers student academic data and compares it with scholarship data to find matches.

### 2.1.1.6 STAR and Academic/Professional/Social Engagement

STAR is the all-in-one place for UH students to check on their progress in general education and major courses, University status in terms of enrollment and tuition payment, and their official transcripts. Since STAR is designed to fit the general academic needs of all students at UH, it is unrealistic to expect STAR to provide specialized and detailed support for each department. Each department is different in terms of courses and requirements, and STAR does not offer any features that go into depth in each individual department’s idiosyncrasies. To get more detailed information about major requirements, students must access separate department websites or contact the department’s academic adviser. In features such as Academic Essentials, Graduation Pathway, and Scholarships, STAR only offers baseline information. For instance, in Academic Essentials, STAR focuses on the student’s broad academic goals (i.e. graduation date and highest degree goal) rather than their arguably more helpful and specific major-related goals. In Graduation Pathway,

STAR notifies students which course categories they are missing, but does not suggest the specific classes that they are missing. In Scholarships, STAR lists relevant scholarships but does not provide detailed information about how to apply or how to prepare for them. Although STAR succeeds at being a University-wide, cross-departmental degree planner system, it lacks the detailed department-specific support that is crucial for a student's success and growth within his/her major.

The screenshot shows the Starfish Connect dashboard for a user named Randy Albright. The interface is divided into several sections:

- Top Navigation:** Home, Services, Randy Albright (profile picture).
- Left Sidebar:**
  - My Success Network:** Includes links to Tutoring Center, Gold, Yasmin - 1st Year Advisor, Hand, Sara - Peer Mentor, and Jackson, Paul - Residence Hall Advisor, each with a "See available appointments" link.
  - My Messages:** Shows messages from Paul Jackson, Yasmin Gold, and Cindy Ayers, with timestamps like 7:14 pm 05-09-2014, 2:19 pm 05-07-2014, etc.
- Right Sidebar:**
  - My Success Path:** Shows an "Academic Recovery Plan (In Progress)" with a "View Details" button.
  - Appointments:** Lists "Yasmin Gold: Today at 5:30 pm General Concern" and "Sara Hand: 05-12-2014 at 1:00 pm Tutoring".
  - Courses I'm Taking:** Shows "College Composition II (246)" with details for Instructor (Gold, Yasmin), Ayers, Cindy, Advising Hours, Office Hours, and Group Session.

Figure 2.9: Example Starfish Connect page. *Source: Starfish CONNECT gallery*

### 2.1.2 Starfish by Hobsons

The slogan for Hobsons is “Education Advances: Imagine a world where all students find their best fit [11].” Hobsons offers a wide range of educational solutions, ranging from students K-12 to college students. Starfish by Hobsons is one of their platforms which focuses on success, support, and retention initiatives, and engaging students more effectively with the campus community. There are three main parts of the Starfish Enterprise Success System: Early Alert, Connect, and Degree Planner.

#### 2.1.2.1 Early Alert

Early Alert is a early warning and student tracking model which mines student performance data from existing technologies at the particular institution to detect at-risk students. These students are detected early enough, such as at the first sign of a problem, so that there is enough time to make a difference. There is a type of reward system called Kudo (a positive feedback note), which is used to encourage students and reward them for improvement or good work.

#### 2.1.2.2 Connect

Connect is an online appointment scheduling and case management system. This system promotes communication between students and their advisers, instructors, and tutors by means of in person meetings, phone calls, or virtual meetings. Connect includes a kiosk to allow easily scheduled walk-in meetings. These kiosks can help staff to manage a student queue and also allows students to

check wait times remotely, which can save a lot of time and frustration. Connect also includes a road map for each student, which documents the steps a student must take to achieve his or her goals. This map is created by an adviser and is visible to all members of the student's support network.

#### **2.1.2.3 Degree Planner**

Degree Planner provides academic templates which advisers can use to easily edit to adjust to a particular student's needs. It also focuses on students' constantly changing goals and ability to adjust the student's plan to accommodate these goals. When a student deviates from their given plan, the student's adviser is notified so that they can plan a meeting with the student to check on their status and re-identify their goals.

#### **2.1.2.4 Starfish by Hobsons and Academic/Professional/Social Engagement**

Starfish by Hobsons provides integrated systems that can keep track of students and keep students on track [11]. Its integration into different departments and customization of more specific goals fulfills the academic goals of RadGrad more than STAR. However, this system is concerned only with academics and does not take other factors into consideration such as internships, outside work and projects, and other extracurricular activities. While a student may seem to be on track based off their academic record, there are other factors that come into play when it comes to "staying on track." Traditionally, an "on track" student may have completed all of the coursework within 4 years with at least a 3.0 GPA. However, what if "on track" were redefined to be much more complex, and include other factors outside of coursework? Although these factors may not technically be requirements to graduate, they may be highly recommended, and a system that could help encourage students to pursue these other factors, without them being technically required, would create a different class of graduates entirely.

### **2.1.3 College Scheduler**

The College Scheduler company has two products: Schedule Planner and Pathway Planner [2]. The Schedule Planner focuses on optimizing the way students can plan their schedules, and the Pathway Planner focuses on optimizing the way students progress towards graduation.

#### **2.1.3.1 Schedule Planner**

Schedule Planner allows students to easily schedule (or automatically generate) their classes around outside obligations. It also helps students to maximize their credit hours and graduate on time. Schedule Planner also analyzes student preference data to predict the optimal number of course sections to offer and helps to evenly distribute class fill rates. It enables advisers to create course

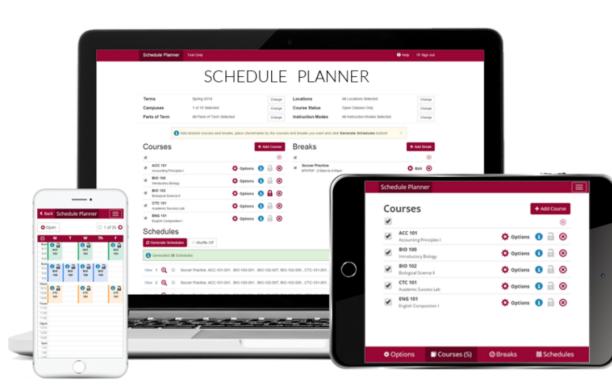


Figure 2.10: Example of Schedule Planner. *Source:* <http://www.collegescheduler.com/schedule-planner/>

schedules for groups of students at a time. One of their main goals is to allow students to focus on which courses to take rather than worrying about when they are being offered.



Figure 2.11: Example of Pathway Planner. *Source:* <http://www.collegescheduler.com/pathway-planner/>

### 2.1.3.2 Pathway Planner

The Pathway Planner allows students to plan their schedules in a multi-year format to encourage seeing the bigger picture and to plan ahead. It provides visuals to show students how their predicted course loads will affect their graduation date. Administrators can also see the courses that students plan on taking before registration. This allows for the addition and elimination of courses to best fit student needs.

### 2.1.3.3 College Scheduler and Academic/Professional/Social Engagement

College Scheduler focuses on the scheduling aspect of degree planning. However, it views scheduling as a long term event, and allows students and administrators to work together to offer courses in an optimal manner. While College Scheduler addresses the needs to students as a whole, it does not

offer individualized support based off individual needs. Every student has different goals, plans, and schedules, and there is no one master schedule that can accommodate them all. However, if it were to offer individual support on a case by case basis, it would be able to help a larger amount of students to reach their unique goals.



Figure 2.12: Example student view of the Blackboard Planner mobile application screens. *Source:* <http://www.blackboard.com/mobile-learning/planner.aspx>

### 2.1.4 Blackboard Planner

Blackboard recently bought out the college planning system MyEdu to create a new mobile student planning application called Blackboard Planner [1]. The main goals of Blackboard Planner are to improve student outcomes, simplify planning, and provide better support. Since the system was released in October 2016, at the time of writing, there currently is not much information regarding the system and its usage.

#### 2.1.4.1 Improve Student Outcomes

Blackboard Planner aims to improve student outcomes by providing students with real labor demand information from Burning Glass and Roadtrip Nation, which can ideally allow students to make better academic and career decisions.

