Uncovering the Hidden Curriculum of University Computing Majors via Undergraduate-Written Mentoring Guides: A Learner-Centered Design Workflow

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ABSTRACT

The hidden curriculum consists of the unwritten rules, unspoken norms, and field-specific insider knowledge that are essential for student success but are not taught in classes. Examples include social norms about how to interact with authority figures, where to ask for unadvertised career-related opportunities, and how to navigate around the official rules of a bureaucracy. The hidden curriculum can be pervasive in university computing majors because some students come in with more prior childhood exposure to technology culture and can thus navigate this cultural context more fluently. It is possible to learn this type of tacit knowledge from personal mentors, but not everyone has access to a good mentor. To address this challenge, this paper presents a novel thesis for how to teach students the hidden curriculum in a more scalable way: We propose that a peer-written guide that has a relatable tone and a focus on local context can emulate what a peer mentor does by emotionally resonating with students, teaching them aspects of the hidden curriculum, and motivating them to take concrete action. To demonstrate this thesis we created a mentoring guide for interdisciplinary computing HCI majors at our university. Interviews with 17 students and a survey of 112 students showed that our guide's relatable tone could emotionally resonate with students, that it boosted some readers' self-confidence, and that it inspired them to take actions such as creating a project portfolio. Based on these experiences, we developed a five-step learner-centered design workflow to help others create guides for their own local contexts, with recommendations for 1) setting up a mentoring guide, 2) needfinding, 3) creating, 4) distributing, and 5) maintaining.

KEYWORDS

informal learning, hidden curriculum, peer mentoring guide

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1 INTRODUCTION

Over the past few decades, computing education research has made significant advances in theories, tools, and techniques to improve formal university curriculum, which include specific courses (e.g., CS1, CS2) [3, 25, 34] and structured mentorship programs (e.g., the Early Research Scholars Program [1, 16]). These efforts have helped many students thrive within the classroom and research lab, but students also face a variety of challenges that lie outside the scope of this formal curriculum that has been well-studied by prior work. For instance, many struggle to navigate what education scholars call the *hidden curriculum* [26, 30, 35], which includes the unwritten rules, unspoken social norms, and field-specific insider knowledge that are essential for student success but are not taught in classes.

To illustrate what we mean by *hidden curriculum*, consider Alicia, a student from a low-income family who is the first in her family to attend college. Even though she earns good grades in her classes, she notices that her classmates from more well-resourced backgrounds seem to have an easier time getting ahead in their careers. They appear to have access to some secret 'insider knowledge' and are somehow able to find more opportunities, network more fluently, obtain prestigious internships, and ultimately get good jobs right after graduation. In contrast, she does not know how to even start approaching senior students, professors, and alumni to discover such opportunities. There are professionally-oriented clubs and student mentoring organizations on campus, but she lacks the self-confidence to join them since the students there seem too experienced and intimidating. Alicia feels frustrated since she excels in the formal curriculum by earning good grades in all her classes, yet she struggles to find professional and career opportunities because she does not know how to access the hidden curriculum that many of her peers seem to learn *outside* of classes.

The first author of this paper is a female minority computing student at a large public U.S. university where there are thousands of students just like her and Alicia. Our university (UC San Diego) has over 33,000 undergraduates – 24% from underrepresented ethnic groups, 38% first-generation students, and 33% transferred in from community colleges. The interdisciplinary computing department she enrolled in (Cognitive Science) is currently the fifth largest in the school and the largest computationally-focused one, with over 2,000 students [42]. She has personally mentored some of these students and taught them parts of the hidden curriculum, but this kind of personalized mentoring cannot scale to thousands of students. Also, she noticed that some of the students who need this guidance the most may not have the self-efficacy [2] to proactively ask for help or join relevant student clubs.

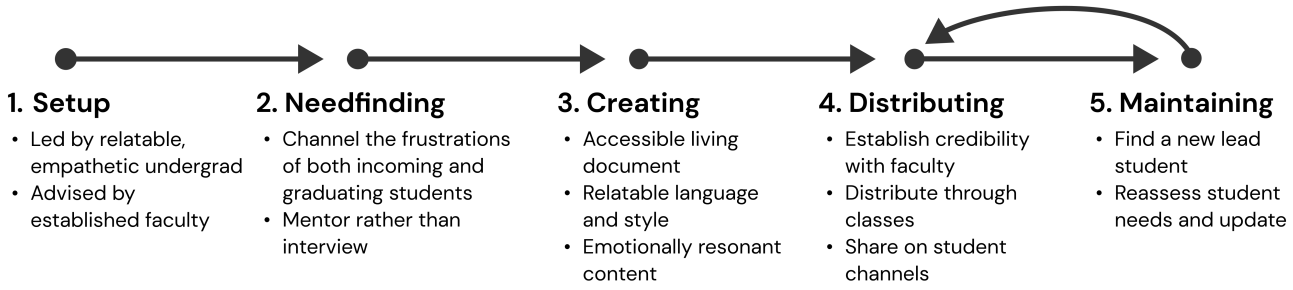


Figure 1: Our learner-centered design workflow [41] for creating undergraduate mentoring guides. Section 4 details each step.

Relevance to computing education: While this type of inequity exists across many fields, our sense is that it may be especially prominent in computing-related departments due to prior research that shows how incoming students who grew up with more childhood exposure to computers and technology culture may have access to more 'insider knowledge' and therefore higher self-efficacy about how to navigate a computing major [27–29]. For instance, students whose parents are college-educated and work at tech companies will likely understand the hidden curriculum of computing majors and career paths more than those who did not come from such backgrounds. And students from certain demographic groups [29] may be more likely to have grown up around technology culture, thereby giving them more of these 'preparatory privileges' [28] as they first enter college.

Motivated by the first author's personal experiences, two years ago (in 2021) we started making and distributing a peer mentoring guide to reveal the hidden curriculum of her interdisciplinary computing major. This guide contains advice on how to navigate courses, how to talk to professors, how to approach peers for help, how to create a project portfolio to prepare for jobs, how to look for internships, and how to get full-time jobs in the tech industry.

For this paper, we distilled our two years of experience working on this guide into a case study of learner-centered design for computing education, a method of applied research popularized by Mark Guzdial's 2015 book [14]. From this study we derived two generalizable contributions: 1) a novel thesis about creating peer mentoring guides to reveal the hidden curriculum, and 2) a five-step learner-centered design workflow that implements this thesis.