#### 2.1.4.2 Simplify Planning

Blackboard Planner aims to simplify planning by offering customized scheduling, hassle-free registration, and an academic plan tracker. These features are aimed at helping students graduate on time.

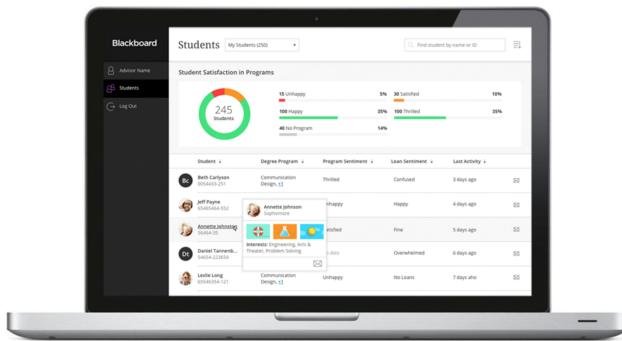


Figure 2.13: Example adviser view of Blackboard Planner.

*Source:*

<http://www.blackboard.com/mobile-learning/planner.aspx>

#### 2.1.4.3 Provide Better Support

Blackboard Planner provides an adviser view which allows advisers to combine their insight into the student's academic plans, student sentiment, and predictive analysis together to offer well-informed support to students.

#### 2.1.4.4 Blackboard Planner and Academic/Professional/Social Engagement

With the limited information available about Blackboard Planner, it seems to address many degree planning problems that older degree planners, such as STAR, Starfish by Hobsons, and College Scheduler do not. For instance, Blackboard Planner uses job market analytic services to provide students with the most relevant and up to date information regarding careers. However, while Blackboard Planner seems to excel at offering post-graduation advice, it seems to be lacking in pre-graduation advice. Blackboard Planner does not offer course advice to fit the student's current lifestyle, taking work and extracurricular activities into consideration. Planning for the future is important, but students must remember to plan for the present as well.

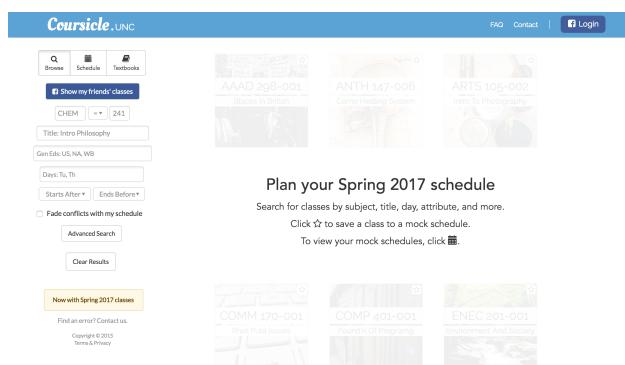


Figure 2.14: The Coursicle page for the University of North Carolina.*Source:*

*Source:*

<https://www.coursicle.com/unc/>

### **2.1.5 Coursicle**

The slogan of Coursicle is “Course registration sucks but Coursicle makes it better [3].” The features of Coursicle are: students can receive text or email notifications when a seat opens up in class, students can schedule their courses using an attractive schedule planner, students can search through courses more easily with a variety of filters, students can create schedules with all prospective classes and then narrow them down to one workable schedule, students can easily compare textbook prices online through Coursicle, and students can view what classes their classmates are signed up for via Facebook.

#### **2.1.5.1 Coursicle and Academic/Professional/Social Engagement**

Coursicle is focused on making students happy by making registration easier and more enjoyable. However, although Coursicle makes it easier, it does not suggest classes to students based off their goals and previous coursework. Coursicle definitely helps alleviate the psychological pain of registration, but it does not alleviate the overall ongoing pain of degree planning.

### **2.1.6 Individual Student Software and Academic/Professional/Social Engagement**

There are other types of download-able software currently available for students to use individually. These systems are for individual use, and are not tailored for institutional implementation. To use these systems, students input information about their education, such as classes, credits, and requirements. This data is then used to create organized visualizations to help students to better see their goals and pathway. A popular generic system is the Microsoft Office College Credit Planner Template. Many individual colleges and universities have their own custom download-able course planning spreadsheets as well. While these systems help students to organize the data they have, they do not offer any new ideas or suggestions for further improvement.

## **2.2 Social Network**

### **2.2.1 LinkedIn**

LinkedIn is widely known for being the world’s largest professional network [6]. It sets itself apart from other popular social media sites by being focused solely on building professional identities and forging professional relationships. There are six major components to LinkedIn: Home, Profile, My Network, Learning, Jobs, and Interests.

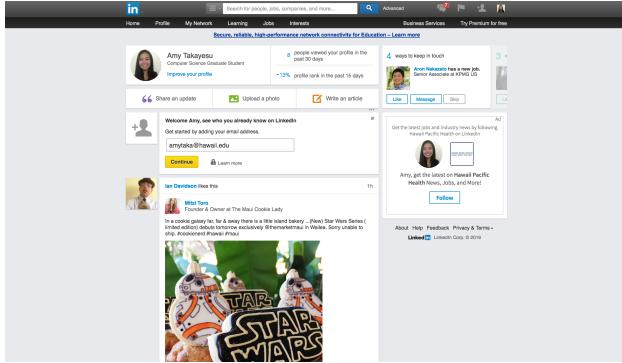


Figure 2.15: LinkedIn homepage. *Source:* <http://www.linkedin.com>

### 2.2.1.1 Home

A user's homepage is arranged in a feed type format, with quick information about your profile, profile views, and incoming messages. The feed section contains recent updates from connections and companies related to your interests. There are also sections that encourage engagement—for instance, quick ways to “share an update”, “upload a photo”, or “write an article” and suggestions to “reconnect with your colleagues” and to add someone you may know.

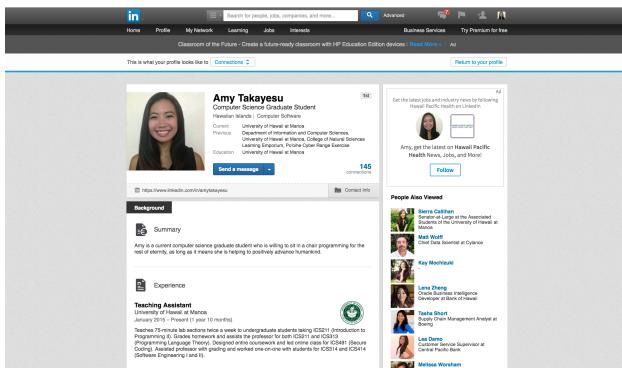


Figure 2.16: LinkedIn profile. *Source:* <http://www.linkedin.com>

### 2.2.1.2 Profile

A user's profile page is available for other LinkedIn users to see. Users can decide what information they would like to share about themselves, but it is all limited to professional related categories such as education, work experience, volunteer work, and skills and endorsements.

### 2.2.1.3 My Network

A user's network includes current connections, recommended connections, connections added through outside contact information, and contacts added through an alumni network.

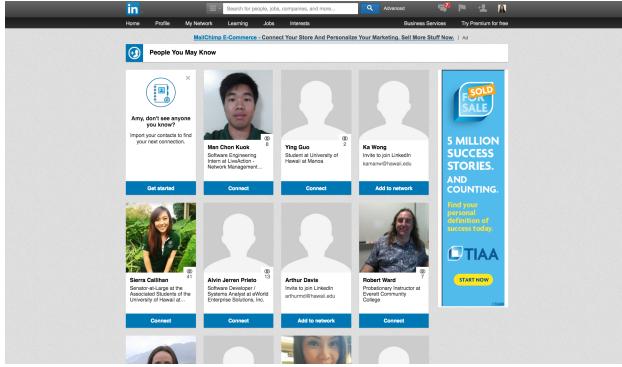


Figure 2.17: LinkedIn network page. *Source:* <http://www.linkedin.com>

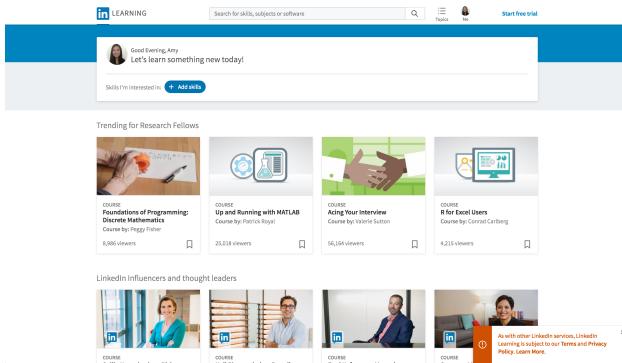


Figure 2.18: LinkedIn learning page. *Source:* <http://www.linkedin.com>

#### 2.2.1.4 Learning

LinkedIn offers online courses on professional development topics such as leadership, storytelling, creating alliances with employees, and winning back a lost customer. There are also field-related courses, such as online code courses. These courses are often in the form of videos, and can be accessed by premium LinkedIn members.

#### 2.2.1.5 Jobs

Jobs on LinkedIn automatically suggest jobs for users based off the information on their profile. Jobs can also be searched for using keywords such as job title, company, and location. Users can set preferences to refine their automatic suggestions.

#### 2.2.1.6 Interests

In the Interests section, users can follow companies and groups based off their personal interests. There are also links to SlideShare and ProFinder, which offer services for creating professional presentations and hiring local freelancers, respectively.

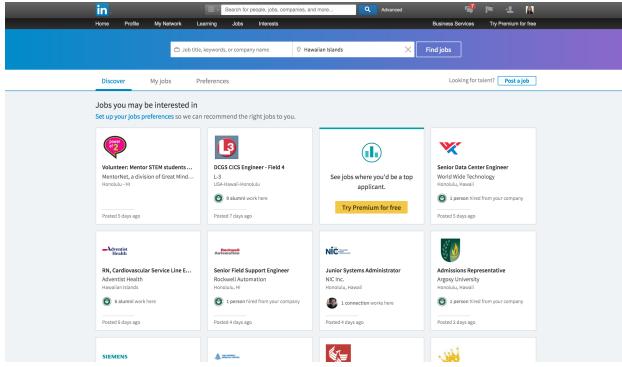


Figure 2.19: LinkedIn jobs page. *Source:* <http://www.linkedin.com>

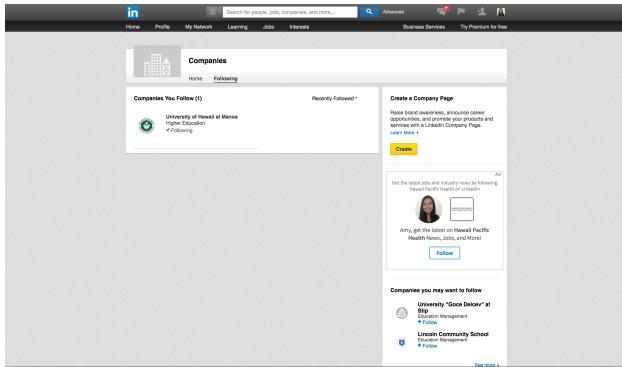


Figure 2.20: LinkedIn companies page in the Interests section. *Source:* <http://www.linkedin.com>

### 2.2.1.7 LinkedIn and Academic/Professional/Social Engagement

LinkedIn is a large global professional network. The more people it reaches, and the more diverse it becomes, the more successful it will be. This works on a large scale. Due to this, LinkedIn inherently fails to provide the intimate support of a smaller and more personal community. It is easy to become overwhelmed with the breadth of LinkedIn, but if there were a place that offered a smaller and more specific community with a lot more depth, people would be able to create stronger and deeper connections (with the trade-off being having less connections overall). For students who have not graduated college yet, having strong connections with the people they are surrounded by (colleagues, professors, alumni, etc.) is arguably more important than having many loose connections with a wider network. This is not to say one type of network is better than the other—but for students, the support they need will come from the smaller and stronger network.

### 2.2.2 TechHui

The TechHui page describes itself as being “Hawaii’s Technology Community [13].” The TechHui site has ten main sections: Profile, Members, Events, Forum, Groups, Photos, Videos, Blogs,

Directory, and Coders.

A screenshot of a TechHui profile page for a user named Amy Takayesu. The page includes a profile picture, a bio section with text about her education and interests, a 'Recent Activity' feed showing posts from herself and others, and sections for 'My Groups' and 'Sponsors'. The background shows other users' profiles and activity.

Figure 2.21: TechHui profile page. *Source:* <http://www.techhui.com>

### 2.2.2.1 Profile

Each user has a profile page which contains information such as a name, profile picture, occupation, areas of interest, software language proficiency and interests, and recent activity.

A screenshot of the TechHui members page, showing a grid of member profiles. At the top, there's a 'Featured Members' section with small profile pictures. Below it is a larger section titled 'All Members (3,587)' with many more profiles listed in a grid format. Each profile includes a thumbnail, the member's name, location, and a 'Contact' button.

Figure 2.22: TechHui members page. *Source:* <http://www.techhui.com>

### 2.2.2.2 Members

The members page lists all members, including a section at the top for featured members. Each member is listed by their name, with their profile picture and location. Through this page, users can communicate with other users by commenting on other user's profile pages.

### 2.2.2.3 Events

The events page lists upcoming events and featured events. The event snippets include an imagine, a name, a time and date, a location, the name of the organizer, the type of event, and a brief

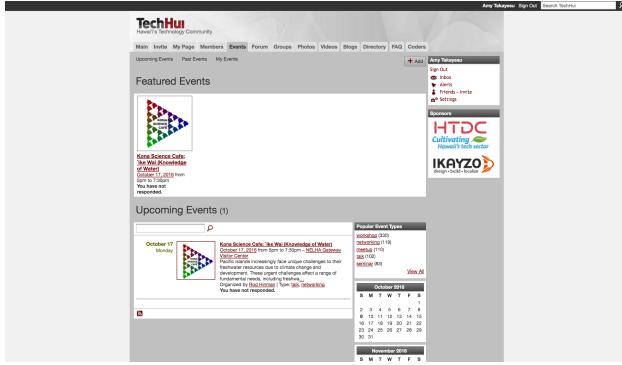


Figure 2.23: TechHui events page. *Source:* <http://www.techhui.com>

description of the event. Users can click on these snippets to go to an event page, which includes more detailed information and allows users to respond to events with “will attend”, “might attend” and “will not attend.”

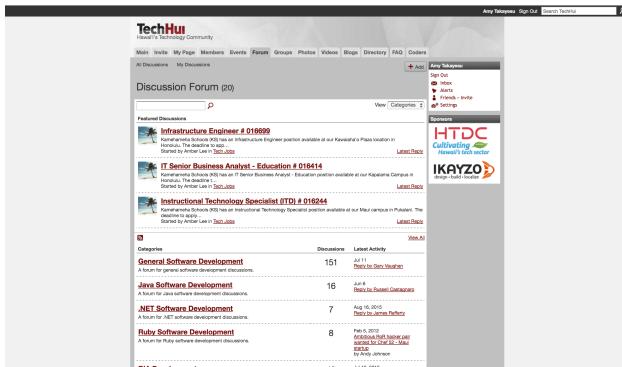


Figure 2.24: TechHui forum page. *Source:* <http://www.techhui.com>

#### 2.2.2.4 Forum

The forum page includes a list of technology related categories, which can be clicked on to access a list of related forums. It also includes some featured forums at the top. Some of these categories include “General Software Development”, “Java Software Development”, “Funding Technology Startups”, “Software Design Patterns”, “Tech Jobs”, “Tech Resumes”, “Web Design”, “Tech Humor” and more. Users can both start discussion forums and respond to other users’ forums.