Our thesis is that ***a peer-written guide that has a relatable tone and a focus on local context can emulate what a peer mentor does by emotionally resonating with students, teaching them aspects of the hidden curriculum, and motivating them to take concrete action.*** We demonstrate that this thesis is plausible via interviews with 17 students and a survey of 112 students who read our guide. Our findings indicate that its relatable tone was able to resonate with students emotionally, that it boosted some readers' self-confidence, and that it inspired them to take actions toward their career goals such as creating a project portfolio and reaching out to prospective employers.

Based on this thesis, we generalized our experiences into a five-step workflow for project setup, needfinding, and then creating, distributing, and maintaining peer mentoring guides (Figure 1). This workflow aims to provide a scalable approach that enables students at different universities to create guides that are personalized for their own settings. We believe that this bespoke approach is the most practical way to scale up access to the hidden curriculum. This is because many of these unspoken rules (even for general-purpose topics like job hunting) are dependent on the *local context* of a specific university and department, so it is not possible to create a one-size-fits-all guide for everyone. We envision a future where there are thousands of such guides created by students in different settings to help their classmates.

To our knowledge, this paper is the first to describe the design process for a student-created mentoring guide of this sort (Figure 1), which differs from more formal mentoring programs led by faculty or university staff. We believe that a direct student voice speaking to peers provides a unique type of resonance for readers that complements the expertise of more experienced faculty and staff.

In sum, this paper's contributions to computing education are:

- The thesis that a peer-written guide that has a relatable tone and a focus on local context can emulate what a peer mentor does by emotionally resonating with students, teaching them aspects of the hidden curriculum, and motivating them to take concrete action.
- An implementation of this thesis in the form of a mentoring guide that uncovers the hidden curriculum of an interdisciplinary computing HCI major in our university. This guide has received over 2,700 online views so far. And data from 17 student interviews and 112 survey responses indicate that students have found it to be a relatable and useful resource that motivates some to take action toward their career goals.
- A learner-centered design workflow to help others create their own local peer mentoring guides based on our thesis.

2 BACKGROUND AND RELATED WORK

2.1 The Hidden Curriculum

Our project builds upon the lineage of research on the *hidden curriculum* [26, 30, 35], which consists of the "unspoken lessons, norms, values, and perspectives that impact learning and academic performance[1]. This curriculum is often implied and not explicitly taught, which poses various accessibility and equity barriers." [10] Examples include social norms around etiquette when talking to authority figures, how to take initiative without appearing 'out of line', and

[1]Not understanding the hidden curriculum can also hinder students' future career prospects *even if they excel academically*, since it might cause them to miss out on valuable social and professional networking opportunities that their peers can access.

how to navigate around the bureaucratic rules of the institution [9]. An author of a recent book on this topic [13] defined the hidden curriculum similarly as "the set of tacit rules in a formal educational context that insiders consider to be natural and universal. Those with prior knowledge of those tacit rules are prepared to succeed because they have learned the rules before, and those with no or little prior knowledge don't even realize when they are breaking the rules let alone how to use these rules to their advantage" [18].

Extensive prior research has shown that members of underrepresented groups (e.g., first-generation college students, ethnic minorities, those from lower-income households) are less likely to be familiar with such implicit social cues that comprise the hidden curriculum [6–8]. Thus, when these students enter college they are at a disadvantage relative to their classmates from more privileged socioeconomic backgrounds who may have learned these lessons from childhood or from well-connected peers [17].

The majority of existing research on this topic is descriptive in nature. Many studies over the years have detailed the existence of the hidden curriculum in various educational settings by interviewing students and faculty. These settings include undergraduate education [13, 26, 40], Ph.D. programs [9], and professional training programs such as medical schools [33], surgery residency programs [15], and veterinary [44], nursing [36], and pharmacy schools [43]. However, there have been few research-based efforts that give actionable advice to students to help them learn the hidden curriculum, which is what our project attempts to do.

We found only two published examples of such advice guides: First, sociology professor Jessica Calarco wrote a guidebook called *A Field Guide to Grad School: Uncovering the Hidden Curriculum* [9]. This book shares the goals of our project but is meant for research-focused masters and Ph.D. students, while ours focuses on undergraduates. The other is a Canadian website called *Uncovering the Hidden Curriculum* (https://hiddencurriculum.ca), which contains self-paced learning modules to help undergraduates with general study skills and professional development. These modules cover topics such as executive function, communication, critical thinking, intra/interpersonal skills, and social accountability. Note that both projects were designed to be broadly applicable regardless of one's chosen field, which extends their reach but sacrifices specificity. For instance, neither gives advice on the specific nuanced ways to succeed within the setting of, say, a computer science department.

Our research extends this prior work by taking a complementary approach. First, our thesis is that such a guide should be led by students who are peers of the target audience, *not* by professors or professional staff, since students can express themselves in a way that is the most relatable to their peers. The other premise of our thesis is that valuable advice is often specific to one's local context, so a general-purpose guide like the two above may not be sufficient. Even Calarco acknowledges the challenges of writing a single guide to cover the vast diversity of academic fields, mentioning in her book's introduction that "it's important to note up front that some aspects of the hidden curriculum vary across disciplines, across departments, and across degrees" [9]. Instead, our novel approach is to propose a learner-centered design workflow (Section 4) to enable students at various schools to create their own local guides.

2.2 The Hidden Curriculum in Computing Education

Researchers have revealed aspects of the hidden curriculum related to computing via studies of student experiences. Books such as *Unlocking the Clubhouse* [29] and *Stuck in the Shallow End* [27] document how some students in underrepresented groups may arrive in college with less exposure to computers and tech culture, so they may not be as adept at recognizing the hidden norms of how to navigate computing majors or tech-related jobs. Similarly, Kwik et al. reported on the experience of community college transfer students to a 4-year undergraduate computing program [22]. Sharma et al. revealed some of the unspoken norms that prevent undergraduates from participating effectively in computing-related research at a large Ph.D.-granting university [38]. And there are several lines of work around revealing the gaps in student knowledge between what they learn in a formal CS curriculum and what 'hidden' knowledge they need to know (beyond coursework) to be prepared for technology industry jobs [4, 5, 20]. Our project tries to fill these gaps by creating a guide that helps students navigate the non-academic aspects of our department to help them obtain research lab opportunities, internships, and full-time jobs. However, note that other computing education scholars, such as Kallia and Cutts [19] and Kirdani-Ryan et al. [21], argue that the framing of modern CS departments around preparing for competitive tech industry jobs may harm students whose goals are not aligned with these dominant yet unspoken norms.