#### 2.2.2.5 Groups

There are many different groups listed on this page, including some featured groups. Each group snippet has an image, a name, the amount of members in the group, the date of the group’s latest activity, and a brief description of the group. Users can click on these snippets to learn more about

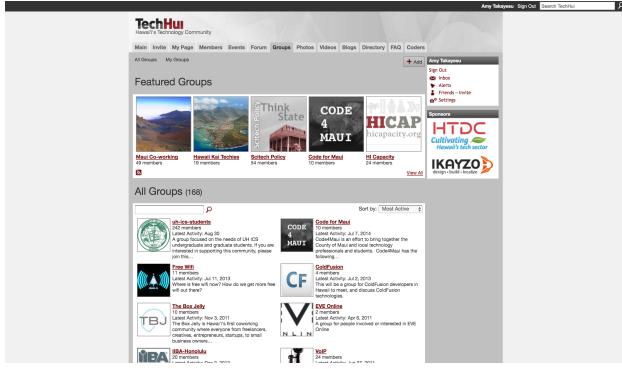


Figure 2.25: TechHui groups page. *Source:* <http://www.techhui.com>

the group and to join the group as well. Once in the group, users can participate in commenting on the group wall and creating and responding to group discussion forums.

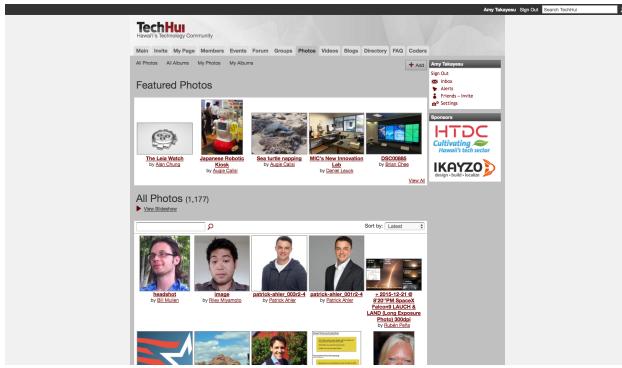


Figure 2.26: TechHui photos page. *Source:* <http://www.techhui.com>

### 2.2.2.6 Photos

On the Photos page, users can easily view all public photos uploaded by users (including profile pictures). Featured photos are included as well. Users can view these photos and comment on them as well.

### 2.2.2.7 Videos

On the Videos page, users can easily view all public videos uploaded by users. Featured videos are included as well. Users can view these videos and comment on them as well.

### 2.2.2.8 Blogs

This page displays a feed of all users' blog posts. Posts are also organized by featured posts, latest posts, most popular posts, and monthly archives. Users can click on these blog posts to read them

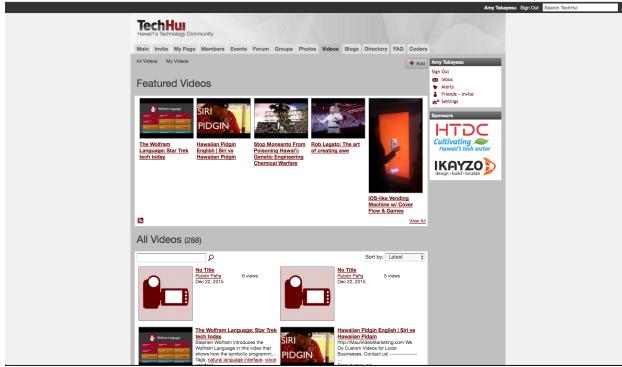


Figure 2.27: TechHui videos page. Source: <http://www.techhui.com>



Figure 2.28: TechHui blogs page. Source: <http://www.techhui.com>

in their entirety and can comment on them as well.

### 2.2.2.9 Directory

This page includes a listing of technology related jobs in Hawaii, organized into 21 subcategories. Users can click on these listings to view more details about the jobs, and also to access external websites.

### 2.2.2.10 Coders

This page lists web startups that are writing code in Hawaii. The list contains just the names of the startups, which can be clicked on to learn more at the startup website.

### 2.2.2.11 TechHui and Academic/Professional/Social Engagement

TechHui caters to a community much smaller than LinkedIn. However, it remains too broad to cater to the specific needs of undergraduate students. TechHui aims to satisfy the needs of a variety of people, with only a small portion of them being current undergraduate students. It is

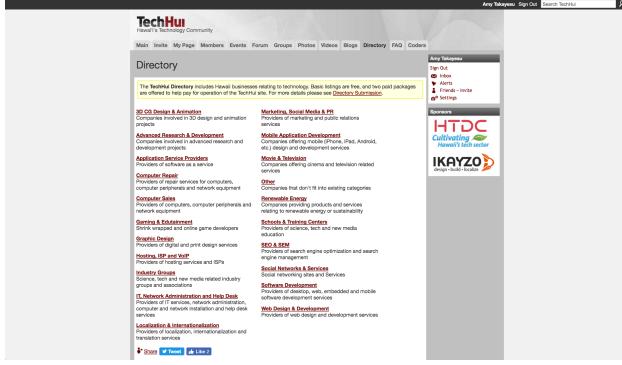


Figure 2.29: TechHui directory page. *Source:* <http://www.techhui.com>

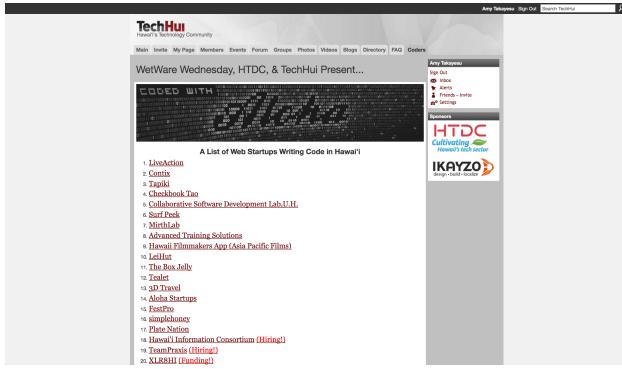


Figure 2.30: TechHui coders page. *Source:* <http://www.techhui.com>

unreasonable to expect TechHui to add features specifically for one group of members. However, if it were reasonable, TechHui ideally could suggest events and people to students based off their goals and interests. It could find ways to encourage students to engage with these events and people, and cultivate strong and healthy relationships between students and the rest of the community. It could provide ways for members to easily know what projects others are working on, and allow members to join projects that they are interested in. In this way, it would be more than just a discussion site, but a strong social network as well.

### 2.2.3 Rate My Professors

Rate My Professors allows users to communicate and share content with each other by posting reviews of colleges and professors [9]. Although users can create accounts, the reviews are listed as anonymous. Other users can provide feedback on reviews with either a thumbs up (user found this to be useful) or thumbs down (user did not find this to be useful). The site also contains site-generated blog posts and videos, but users cannot directly interact with these.

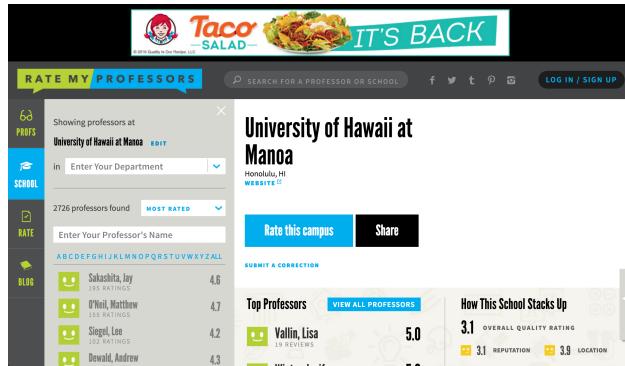


Figure 2.31: Example Rate My Professor page for UH Manoa. Source: <http://www.ratemyprofessor.com>

### 2.2.3.1 Rate My Professor and Academic/Professional/Social Engagement

Rate My Professor aims to be very disconnected from universities by allowing users to be anonymous and share openly without any direct association to the institution. While this allows users to post without fear of repercussions, it may encourage negative relationships between students and professors. It distances the two groups of people, and instead of providing constructive criticism to the professor, it simply encourages the perpetuation of the opinions of past students. In this way, it does not encourage forward movement. Rate My Professor could improve by becoming integrated with the university so that reviews are no longer anonymous, and students can take full responsibility of their opinions. Additionally, professors will be able to view informative data about their teaching effectiveness, which may allow them to improve over time. In this way, the goal will become to improve all members of the community, rather than to create more distance between them.

### 2.2.4 Other Popular Social Networks and Academic/Professional/Social Engagement

Social networks have become extremely popular and there are too many of them to describe in detail here. The top fifteen most popular social networks as of September 2016 [14] are Facebook, Instagram, YouTube, Twitter, LinkedIn, Pinterest, Google+, Tumblr, Reddit, VK, Flickr, Vine, Meetup, Ask.fm, and ClassMates. While most of these are not academically focused, they could potentially host an academic environment. Additionally, while RadGrad could be integrated directly into one of these existing social networks (i.e. become a Facebook application), creating a standalone application does not exclude members who do not have a Facebook or are not active on Facebook, it does not depend on the continuing popularity of Facebook, and I believe it may develop a stronger sense of brand.

## 2.3 Gamification

Since it would be ineffective and senseless to discuss every existing video game, I conducted a brief informal survey of some ICS students (both undergraduate and graduate students) regarding their current favorite video game. I was able to solicit sixteen responses shown in the table below. In the following section I will discuss four different video games, with each one from a different genre: Role Playing Game (RPG), Multiplayer Online Battle Arena (MOBA), collectible card, First Person Shooter (FPS), and augmented reality. One of the games is my current favorite video game and four of them are popular video games according to the surveyed ICS students.

ICS Students' Favorite Games			
Gender	Degree	Favorite Game	Game Genre
Male	Undergraduate	Seven Knights	RPG
Male	Undergraduate	Kerbal Space Program	Space Flight Simulation
Male	Undergraduate	League of Legends	MOBA
Female	Undergraduate	League of Legends	MOBA
Male	Undergraduate	Monster Hunter	RPG
Male	Undergraduate	NBA2k7	Sports
Male	Undergraduate	Hearthstone	Collectible Card
Male	Undergraduate	RimWorld	Construction Management
Male	Undergraduate	Geometry Dash	Arcade
Male	Undergraduate	Overwatch	FPS
Female	Undergraduate	Pokemon Go	Augmented Reality
Female	Graduate	Pokemon Go	Augmented Reality
Female	Undergraduate	Minecraft Sky Factory 2.5	Sandbox
Female	Graduate	Call of Duty	FPS
Female	Undergraduate	Assassin's Creed	Action/Adventure
Female	Graduate	Summoner's War	RPG



Figure 2.32: Summoners War gameplay

### 2.3.1 Summoners War

Summoners War is a mobile fantasy RPG with over 60 million players worldwide. It is based off a freemium model, with many players playing for free, and many other players playing with in-application purchases. Based off the iTunes Summoners War page, the basic premise of Summoners War is as follows: “Jump into the Sky Arena, a world under battle over the vital resource: Mana Crystals! Summon over 900 different types of monsters to compete for victory in the Sky Arena! Assemble the greatest team of monsters for strategic victories! [12]” As with many games, one of the interesting things about it is its ability to motivate users into completing several, often tedious and unenjoyable actions, in order to achieve a virtual reward. One of the examples of this is the weekly Arena Rank. The Arena is where players can battle against other players, in an attempt to reach as high a rank as possible. There are different ranks based off the amount of victories and defeats the player has had: Beginner, Challenger, Fighter, Conqueror, Guardian, and Legend. The Arena is often very difficult, and in order to achieve a certain standing, the player must constantly battle others, and set up a solid defense that cannot be defeated by other players. In order to improve one’s defense and offense team, a player must spend hours doing grueling tasks, such as gathering magical essences, gaining EXP points to level monsters, and collect “runes” which can be strategically placed on each monster to improve certain stats. Doing these tasks can take up a significant amount of time and energy. Each week, a player is awarded a certain rank based off their performance in the Arena that previous week. This rank is manifested in the form of a small icon next to the player’s name. When players see other players’ icons, they are immediately informed of that person’s standing in the game, and the player him/herself will be rewarded with feelings of pride and satisfaction.

Summoners War also allows players to join guilds in order to receive guild points, which can be used to purchase additional helpful items. Guilds are composed of at most 30 players, and they must strategize and work together in order to move up in rank and gain more points.



Figure 2.33: League of Legends gameplay.

### 2.3.2 League Of Legends

League of Legends is a multiplayer online battle arena (MOBA) type of video game and also follows a freemium business model [5]. In this game, the player assumes the character of a summoner who controls a champion with unique abilities, and they battle with a team of other champions against another team of champions (either other live players or computer controlled). The main goal of the game is to destroy the opposing team's nexus, which is a structure at the middle of the team's base and is protected by defensive structures. At the start of each match, all champions start off weak, but they can increase in strength throughout the game by accumulating items and experience. Each match typically lasts from 20-60 minutes. There are three different game modes: Summoner's Rift, Twisted Treeline, and Howling Abyss. Each game mode is similar in that a team of players must work together to accomplish a terminal objective and a victory condition. Each mode also includes smaller intermediate objectives that can help teams to get closer to victory. Opposed to Summoner's War, gold gathered during the match and items purchased with that gold only last for that match, and do not carry over to future matches. Each match begins with each player being more or less equal in terms of advantage, regardless of how much time or effort the player has put in beforehand. However, the game does include other incentives to continue to win games and see personal development. Players get player experiences from playing matches on a single account. As their experience increases, they can ascend from level 1 to 30. Higher level players are given access to different maps, game modes, and additional abilities and features which give players a small boost in battle.



Figure 2.34: Hearthstone gameplay.

### 2.3.3 Hearthstone

Hearthstone is a free to play online collectible card video game. It is turn based between two opponents, who use constructed decks of thirty cards, and a selected hero with a unique power [4]. Players can attack the opponent using mana points. The main goal is to reduce the opponent's health to zero. If the player wins, they can earn in-game gold, new cards, or other in-game prizes.

Players can use the gold or microtransactions to purchase new cards to improve their decks. There are several different game modes: casual and ranked matches, daily quests, and weekly challenges. Unlike many other popular collectible card games, Hearthstone does not allow players to trade cards. Instead, players can disenchant their unwanted cards into arcane dust, which can then be used to craft new cards of the player's choice.



Figure 2.35: Overwatch gameplay.

#### 2.3.4 Overwatch

Overwatch is a team based multiplayer first person shooter (FPS). Each team has six players, and each player may select one predefined hero character [7]. There are four classes of heroes: Offense, Defense, Tank, and Support. Each hero character has unique movements, attributes, and skills. As the team is being set up, the game will provide advice if the team is unbalanced. However, once the game starts, players can still switch characters after a death or after returning to their home base. The team of heroes work together to secure and defend certain control points and/or escort a payload across the map in a certain amount of point. As players continue to play matches, they can gain rewards that do not affect gameplay, such as character skins and poses. At the end of each match, a server-determined Play of the Game (PotG) is replayed for all players. This play is based off certain factors such as a high scoring moves or effective use of a skill. Up to four individual achievements per team are highlighted, and afterwards players can vote for one to promote. The player who wins the most votes get a reward of experience points. As players gain experience points, they can earn a loot box, which provides certain in-game prizes and in-game currency. If players do not have enough experience points for a loot box, they also have the option to obtain one through a microtransaction. The game supports several different gameplays such as tutorial and practice modes, casual matchmaking, weekly brawls, custom games, and competitive play. Casual matchmaking allows players to play alone or with friends, and are randomly matched against others with similar skill levels. The weekly brawl gameplay was inspired by Hearthstone, and features matches with unique rules, which change weekly. Custom games allow users to have

private or public games and can edit different options for that specific match. Competitive mode allows players within a certain region and on a certain platform, to become ranked. This mode is run in 2.5 month seasons. Only players at level 25 or above can participate. Participants also much first play ten preliminary matches which will assign the player a skill rating from 1 to 5000, which is used to create ideal matches. Similarly to the arena battles in Summoners War, there are seven skill ranking tiers: Bronze, Silver, Gold, Platinum, Diamond, Master, and Grandmaster. Players can be demoted to a lower tier or promoted to a higher tier based on their performance. Each competitive win awards a player with in-game currency. Players will also get an additional award based on their final ranking at the end of the season.