Efforts to teach the hidden curriculum to computing students have focused on structured mentoring programs [1, 31]. Mentoring can be highly effective but requires personalized contact, so it does not scale as well. Also, students with lower self efficacy [2] may be reluctant to take the initiative to join a mentoring program. It can be faster for them to get started by reading a guide like ours. For instance, Section 5 presents excerpts from our interviews with students who read our guide, such as this one from a community-college transfer student: *"When I just transferred here I tried to ask my peers questions. I just feel like not everyone wanted to share their experience and some people don't have time to do that. But this guide doesn't take people's time and you can find most information here."*

To our knowledge, our work in this paper is the first to describe the design process of uncovering aspects of the hidden curriculum by creating peer mentoring guides. Also, our approach to creating these guides is student-led, which complements prior work on mentoring programs that are led by faculty or university staff. Lastly, although our approach is not limited to computing, we believe that it is especially relevant to computing due to the well-documented disparities that exist between students who come into college with lots of prior exposure to tech culture and those who do not [27–29]; the former group is more likely to know about how to navigate computing majors and prepare for tech-related careers. Our guide thus aims to level the playing field by sharing computing-related hidden curriculum knowledge with all students.

Figure 2: Excerpts from the Table of Contents of our 50-page student-written mentoring guide to the hidden curriculum.

3 OUR GUIDE TO THE HIDDEN CURRICULUM

Starting in 2021 we have been working on a free online guide[2] to help students navigate aspects of the hidden curriculum within an interdisciplinary computing department, Cognitive Science, with over 2,000 students. Cognitive Science is now the fifth largest department at our university [42], and it is the largest computing-focused one on campus (slightly larger than Computer Science & Engineering). Students can choose from five majors (technically called *degree specializations*) within Cognitive Science, with the two most popular being machine learning and HCI (human-computer interaction). Since HCI is currently the largest major amongst these five in our department, we have mentored many HCI students who struggled to navigate the nuances of our large department. Thus, we created this guide specifically for students majoring in HCI, although some advice generalizes to related computing fields.

Figure 2 shows an excerpt from its table of contents. At first glance, it may seem like some of this information should be provided by the university. For instance, information about course planning ought to be on a department website, and advice on professional networking should be available at the university career center. However, the reality is that official university resources often fall short precisely because they are so 'official' and thus cannot cover the unspoken nuances that comprise the hidden curriculum. For instance, a department website cannot reveal insider strategies on how to petition out of prerequisite courses (which the department itself set as requirements). And staff at a university career center probably do not know the unwritten rules of how to obtain jobs in specific fields; they only provide more generic high-level advice since they need to advise students across all majors.

Thesis: The shortcomings of existing student advice resources led us to develop the following thesis, which we tested by creating our guide and distributing it to hundreds of readers over the past two years (see Section 5 for details):

> A peer-written guide that has a relatable tone and a focus on local context can emulate what a peer mentor does by emotionally resonating with students, teaching them aspects of the hidden curriculum, and motivating them to take concrete action.

To provide some context for this thesis statement, the gold standard we are aiming for is a one-on-one mentoring relationship. Research has shown that a good mentor can personally help a student to navigate aspects of the hidden curriculum [40] such as how to initiate conversations with professors at their office hours[3]. Unfortunately, there are not enough mentors to serve the thousands of students in our department. Also, students who need help may lack the self-efficacy [2, 9] to proactively seek mentorship. Therefore, one approximation to live mentoring is to create a guide that emulates a supportive mentor speaking to students. Our approach to doing so is to have the guide be written by a fellow student who adopts a colloquial and relatable tone that can resonate with their peers.

In addition, our thesis's focus on local context is critical because even when discussing general topics such as job searching, addressing local concerns can make students feel like our guide was written with them in mind rather than a generic advice resource they might find online. This design decision was inspired by education scholars who point out that "every college campus, indeed every educational context, has its own hidden curriculum of tacit norms and rules [...] Elite institutions have their own codes and rituals, and first generation students in particular would benefit from a primer" [18]. Thus, many parts of our guide include specific details about our own local university and department context and thus may not

[2]Our guide is viewable online at https://bit.ly/ucsd-cogsci-design-guide

[3]Note that mentors are different from tutors. Whereas tutors directly help students learn the academic contents of particular classes, mentors more broadly advise on higher-level goals that go beyond academics [40].

generalize to other settings. In fact, our hunch is that its appeal to our students comes from the fact that it is so personalized rather than being a generic "how to succeed as a college student" guide that tries to be for everyone.

Driven by this thesis, we created a 50-page mentoring guide formatted as a Google Doc that covers topics such as:

- What HCI is and what kinds of jobs it can lead to
- How to get started as an HCI major within our interdisciplinary computing department (Cognitive Science)
- How to start making an HCI project portfolio for job hunting
- How to strategically plan out course sequences to build a strong project portfolio in time to apply for internships
- When to try to petition out of prerequisite classes to strategically take certain classes in a different order (e.g., taking project classes earlier and using those projects to apply for internships)
- What to do if one feels behind relative to one's peers (e.g., it has a section titled *"I'm a 3rd/4th or transfer student year and haven't taken any project classes yet ... what do I do?"*)
- Examples of cold-emails to send to professors, hiring managers, and others to politely ask about opportunities
- Insider tips for getting one's resume and portfolio into the hands of recruiters at career fairs (e.g., in a section called *"Career fairs seem big and scary. Got any tips?"*)
- Affirmations for building self-confidence (e.g., a section titled *"I don't feel qualified enough to ask professors if I can be a research assistant ... what do I do?"*)
- Emotional reassurance and step-by-step verbal 'scripts' for dealing with various scenarios (e.g., *"The chat isn't going so well ... the recruiter doesn't seem interested in me or says I'm not eligible for positions ... what do I do?"*)

Design Rationale: Our guide is meant to reveal the many hidden snippets of informal knowledge (some examples are shown above) that are currently being passed around via word-of-mouth or buried within online forum threads that are hard to find unless one knows where to look. The status quo is that students who are already 'in the know' have the most access to such information, either via friends or from being part of 'in-groups' like career-oriented student clubs. In our personal experience, many of these students come from more socioeconomically-privileged backgrounds. In contrast, many of their classmates (especially those from less well-resourced backgrounds) do not even know where to start looking for informal advising resources and may be intimidated to join formal organizations such as student clubs. Also, it takes a level of confidence to seek out help, so low-self-efficacy [2] students avoid reaching out to potential mentors out of fear of wasting their time or avoid proactively applying to internships out of fear of being underqualified. This is why our guide provides emotional reassurances, confidence boosters, and step-by-step oral conversation scripts for dealing with challenging interpersonal scenarios.