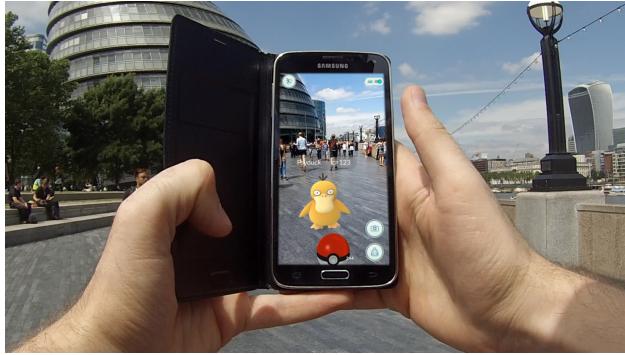


Figure 2.36: Pokemon Go gameplay.

### 2.3.5 Pokemon Go

Pokemon Go is a free-to-play, location-based augmented reality game for mobile devices [8]. Players use their device's GPS to locate, capture, battle, and train virtual monsters known as Pokemon. The Pokemon appear through the device's camera as though they were in the same real-world location as the player.

Players can customize an avatar, which is displayed throughout the game on a map using the player's current geographical position. The map will show game related locations such as PokeStops and Pokemon gyms. Players can get items from PokeStops such as eggs, Poke Balls, berries, and potions. Users can also equip PokeStops with lures, which can attract wild Pokemon. Pokemon gyms are where players can battle and take over the gym in a “king of the hill” style. These PokeStops and Pokemon gyms are usually located at real-world places of interest.

Different types of Pokemon are located in different areas of the world. For example, water-type Pokemon are typically found near bodies of water. Players can capture wild Pokemon by “throwing a Poke Ball” (making a swiping motion on the device) at the Pokemon. When the Pokemon is caught, the player additionally receives stardust and/or candies, depending on the type of Pokemon. These items can be used to raise the Pokemon's combat power (CP).

The ultimate goal of the game is to capture and evolve all 151 Pokemon. However, throughout the game, there are also many other ways for players to gain experience points. Players can increase in level, and at level 5, they can join one of three teams: Team Valor, Team Mystic, or Team Instinct. These teams play a role when battling at the Pokemon gyms.

### **2.3.6 Gamification and Academic/Professional/Social**

Clearly there are certain aspects about popular video games that make them so enjoyable, addictive, and satisfying to so many people. Even the two students who initially declared that they "don't have time for games" or simply just don't play games eventually admitted that they did play Pokemon Go at one point. All four games discussed above have a few things in common: multiplayer, small and large rewards throughout the game, additional rewards given simply for putting in time, and the persistence of the player. Four of the five games also include a team aspect which encourages players to work together to advance individually.

The multiplayer aspect of the games allows players to interact with and become competitive with other players. Rather than beating one's own score, these games allow players to compare themselves with others and advance relative to other players, rather than simply advancing relative to their past selves. Multiplayer games encourage healthy competition, which can cause players to become more motivated.

The format of the rewards in these games suggest that small rewards as well as large rewards throughout the game, given for a diverse amount of tasks, continues to motivate players and make sure that they do not get discouraged. These awards are often just ranks or an in-game item that can help the player to improve.

Another similarity in the four games discussed above is the rewards given to players simply for putting in time to play (i.e. EXP points). While players who constantly lose may feel unmotivated and lose interest, if they are given some kind of point just for trying, it makes their attempts seem less fruitless. Players should be encouraged to play, and even more so if they encounter problems.

The persistence of the player in these video games allows players to continuously improve over time, rather than starting anew with each game. When players can see their improvements, they can be reminded of their past progress, and be encouraged to continue the progress, regardless of how grueling it may be. Once users see that they have done it before, they will know that they can do it again.

Finally, the team aspect of many of these games suggest that many players enjoy working together with other players to achieve both team and individual goals. This shows that when people work together, they can become stronger both as a team and individually.

## **CHAPTER 3**

### **RADGRAD SYSTEM REQUIREMENTS**

I believe that the best way to address current ICS student issues is through an online system that combines degree planning, social networking, and gamification. The specific features of the system evolved over time through a process conducted in Fall 2015-Spring 2016 by Philip Johnson. This process incorporated feedback from the four major RadGrad user groups: students, faculty, academic program advisers, and alumni/local high tech community members. Spring 2015 students in Software Engineering II became directly involved in the design process by creating their own paper and HTML mockups and by doing user tests and analyses on their suggested systems. Faculty members and academic program advisers provided feedback through a RadGrad advisory board and through advising sessions. Alumni and local high tech community members became involved through RadGrad talks at local tech meetups. In this chapter I present the resulting design of the RadGrad system.

### **3.1 Degree Planner**

#### **3.1.1 Degree Plan**

Each student in RadGrad will have a degree plan, which displays the student's courses, extracurricular activities, and outside work on a semester-by-semester basis. This plan contains future data as well as historical data. This allows students to easily view their progress and prepare for the future.

#### **3.1.2 Degree Goal**

Although each student is aiming for a bachelor's degree in ICS, a more specific goal is beneficial in helping the student find a focus for their education and career goals. Some of these specific goals include B.S./B.A/B.S Computer Engineering and Security/Ph.D. Prep/Silicon Valley Tech. By specifying these specific goals in a concrete way, students can feel less overwhelmed by the large expanse of ICS classes, more prepared for the future, and more easily form communities of interest with other like-minded students.

#### **3.1.3 Dashboard**

Each user has access to a personal dashboard, available upon login. This dashboard provides a quick look at some of the user's stats, such as current ICS GPA, current ICS credits awarded, summary of schedule, current degree goals, interest tags, user picture, suggested vignettes, stoplight,

recommendations, currently active petitions, and predictions. This is a quick and easy way to provide students with a variety of information on their overall progress in their major.

### **3.1.4 Recommendations**

Recommendations aim to help students understand how to change their current behavior to improve their ICS experience. Unlike Starfish by Hobsons, RadGrad will base recommendations on factors beyond academics, such as the student’s current degree plan, degree goals, and professional interests. Some examples of possible recommendations are: relevant courses or extracurricular activities not already present in their degree plan, an estimate of ideal maximum work hours, predicted impact of their GPA, and relevant mentorship opportunities that are not being taken advantage of.

### **3.1.5 STAR Interface**

RadGrad will request a relationship with the UHM STAR website, which will provide students with their current and past courses and their resulting grades. This will allow students to see all of their relevant course information in the same place that they get all their other ICS information. RadGrad could also integrate with the STAR scholarship database to find ICS-related scholarships and encourage students to apply for them, based off their information and goals. For instance, if one of the student’s main goals is to graduate debt-free, they should be informed of applicable scholarships. In addition to the information provided by STAR, since the database will be much smaller, RadGrad could provide more specific details about each scholarship, how to become eligible, and how to apply.

### **3.1.6 Workload Adviser**

RadGrad will implement a virtual workload adviser, which will combine the student’s course load, outside work hours, ICS grade data, and employer expectations to give the student advice on how much work they should be taking on at one time. It will offer suggestions, such as “If you drop 1 ICS course and reduce your work hours to 10 per week, the average ICS GPA is 3.4.” Unlike Blackboard Planner, RadGrad offers suggestions for students in the present time, rather than just for the future. This can help students to have a more realistic view of their goals, prevent students from getting burnt out, reduce stress levels, and encourage a healthier school-work balance.

## **3.2 Degree Planner: Possible Further Implementations**

### **3.2.1 Predictions**

Each student will have a prediction model, which predicts post-graduation aspects based upon recent graduates, data from local tech organizations, recruiters, headhunters, etc., and data from

the ICS faculty. This data is then combined with the student's individual degree plan and degree goals to produce a customized prediction. This feature will hopefully help students feel better prepared for their future after graduation.

### **3.3 Social Network**

#### **3.3.1 Profile**

Students, faculty, graduates, and administrators will each have their own respective profiles. Student profiles will contain personal information including name, email, details about their degree, images, interests, projected graduation date, and professional recommendations based off their inputted information. Faculty profiles include name, email, image, professional interests, and descriptions of current projects they are working on. Graduate profiles will include details about their life after graduation such as place of employment and position description. All profiles will be publicly available so that the ICS community can view each others' profiles and find connections.

On a gamification level, profiles also allow users to be persistent and easily view their progress. Since each user has a username and profile, they will be persistent on RadGrad, and all of their achievements will build up on their profile as they progress through college and beyond.

#### **3.3.2 Course Feedback**

As a supplement to the UH system's end-of-semester course feedback system, RadGrad offers a mid-semester public course evaluation system. This allows students to reach out and communicate with each other and professors to make the learning experience as ideal as possible for all parties, while there is still time left in the semester. Ideally this will improve the quality of courses, the satisfaction of the students, and the teaching abilities of the professors. Unlike Rate My Professor, this process is not anonymous, and encourages professors to improve, rather than encouraging other students to avoid a certain course.

#### **3.3.3 Degree Feedback**

RadGrad will reach out to ICS alumni approximately six months after graduation. At this time, these ICS graduates will answer a number of questions regarding their life after graduation (i.e. graduate education, career prospects, retrospective thoughts about the ICS department, etc.). This feature will provide data that will help the ICS department improve their degree program, and also provide clear and convenient lines of communication between alumni and the ICS department.

### **3.3.4 Feedback and User Evaluation**

RadGrad will provide a easy and convenient way for users to provide RadGrad feedback about the system. There will be links for immediate feedback, and there will also be yearly surveys to measure user satisfaction over time. By providing an easy stream of communication between users and RadGrad developers, RadGrad can be constantly growing along with the department in order to serve their evolving needs as best as possible.

## **3.4 Social Network: Possible Further Implementations**

### **3.4.1 Department Feedback**

Any type of user can initiate department feedback by starting a petition. The petition will be public, and any other user can edit it as well. Once the editors of the petition reach a consensus and get at least 20 votes of confidence from other users, the user will become finalized and other users may sign the petition over a course of two weeks. The petition will then be discussed at a faculty meeting, eventually leading to the petition being implemented, not implemented, or deferred. By giving users a platform to easily collaborate with each other over a common cause, members of the ICS department will feel more empowered, more involved, and ideally more satisfied.

### **3.4.2 Mentorship**

RadGrad users can be certified mentors if they are in ICS 390 or a TA. A student is working under a mentor if they are a ICS 499 student working under a professor or participating in a research group opportunity under a faculty sponsor. There can be other possible instances of mentorship, and over time, a network of mentorships will form, which could possibly help foster more and better mentorships with future students.

### **3.4.3 Billboard**

RadGrad can also provide some physical hardware (i.e. a large monitor) to be displayed in the ICS department. This display will show aspects of RadGrad (i.e. statistics gathered from RadGrad, upcoming events, current petitions, etc.). This will further encourage engagement throughout the department, as it will be a constant reminder of the current status of the community, and will perhaps contribute to promoting an overall closer “community” feel.

## **3.5 Gamification**

### **3.5.1 Stoplight**

The stoplight is a UI widget embedded in the dashboard, which takes on the appearance of a traffic stoplight, and uses the red/yellow/green colors to indicate the extent of that student's ICS activity. The light is green if the student is taking excellent advantage of what the department has to offer. The light is yellow if the student is taking sufficient advantage of what the department has to offer, and the light is red if the student is not taking enough advantage of what the department has to offer. To determine this, the stoplight takes into account the student's professional interests and goals, their GPA, available opportunities, the opportunities they have taken advantage of, the available courses, and the courses that the student has taken. By being encouraged by the changing colors of this stoplight, fueled solely by the student's actions, students may take this as a personal challenge, or game, to keep the stoplight at a certain color as much as possible. This is a simple way for students to track their progress throughout their ICS journey. This is an example of small rewards that are given throughout the "game" of ICS—students can visually see improvement, as though they are achieving a new rank. Similarly to EXP points in games, students can get these achievements simply by putting in more time and effort. They don't necessarily have to win a Hackathon or get straight A's, but as long as they are participating and putting in the effort, it will show on their Stoplight.

### **3.5.2 Leaderboard**

A public leaderboard will be available for students to actively compare themselves against others in the department in terms of ICS GPA, velocity (a calculated value indicating a student's progress through the program), and professional preparation (a calculated value combining coursework and extracurricular activities). An award ceremony type of tradition could be started out of this, which awards high ranking students. This type of active and constant comparison could help foster healthy competition and higher engagement among students. This is an example of the multiplayer aspect of the aforementioned games that foster healthy competition and drive within players. Without the RadGrad network, students are left mostly oblivious to the progression of others and only have themselves to relate their progress to. If a student has always progressed slowly, that student may believe that he/she is continuing to do well, as long as they do not begin to progress even slower. With RadGrad, this student would be able to see the quicker progression of other students, and suddenly create a different goal in his/her mind.

### **3.5.3 Gamification: Possible Further Implementations**

#### **3.5.4 ICE**

ICE is an acronym for Innovation (i.e. a student's involvement in research or other innovative activity), Competency (i.e. a student's grades in ICS courses), and Experience (i.e. a student's involvement in high tech environments through internships or other professional activities). ICE is a measurement of these aspects, calculated using the information provided on the student's profile. This balances the three aspects to emphasize the importance of all three in an ideal ICS experience. Details on how these aspects are measured can be found at [www.radgrad.org](http://www.radgrad.org). These clear measurements of "success" can be eye opening for students. It can be easy to get caught up in the minor details of a major and lose track of the bigger picture. ICE helps students to remind themselves to balance their ICS experiences out, in order to become as attractive as possible for future employers. This feature can also be physically manifested in terms of badges or stickers, as a symbol of rank. This can encourage students to become more competitive and therefore less lazy and more productive. (It helps that a lot of ICS students enjoy the incentives provided by video games.) This is also an example of the rewards and competitive multiplayer aspect of many popular video games.

## CHAPTER 4

# EXPERIMENTAL EVALUATION

The experimental design of RadGrad includes three steps: a baseline assessment, a post-deployment assessment, and a final comparison between the two. These assessments will be given to current undergraduate ICS students and prospective ICS students. It will be deployed electronically via Google Forms and prospective ICS students will be given the assessment during their initial advising session. Current ICS students will be given the assessment during any voluntary advising session and also voluntarily through their ICS courses. Ideally, at least 50 responses will be gathered for both assessments.

### 4.1 Baseline Assessment

The baseline assessment will contain the following questions. The full assessment can be found in Appendix A.

#### 4.1.1 Basic Information

1. *What is your gender?* Goal: Since the ICS program currently has significantly more male students than female students, what are the differences between the experiences of the two genders? Could this give any insight into why there are so little female students? Is this something RadGrad could address? After implementing RadGrad, have there been any differences in the gender ratio or the disparity between the experiences of the two genders? Ideally, both genders should have equally positive experiences in the ICS program.
2. *What is your current status in the ICS degree program?* Goal: How do student experiences evolve as they progress through the ICS degree program? Are there any patterns? Does RadGrad have any effect on this? Ideally, students from all levels should have equally positive experiences in the ICS program.

#### 4.1.2 Prospective ICS Students

1. *How EXCITED are you about entering the ICS program? Rank from 1-5.* Goal: Compare this answer to the same question on the post-deployment assessment. This will provide information regarding how students view the ICS department, based solely on outside information and before their own experiences. Ideally, RadGrad will create more excitement among prospective students due to better presentation and the appearance of a strong, supportive community and satisfied alumni.

2. *How INTIMIDATED do you feel about entering the ICS program? Rank from 1-5.* Goal: Compare this answer to the same question on the post-deployment assessment. This will provide information regarding how students view the ICS department, based solely on outside information and before their own experiences. Ideally, RadGrad will create less intimidation among prospective students due to the appearance of a strong, supportive, and diverse community and satisfied alumni.