4 LEARNER-CENTERED DESIGN WORKFLOW FOR CREATING PEER MENTORING GUIDES

Note that our guide alone is not a generalizable research contribution since it is a specific artifact made for our students. Rather, we use our two years of experience working on and then observing the impact of this guide (2021–2023) as a case study of learner-centered design, which enabled us to develop two research contributions: 1) a thesis for what makes an effective peer mentoring guide, and 2) a novel learner-centered design workflow to help others create their own local mentoring guides based on our thesis.

We already described our thesis in the prior section. In this section we detail the five-step workflow we developed to help others make similar guides, which includes: 1) setup, 2) needfinding, 3) creating, 4) distributing, and 5) maintaining. Figure 1 summarizes this workflow, which is inspired by learner-centered design for computing education, a methodology introduced by Soloway, Guzdial, and Hay [14, 41]. This methodology is similar to user-centered design in HCI, except that learners differ from expert users in several ways. Most notably, learners are often unable to articulate their needs directly and may have different motivations than experts. As a result, this methodology urges designers to find ways to empathize with the needs of learners. In our case, the learners are students in our interdisciplinary computing major who lack the experience or social connections to navigate the hidden curriculum, and their motivations are often career-oriented. Thus, our learner-centered design workflow (Figure 1) is meant to elicit needs from our learner population and result in a guide that can align with their motivations. We now describe each of its five steps in turn:

4.1 Setup

First off, who should be in charge of creating such a guide? We believe that the guide should have a main author who is an undergraduate student and thus a peer of the target audience.

Led by relatable, empathetic undergrad: The ideal person to lead this effort is a student who has learned to successfully navigate the major (e.g., a 3rd- or 4th-year) and who can empathize with the struggles of those who are getting started. Some good choices include students who had to overcome extra challenges on their journey, such as transfer students from community colleges, those who changed majors, those who are the first in their family to go to college, or those from underrepresented groups. Such students may relate better to the struggles of those who are not as visible on-campus. In our case, our guide was created by the first author of this paper, a fourth-year student who started in computer engineering but transferred into our Cognitive Science / HCI major in her 3rd year. She was personally motivated to create this guide since she had to figure out many aspects of the hidden curriculum on her own so she empathized with the struggles of new students.

Advised by established faculty member: It is theoretically possible for a student to write and distribute such a guide on their own, but this effort is more likely to succeed with a faculty advisor who can give some official credibility and field-specific expertise to the guide. The ideal advisor is someone who teaches introductory courses and thus may empathize better with the struggles of new students. Someone who is on the department's undergraduate education committee may also be a good choice.

If a student wants to initiate such a guide project, then they can approach faculty who fit the above criteria to serve as an advisor. And if a faculty member wants to initiate, they can recruit a lead

student author from amongst their teaching staff. For instance, undergraduate TAs or tutors for introductory courses could make for great candidates since they have already shown an interest in helping junior students. One could also frame this initiative as an independent study or senior honors thesis project.

4.2 Needfinding

After setup, the next step of our workflow is needfinding [39] to discover the needs of students in order to prioritize what to include in the guide. Although needfinding is a standard part of user- and learner-centered design [14, 41], here we present three unique aspects of our process that can potentially help others to create peer mentoring guides: 1) channel personal frustrations, 2) talk to both incoming and graduating students, and 3) mentor rather than interview.

1) Channel personal frustrations: We encourage the lead author to first do 'self-needfinding' by channeling their personal frustrations with the status quo and brainstorming what kinds of advice *they* would have wanted to hear when they were starting college. We believe this is a critical first step since it gets the lead author to be emotionally invested.

Note that this method runs counter to how needfinding is typically done – the designer is supposed to observe and interview the target population, and then try to present those people's needs 'objectively' without injecting their own personal biases. Instead, we recommend for the guide's creator to fully embrace their own emotions as a starting point for needfinding. Specifically, our project started two years ago with the lead author coming to the faculty advisor's office hours regularly to discuss her personal frustrations as an older student who recently transferred into the major:

- She found the official department website to be non-relatable since its recommended curriculum of courses did not seem to prepare her for getting tech industry internships. For instance, the department recommends taking project-based design courses later in the sequence, but those courses would often come too late for students to use those projects as portfolio pieces when applying for their first internships.
- Also, the website was more of a reference for formal department requirements rather than a guide for how to achieve what was necessary to succeed.
- Talking to the department's student advising staff was fine for logistical questions like course waitlists, but staff could not provide guidance about which classes to take for her career goals, how to overcome her fear of reaching out to professors for opportunities, or how to best position herself for getting tech industry jobs.
- It was daunting to try to find a mentor to guide her through the department since she transferred in late as an older student. And without a mentor, it was easy to get lost in a sea of 2,000+ students in the major.

2) Talk to both incoming and graduating students: After distilling her personal motivations, the first author performed 28 needfinding interviews with fellow students to discover what they would want to see in such a guide to the hidden curriculum:

- 17 incoming students who were new to the major. She found these students via her faculty advisor asking his colleagues to post a recruitment message to the Piazza discussion forum of the main introductory classes that enroll many incoming students. Having a faculty advisor was helpful here since the advisor could more credibly email his faculty colleagues to ask them to make this recruitment post.
- 11 graduating or recently-graduated students, many of whom she found via the faculty advisor's contact list of his former undergraduate TAs and other alumni who excelled in his past courses.

3) Mentor rather than interview: Our final recommendation here is to *not* to frame the chats as 'formal research interviews' but rather as informal mentoring and listening sessions. Our motto here is: *mentor rather than interview.*

In our case, the first author talked one-on-one with fellow students as a peer who was trying to understand their concerns rather than as a researcher who was doing formal needfinding for a project. (We still obtained informed consent so that participants knew our interviews would be used for research.) We believe this approach was a more effective way to elicit authentic insights than if, say, graduate students or faculty were to perform these same interviews; undergraduates may be less likely to open up about their feelings to those who they do not view as peers.

For the 17 sessions with new HCI majors, students shared their confusions about the major and what kinds of things they wanted advice on. Then the first author provided advice and emotional reassurance for their concerns so that they could come away feeling like they had a concrete next step to take. In sum, these sessions felt more like peer mentoring rather than formal research interviews.

For the 11 sessions with graduating or recently-graduated students, the first author took a similar approach to listen to, empathize with, and commiserate over their shared struggles along the journey through the same university and major. She elicited information such as what these students wish they would have known when they started and what kinds of advice they would give to new incoming students. In terms of delivering concrete value to these participants, the first author echoed their concerns by sharing her related frustrations, offering empathy, and giving a personal promise that their lived experiences would contribute to a guide that can help future students.

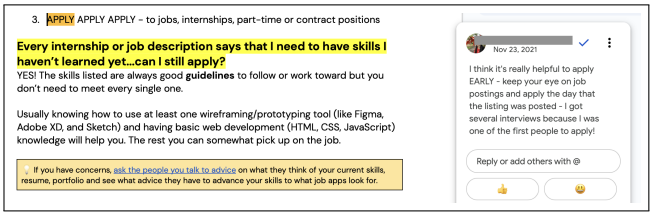
4.3 Creating

After the 28 needfinding chats, the first author wrote a draft of the guide by combining frequently-asked questions from incoming students (N=17) with advice collected from both graduating students (N=11) and her personal experiences. We showed this draft to students in several courses and collected hundreds of pieces of feedback that we integrated. We summarized the guide's contents in Section 3, so here are three design principles that can help others make similar guides: 1) create an accessible living document with 2) relatable language and style and 3) emotionally resonant content.

1) Accessible living document: We recommend creating the guide using a straightforward widely-adopted tool like Google Docs. Since we came from HCI backgrounds, we initially had lofty ambitions

of making our guide into a high-fidelity interactive web experience. We prototyped interactions such as flashcards (e.g., student questions on the front, mentor answers on the back) and choose-your-own-adventure paths that felt like conversing with a virtual mentor. However, we found it cumbersome to update the guide's contents in these richer formats, and early user testing showed that people were confused about how to navigate it. Thus, we decided to make our guide as a 'low-tech' Google Doc so that it is an accessible and easily-editable living document. Using Google Docs lets us quickly edit the guide's contents and have it be viewable by anyone with the URL without needing to set up web hosting. And our target reader audience of undergraduates is already accustomed to Google Docs because many started using it in high school or earlier for both class assignments and personal writing.

Besides ease of access, another benefit of Google Docs is how it makes it easy to collect targeted feedback on specific sections. We received feedback from an introductory HCI course in Spring 2021 (N=146 students). We gave students there a week to add their feedback as Google Docs comments and encouraged them to discuss with classmates in their TA section. We received 490 comments, with each student writing on average 3 comments with 52 words per comment; many shared anecdotes about relevant personal experiences or added suggestions for additional points they wanted us to cover. Here is an example piece of student feedback from that class (see Google Docs comment at the right):



2) Relatable language and style: We recommend writing with a language and style that current undergraduate students can relate to. For example, we used fonts, emojis, and formatting styles that look like what students are used to seeing on modern blogging platforms such as Medium rather than on university websites.

We wrote using a conversational tone that addresses readers like a peer rather than sounding like an authority figure. For instance, sparingly using colloquial language like all-caps and multiple punctuation marks (e.g., "WHAT ARE RESEARCH PAPERS???") can convey relatable feelings of confusion. To give more of an authentic voice, we also used some actual questions from students as section titles, such as *"Career fairs seem big and scary. Got any tips?"*

Career fairs seem big and scary. Got any tips?

Advice	Reason
Go to special sessions before/after the main career fair	Since recruiters from companies are flying in from different areas, companies often host special sessions before career fairs. Go to Handshake ~1 week before the career fair starts to see and register for these. These events are sometimes more large but still a little more intimate and less intimidating

And *"I just started research with a professor ..."*

I just started research with a professor, how can I stand out?

Advice	Example
Communicate before being asked to (take initiative)	If every week before the lab meeting, send a summary to the professor or graduate student "I'd like to talk about _____, I made progress in _____, and here are some questions I have about _____." This alone will help you stand out a lot!
Show progress	"I completed X task and started Y task this week. Here is my progress. Before I continue with Y task, I have some clarifying questions..."
Be realistic about the amount of time you can commit	"I can commit 8 hours a week - 2 hours a day 4 days a week except maybe less during midterms. Is this okay?"

Stylistically, we also split long paragraphs of text into more easily skimmable two-column tables such as "Advice → Reason/Example" (see screenshots above) and "Instead of [this] → Say [that]" (see screenshot below):

I know a bit about design and feel like the advice I get is all the same...how do I get more specialized advice?

Here are some ways to receive more targeted feedback:

Instead of	Say
"Here's my current design/paper/project draft. What do you think?"	"This is my design/project/paper draft. I'm having trouble with this specific section/these choices. I don't know if it needs this interaction, this feature, or this visual, what are your thoughts on these design decisions?"
"Can you critique my portfolio?"	"Can you look at this section of my portfolio? I feel like my wording is kind of passive. What do you think and how would you improve that?"
"I'm not sure what to do next in this project"	"So far I have come up with the problem statement and gathered this context, what do you think my next steps should be?"
"Do you have any design work for me to do?"	"I finished the previous assigned work and have some extra time. I'm interested in learning about X design topic. Do you have any related work?"

3) Emotionally resonant content: The students we talked to definitely did not want to see yet another impersonal website created by the school administration. So we prioritized making our guide into something that would *resonate with students on an emotional level* so that it feels like a fellow classmate talking to them. For example, here we use a quote from a former TA to encourage readers to get started on making an HCI/Design project portfolio right away:

I don't feel ready to make a portfolio...what do I do?

It's important to start a portfolio **even before you feel ready**. If this just means having a blank website with contact information, it's a great start!

There is so much to choose and you want to express yourself best. Portfolios come best in iterations so it's okay if it's not advanced level the first time - it will get better over time. Constantly improving your portfolio will make you feel proud!

> "You will always have the concern you won't be good enough but you will miss 100% of job applications if you don't have a portfolio" - Rajiv, former Design TA at UCSD

And here we address common feelings of rejection that students face during their internship and job application process:

I'm not feeling motivated...How do I deal with "ghosting" or rejection?

The internship hunt is a PROCESS!

Know that there's a company wanting to accept you! You may be feeling this kind of being in ***limbo*** but you ***will*** keep iterating on your own process. Some company somewhere is growing and it's hiring! Keep working on yourself, your projects, and trust that you are the perfect fit somewhere and some company is right for YOU!

You might not get hired one summer. This doesn't reflect anything of you -- you're trying your best. Don't let it go to waste: do projects, do self-care, learn about what you're passionate about.

Students may also resonate with sections like these that are dedicated to providing reassurance:

Why is everything so para → doxical?

Grind, get internships but also find out what you're passionate about while also being well-rounded, and have fun...what do?

It's okay to feel stressed and rushed but know that paralysis or burnout - not being able to do anything is what you want to avoid. It's okay to float by sometimes and only work a little at a time.