#### 4.1.3 Current ICS Students

1. *Which of the following extracurricular activities, if any, pertain to you?* Goal: Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad will increase the amount of student involvement in outside ICS-related activities due to providing students with stronger connections to the ICS community.
2. *Do you feel that you get enough support from others in the ICS department?* Goal: Are students lacking support in certain areas? How can RadGrad help to address this? Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad will provide a way to give more students the support they desire from others in the department.
3. *As a student, do you feel like you have a voice to make changes within the department?* Goal: If most students indicate that they do not feel like they have a voice within the department, what can RadGrad do to address this problem? Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad will cause more students to feel like they do have a voice to make changes in the department.
4. *What makes you proud to be a part of the ICS department?* Goal: This provides information about how current students view the department. A successful department should have a positive reputation among students, which can be manifested with a sense of pride. Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad will cause positive changes in the ICS department's reputation, leading to a greater sense of pride among students, which may play a role in students' success

#### 4.1.4 Current ICS Students: Influences

1. *To what extent have ICS alumni influenced your development in the ICS program?* Goal: Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad will facilitate more student-alumni interaction, and cause more students to be influenced in some way by an alumn in an ICS-related way.
2. *To what extent have ICS peers influenced your development in the ICS program?* Goal: Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad

will facilitate more peer interaction, and cause more students to be influenced in some way by a peer in an ICS-related way.

3. *To what extent have you influenced your ICS peers development in the ICS program?* Goal: Compare this answer to the same question on the post-deployment assessment. Ideally, RadGrad will facilitate more peer interaction, and cause more students play a role in influencing their peers in an ICS-related way.

#### 4.1.5 Graduating ICS Students

1. *Now that you are nearing the end of your ICS degree program experience, how well prepared do you feel to find a job after graduation?* Goal: If the ICS department is fulfilling its duty, most graduating students should feel at least adequately prepared (ideally well prepared) for the future. If most students indicate that they do not feel prepared, what can RadGrad do to address this problem? Ideally, after deploying RadGrad, a higher percentage of students will feel either adequately prepared or well prepared for the future.
2. *If you answered above that you feel unprepared to find a job after graduation, please explain why.* Goal: Are there any common reasons for students not feeling prepared? If so, is there anything RadGrad can do to address this problem? Ideally, after deploying RadGrad, there will be a lower percentage of students who indicate the same problems as the preliminary questionnaire.

## 4.2 Post-Deployment Assessment

The post-deployment assessment has not yet been created, and will be created after deploying RadGrad. A section of the post-deployment assessment will contain the same questions as the preliminary assessment, with some additional choices where necessary to include RadGrad. Another section of the post-deployment assessment will contain questions specific to the student's reactions to using different aspects of RadGrad. In addition to the assessment, post-deployment analysis will include data from at least 10 interviews with RadGrad users to get more detailed information about the users' experiences.

## 4.3 Comparison

After all results of both assessments have been collected (ideally 50 each), they will be compared regarding student expectations versus reality, student satisfaction with the department, student engagement, and student feelings. The overall goal of RadGrad is to see suggestions of positive changes between the preliminary questionnaire and a post-deployment questionnaire that reflect

less disparity between student expectations and reality, greater student satisfaction with the department, more student engagement, and more positive student feelings. These changes will support the hypothesis that RadGrad could cause several significant and positive changes with the students of the ICS department.

## CHAPTER 5

### THESIS TIMELINE

**October 13, 2016:** Complete final version of thesis proposal.

**October 20, 2016:** Have shared thesis proposal and finalized thesis committee.

**November 1 2016:** Finalize preliminary questionnaire and get IRB approval.

**January 26, 2017:** Finish gathering preliminary questionnaire results.

**February 2, 2017:** Preliminary questionnaire analysis completed.

**March 1, 2017:** RadGrad prototype deployed.

**May 1, 2017:** Finish gathering post deployment questionnaire and interview data.

**May 8, 2017:** Finish analyzing post deployment data.

**May 15, 2017:** Thesis submitted

**August 2017:** Graduating with Master's degree

## APPENDIX A

### BASELINE ASSESSMENT

#### ICS Student Experience Questionnaire

This questionnaire will ask you about your ICS degree program experience so far, in order to improve the program for future students.

\* Required

What is your gender? \*

- Male
- Female
- Other :

What is your current status in the ICS degree program? \*

- Completed 0 ICS courses
- Completed 1-2 ICS courses
- Completed 3-4 ICS courses
- Completed 5 or more courses and expecting to graduate within 3 or more semesters
- Completed 5 or more courses and expecting to graduate within 2 or less semesters

NEXT

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Figure A.1: Baseline Assessment: Section 1.

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# ICS Student Experience Questionnaire

## Prospective ICS Students

We are gathering information about the initial feelings of prospective ICS students. Please answer the following questions as honestly as possible. Current ICS students may skip to the next section.

How EXCITED are you about entering the ICS program? Rank from 1-5.



How INTIMIDATED do you feel about entering the ICS program? Rank from 1-5.



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Figure A.2: Baseline Assessment: Section 2.

# ICS Student Experience Questionnaire

## Current ICS Students

We are gathering information about the experiences of current students in order to ensure that the ICS department provides what students need to succeed. Please answer the following questions as honestly as possible. Prospective ICS students may skip this section.

### Which of the following extracurricular activities pertain to you?

We are trying to ensure that our students are getting the best and most well-rounded preparation for their future. For each of the following activities, please check the box if you are currently doing the activity OR have done it in the past. Check any that apply.

- An ICS related internship
- An ICS-related job
- A hackathon or any other type of public computer science challenge  
(i.e. cyber security competitions, programming related contest)
- An open source project
- An ICS-related project outside of class (i.e. personal project, extension of class assignment, working under a professor or graduate student)

Figure A.3: Baseline Assessment: Section 3.

**Do you feel that you get enough support from others in the ICS department?**

Check any that apply.

- I would like more support from professors in the ICS department.
- I would like more support from TAs in the ICS department.
- I would like more support from my peers in the ICS department
- I would like more support from the counselors in the ICS department
- I feel adequately supported by others while pursuing my degree in the ICS department.
- I often feel completely alone in the ICS department and thus only depend on myself

**As a student, do you feel like you have a voice to make changes within the department?**

- Yes
- Somewhat
- No

Figure A.4: Baseline Assessment: Section 3.

**What makes you proud to be a part of the ICS department?**

Check any that apply.

- The prospect of getting a high paying job
- Surviving the rigorousness of the curriculum
- Associating with people in the ICS community
- Working on ICS related projects.
- Receiving ICS related awards.
- Other: \_\_\_\_\_

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Figure A.5: Baseline Assessment: Section 3.

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# ICS Student Experience Questionnaire

## Current ICS Students: Influences

We are interested to know more about who has influenced you in your ICS degree experience, and who you might have influenced. Prospective ICS students may skip this section.

### To what extent have ICS alumni influenced your development in the ICS program?

Check all that apply. Influences include giving advice, answering questions, job recommendations, course recommendations, etc.

- I have not been influenced by any ICS alumni.
- An ICS alumni influenced me to pursue a major in ICS.
- An ICS alumni influenced me to improve my professional development.

### To what extent have ICS peers influenced your development in the ICS program?

Check all that apply. Influences include giving advice, answering questions, job recommendations, course recommendations, etc.

- I have not been influenced by any ICS peers
- An ICS peer influenced me to pursue a major in ICS.
- An ICS peer influenced me to improve my professional development

Figure A.6: Baseline Assessment: Section 4.

**To what extent have you influenced your ICS peers' development  
in the ICS program?**

Check all that apply. Influences include giving advice, answering questions, job recommendations, course recommendations, etc.

- I have not influenced any ICS peers.
- I have influenced a peer to pursue a major in ICS.
- I have influenced a peer to improve their professional development.

**BACK**

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Figure A.7: Baseline Assessment: Section 4.

# ICS Student Experience Questionnaire

## Graduating ICS Students

We would like to know how you feel about your overall experience in the ICS degree program in order to make improvements for future graduates. If you are graduating this semester, please answer the following questions as honestly as possible. All other ICS students may skip this section.

Now that you are nearing the end of your ICS degree program experience, how well prepared do you feel to find a job after graduation?

- Well prepared
- Adequately prepared
- Unprepared

If you answered above that you feel unprepared to find a job after graduation, please explain why.

Your answer

BACK

SUBMIT

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Figure A.8: Baseline Assessment: Section 5.

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