Warning signs of burnout -- i.e. a low midterm -- it isn't always what you're doing wrong but sometimes you're doing too much and you have to pace yourself and do just a little at a time.

You can apply the daily, weekly, monthly concept to your life.

These examples show why we believe it is critical for an empathetic undergraduate student to create this guide (Section 4.1), since they are best-positioned to write the kinds of emotionally resonant content that their classmates can relate to.

4.4 Distributing

After creating the guide, how should it be distributed to students? Just putting it online may not work well, since it may be hard for students to find it on their own. Instead we have three recommendations for proactively distributing the guide: 1) establish credibility with faculty, 2) distribute through classes, and 3) share on student channels.

1) Establish credibility with faculty: Although this guide should be student-led, faculty are essential for distributing it widely and equitably (see next few paragraphs for details about equity). Thus, it is important to get relevant faculty excited about the guide so that they will share it in their classes. We found two ways to do this: 1) The faculty advisor of the project can directly show it to colleagues, which gives it credibility due to their reputation in the department. 2) The faculty advisor can also arrange for the lead student to give a short talk about the guide at a department faculty meeting. In our case, the first author gave a talk about this at an interdepartmental HCI research meeting where almost a dozen HCI-related faculty (plus many students) attended. Several of the faculty who attended expressed enthusiasm about sharing the guide in their classes. We believe this initial face-to-face contact was critical for establishing trust. In contrast, sending a mass cold-email to faculty to advertise this guide could come off as insincere or just get lost in their inboxes.

2) Distribute through classes: In our experience, the way to distribute this guide most fairly and equitably is via introductory and lower-division courses in the department. This achieves the goal of equity better than online distribution (see below) since *all students in the department must take introductory-level courses and thus get a more equitable chance to see the guide.* Some ways to announce the guide include putting a link to it in the syllabus, making a course forum post to introduce it, or passing out paper flyers in class. In our case, first-year students who are undeclared or coming from other majors also took introductory computing classes, which gave the guide even broader exposure.

3) Share on student channels: The lead student can also distribute the guide directly to peers via student channels. The best way to do so varies by school. At some, email may be best, while at others it may be putting up posters on-campus or making Snapchat Stories. Yet other schools may have more active Facebook groups, Discord chats, TikTok, Reddit discussions, or other social media. However, this may not be the best way to reach the students who need the guide the most. This is because those students who know to regularly monitor the (often-private) social media groups are already more 'in the know' about relevant trends. The goal of this guide is to help students who are not already tapped into existing informal networks, so they might not stumble across social media posts on their own. That is why, for greater equity, we recommend also distributing the guide through classes (see above).

4.5 Maintaining

The guide's author will likely be a more experienced 3rd- or 4th-year student. But that means they will graduate within a year or two, so what happens then? Here are our recommendations for maintaining the guide longer-term.

Find a new lead student: The first maintenance task is to find a new student to lead the project, preferably in the year before the current lead graduates. The new lead should have the same relatable and empathetic qualities as the current one (Section 4.1). One way to find such a person is by seeing who has given constructive feedback on the guide so far or talked to the faculty advisor about it. The advisor's own undergraduate TAs could also make for good candidates, along with students whom the original author met with during the needfinding step.

If a new lead student cannot be found right away, that is not a problem since the guide's contents will still be fresh for a few years. The most important thing is that a faculty advisor remains committed to the project so that they can keep publicizing it and be on the lookout for a new lead student.

Reassess student needs and update: Maintenance should be less work than first creating the guide. The responsibilities of the new lead are to periodically reassess student needs and do a 'vibe check' to see if any content should be updated in light of changes in field-specific trends. For instance, certain memes or pop culture references in the guide might get outdated in a few years and need to be changed. Once again, having an undergraduate student who is attuned to the zeitgeist of university life is critical here, since

faculty are unlikely to be the most up-to-date on student-relevant trends. That said, the faculty advisor can help out by distributing the guide to their courses and gathering new rounds of feedback.

5 EVALUATING OUR THESIS: INDICATORS OF IMPACT FROM INTERVIEWS AND SURVEYS

How we can evaluate whether our thesis statement in Section 3 is effective in practice? The gold standard here might be a randomized controlled experiment where we expose a group of students to the guide (with a demographically-matched control group) and track their progress longitudinally for years throughout the major and perhaps even after graduation.

However, we chose not to go down this experimental route since, following the spirit of learner-centered design [14], our goal in creating the guide was to get it to students in our department as soon as possible and then iterate based on feedback. Thus, we strove to maximize potential impact on students by distributing it broadly rather than running a more controlled experiment.

We first released the guide online in Fall 2021. As a high-level indicator of impact, the guide's URL has been opened over 2,700 times in the past two years (via a bit.ly URL tracker at https://bit.ly/ucsd-cogsci-design-guide), so hundreds of students so far have likely read it. To gather details on the specific ways in which this guide has impacted students, we collected qualitative data via:

- Interviews with 17 students who had read the guide and contacted us to give feedback on it (Section 5.1)
- A follow-up survey of students in an introductory HCI course (with 112 responses) where we had them spend a week reading the guide and then give us their impressions of it (Section 5.2)

Data Overview and Analysis: The first author conducted all 17 interviews and transcribed a set of interview notes to discuss with the team. For the follow-up survey, the research team designed survey questions together and collected all the responses. Note that data analyses for interviews were completed in 2022 before designing the survey in Jan 2023.

For both the interview and survey analyses, the research team read over raw data together using an inductive approach [11] with open coding and collaboratively took notes on possible themes and accompanying codes. We iterated on these codes several times as we tried categorizing responses with them. We adjusted several codes as we noticed redundancies and conceptual mismatches. For instance, there was originally a separate code for students who mentioned how reading the guide 'jump-started' their motivation to start taking some action, but we merged it with the responses for specific actions to streamline the concepts in Table 1. We also originally coded the entries in Table 2 as different kinds of 'mindsets' but later decided that the concept of 'emotional reactions' more accurately reflected those reader responses. Once finalizing the codes, we iteratively applied them to all of the data together to reach consensus.

Note that the findings we present here are a starting point for demonstrating the potential impact of such a guide and should not be interpreted as rigorous empirical evidence that this type of guide is more or less effective than other mentoring approaches. This is in part because we did not randomly sample from amongst all HCI-related majors at our university. Our interview participants were those who independently found the guide, read it, and reached out to give feedback. And our survey participants were from one particular introductory HCI course. Since our guide is only for HCI students, this was a reasonable starting point for a course-wide survey. But deploying it to a more general introductory Cognitive Science or Computer Science course in the future could reach early-stage students who are still undecided about their major.

5.1 Reader Feedback via Interviews and Google Docs Comments

One informal indicator of impact (albeit with a self-selected sample) is readers directly telling us how the guide has affected them. To gather this feedback, we put the first author's email address on the first page of the guide and encouraged readers to contact us to schedule an interview if the guide made an impression on them. The first author also proactively reached out to some students who left comments on the guide's Google Doc to ask them whether they want to be interviewed.

The first author conducted Zoom video interviews with 17 students (7 men + 10 women) whom we found via the method described above. Each interview lasted 30–60 minutes and was guided by what readers sought to discuss about how the guide impacted them or what feedback they had for us about it. We inductively categorized representative quotes from interview participants P1–P17 into a set of themes. In addition, several readers left written comments in the Google Doc, so we included them into our analyses with the author labeled as 'DOC'.

Informal conversational style: Several students liked the informal conversational style of the guide, which contrasted with the formal writing style of official university resources. For instance, P5 said, *"This is a lot to read, but the language is so colloquial that it's just like I can hear another student talking to me, like it made things very digestible."* P4 mentioned how the casual typographical style (which we discussed in Section 4.3) made it feel relatable: *"The emojis are good since it breaks up the text and makes it more personable and fun [...] they also sort of denote an idea: a wave emoji is a greeting and light bulb is ideas and a comment emoji helps people understand what a section is talking about."*

Impact on early-stage students: Several Google Docs comments mentioned how the guide could benefit early-stage students. For instance: *"I love that [it] provides encouragement for incoming students! It can alleviate a lot of concerns and reservations they have when deciding whether or not to pursue this path"* (DOC).

From our interviews with early-stage students, P2 mentioned that *"I remember seeing [the guide], freaking out, and wondering why didn't I find this before?"* P11, a first-year student, said *"it was super comprehensive and [covered] questions I hadn't even thought I had."* More specifically, those who just started college found it useful for defining field-specific vocabulary about HCI and UX design that they had not learned yet. P1, another first-year, said, *"I find the 'how to make a portfolio' section very helpful – I didn't even know what a [UX design] case study was until I checked this guide out."*

The guide also motivated students to take specific actions such as starting a project portfolio website, reaching out to older students to ask for advice, or enrolling in some of the recommended classes. For instance, P2 said, *"through this document I've been able to ask people about their career to a point where they're like a mentor to me now."* Relatedly, P12 mentioned, *"[Because of the guide] I'm also talking to people like you - I followed a couple of people on social media and tried to get to know a little more of the stuff that's going on in college in design."* And P1 said, *"I took a visual arts class and a seminar from the guide and petitioned [into another] class to take."*

Impact on later-stage students: Several later-stage students also found the guide useful, especially P3 and P6, who transferred into our university from a community college. For instance, P3 said that as a new community-college transfer student it was hard for her to ask other people for advice. Instead she found it easier to get started using our guide:

> *"When I just transferred here I tried to ask my peers questions. I just feel like not everyone wanted to share their experience and some people don't have time to do that. But this guide doesn't take people's time and you can find most information here [...] I think this is guidance for people who just entered this field no matter whether you're a first year or junior student that just transferred [...] I really like how you make it for different kinds of people who are just getting started or people like me who are older students."*

Validation by graduating students: Four interview participants who were about to graduate soon gave us some anecdotal validation that the guide contained information they would have liked to see, which could have potentially helped them back when they were getting started as a Cognitive Science / HCI major. P7 mentioned that *"a lot of this was validation that I've been doing things correctly and that I'd been getting the advice that I needed and having the conversations that I needed to have."* P7 also felt validated by how the guide described how to get through challenges similar to those that she had previously faced: *"I felt very seen."*

More generally, students corroborated that the guide would have been useful had it existed a few years earlier when they were getting started: *"I wished I could have read this before going into the major"* (P10), and *"I like this section [about first steps to take], it's very informative. As no one had personally told me about this, I just had to muddle through!"* (DOC)

5.2 Follow-up Survey of HCI Students

The 17 reader interviews we summarized in Section 5.1 came from a self-selected sample of students who both read the guide and proactively contacted us to give feedback on it. We wanted to see whether their insights might generalize to a broader population of HCI students. To do so, we conducted a follow-up survey in an introductory HCI course in January 2023.

The course we chose currently enrolls 141 students and teaches user-centered design methods for creating web and mobile applications. The instructor included our survey as an optional last question on a weekly homework assignment. Students received no monetary payment or extra credit for completing it, nor any penalty for skipping it.

Our survey introduces our hidden curriculum guide and asks two open-ended questions:

- Spend at least 30 minutes reading this guide and reflect on what impressions (if any) it has made on you so far. For instance, has reading this guide affected your plans or feelings as you progress through this major?
- Please provide us with any feedback on this guide or suggestions for improvement.

These simple questions are meant to gather students' first impressions, akin to doing informal 'user testing' of the guide's contents. We wanted to lower the barriers to participation, even if it meant not collecting more detailed or rigorous data.

Students had one week to complete the survey and submit it with their homework. Despite it being optional, 112 students (79% of the class) wrote a response. This high response rate may be due to students being personally motivated by the guide since it addresses some of the challenges that they are facing. Here were the most common categories of responses:

5.2.1 ***Actions that students took after reading the guide.*** One sign that the guide had concrete impact is if students took some action after reading it. Table 1 shows that most respondents mentioned at least one action that the guide inspired them to take (37% listed one specific action and 31% listed more than one). Out of those respondents, 11 said they already did the action they described (rather than just getting inspired to possibly do it). Although this number seems low, recall that most students saw the guide for the first time in this class[4] and had only a week to complete the survey. Some actions that students mentioned taking after reading the guide include:

- Contacting prospective employers: e.g., *"I have learned how to connect and talk to the people in my field. In fact, after reading the guide, I messaged many people via LinkedIn and had a call with a current Google software engineer to learn about what he does and what I can do to be prepared."*
- Several students who had read the guide before this class[5] said that the section about course planning strategies led them to sign up early for classes that they did not originally plan to take until later years.
- Joining student organizations: *"I had access to this hidden curriculum [guide] very early on in my first year.[5] It was the first form that bolstered my confidence to apply to different design organizations and gave me the motivation to kickstart my career journey. When I first read it, I felt a bit overwhelmed because there seemed like a lot ahead of me that I needed to accomplish. After reading through it, I had the motivation to apply to organizations like [student organization names] which all turned out well for me."*
- Creating a personal website to showcase their programming and design projects for prospective employers.

[4] Only 10 respondents (9%) mentioned they had seen this guide before, so most were first-time readers.

[5] The guide was first released in Fall 2021 and has been publicized in prior HCI-related courses, so a few students had already seen it before.

Table 1: Number of respondents to our class survey who mentioned taking or planning to take actions after reading our guide.

	# respondents	% of N=112
Listed 1 specific action that the guide inspired them to take after reading	41	37%
Listed 2 or more specific actions that the guide inspired them to take	35	31%
Mentioned specific advice they liked but no actions they want to take	15	13%
Did not mention specific advice or planned actions	21	19%

5.2.2 ***Actions that students were inspired to take.*** Another possible indicator of impact is if the guide inspired students to at least plan to take some action after reading. The first two rows of Table 1 show that 68% of respondents mentioned specific actions they plan to take after reading the guide. The most common kinds of reported plans include:

- Starting a portfolio website: e.g., *"one of the next steps I've found I can take is to just start working on a portfolio, even though I feel there isn't enough for me to show off. Having delayed creating one for a while as I often feel that it'll look much better once I have some more projects of higher quality and substance, I've neglected to create a baseline for me to start off with."*
- Contacting people: *"After reading the guide, I believe my next step could be reaching out to more experienced students and professors to have a glimpse of what opportunities are there in the current industry."*
- Planning courses more strategically, especially trying to enroll in more project-based classes to improve one's portfolio and resume: e.g., *"[the guide] pretty much has molded how I've been thinking about enrolling in classes."*
- Building recurring habits: e.g., *"When reading this guide, I got a better understanding of how to plan actionable steps daily, weekly, and monthly from the planning section. I want to incorporate this idea into my next steps by being more consistent with applying to jobs and practicing for interviews. I can set actionable daily tasks, and weekly/monthly goals of number of jobs to apply to and skills to practice."*
- Stepping outside of comfort zone: e.g., *"My next few steps would be to be okay with doing more things I used to be afraid of or uncomfortable with - whether that's networking, attending professional events, talking with industry professionals, or even something as simple and mundane as making mistakes."*

Note that these responses come with two caveats: 1) our open-ended survey prompt mentioned future plans as an example of something they could reflect on, which might have primed some to write about plans even if they are not committed to completing them, and 2) we did not follow up to see if respondents actually took those planned actions.

5.2.3 ***Emotional reactions to reading the guide.*** Table 2 summarizes the range of emotions expressed by readers:

- Positive emotional reaction (47% of respondents): Common examples here include increased self-confidence and a sense of urgency to get started on one's career development goals, e.g.,: *"The advice for how to begin these [professional networking] conversations provide me with a framework that I can follow and tweak as I go to fit my purposes, but just having that as a starting point has increased my confidence to just go for it."*
- Mixed reaction (14%): Other students reported a mix of positive and negative reactions. One common pattern here was students reporting how the guide made them feel anxious (negative emotion) yet optimistic (positive emotion). For instance, a third-year student wrote, *"Overall, the read through the document has left me feeling both a bit nervous yet motivated at the same time. I wished I could have seen this earlier so that I could've had a solid basis to work with starting out rather than figuring out what to do for the first two years of university. So with two years left, I honestly feel a bit anxious knowing my time is limited here."*
- Negative emotional reaction (3%): Some later-stage students reported feeling worse after reading. For instance, a fourth-year wrote, *"Ultimately, I feel I don't have much [time] left in my [HCI] design journey at UCSD [our university]. Reading this resource guide mostly made me feel regret: I didn't have this resource at my disposal when I was a fresh undergrad."*

5.2.4 ***Other indicators of impact.*** We found three other kinds of potential impact in survey responses that did not fit into the above categories of specific actions or emotional reactions:

1) "I wish I had found this guide earlier!" 20% of respondents mentioned something along the lines of wishing that they had found this guide earlier (without any prompting from the survey questions). For instance:

> *"After reading through this guide, the one thing that immediately came to mind was that I wish I had access to it sooner. Had I seen this in freshman or sophomore year, I think it would have had a dramatically more significant impact on my ideas for next steps, my ability to structure my courses, and my networking/outreach efforts."*

Others mentioned how they wished they had discovered it sooner since it fills a gap in their formal college curriculum:

> *"I honestly wish I had come across a resource like this early on in my college career. The 'How do I find an internship' section really hit on a lot of things I had to figure out myself such as when to start applying. Reading through this guide made me feel better about not knowing how the internship application cycle worked until my junior year because it really is something that isn't explicitly taught, but rather something you learn from your parents or from experience."*

Table 2: Number of respondents to our class survey who mentioned certain emotional reactions after reading our guide.

	# respondents	% of N=112
Positive emotional reaction (e.g., self-confidence boost)	53	47%
Mixed reaction (e.g., felt anxious yet optimistic)	16	14%
Negative emotional reaction (e.g., felt discouraged)	4	3%
Did not mention emotional reactions	39	36%

This is an example of the hidden curriculum because it is a useful piece of knowledge that is not explicitly taught, so it is often learned informally from peers or parents. Also note that these anecdotes corroborate what we found in reader interviews (Section 5.1).

2) Relatable tone made students feel like they belonged: 17% of respondents mentioned a feeling of belonging, which some attributed to the relatable tone of the guide. For instance, one wrote: *"I intensely enjoyed the casual, almost mentor-like tone depicted throughout the document - it made me, a reader, feel secure and welcomed into a community through just a document."* Note that this also corroborates what we found in the reader interviews from Section 5.1.

Some felt a sense of solidarity with peers and reassurance that they were not alone. One wrote, *"I realized everyone on the path has the same pressure as me, so normalizing the pressure helps me to be more productive and motivated."* And another wrote: *"Reality is often unpredictable, and life cannot be completely planned, but having a vague college career path and reminder that you're not alone in the journey in the form of this google document is still pretty sweet to have :)"*

In addition, knowing that it was written by a fellow undergraduate student in their department made the guide feel more like it was specially made for them, rather than generic advice they might find online on forums or blogs:

> *"Reading this guide made me tear up a little. I love the amount of passion, pride, and care that went into making this guide. [...] I really appreciate that and it's breathtaking to see the amount of work that was put into this guide for the benefit of future students."*

3) Help students cope with imposter syndrome: 4% of responses mentioned imposter syndrome. e.g.,: *"Even though I still have to deal with imposter syndrome on a daily basis, the student guide ameliorates this kind of pressure because each section has an undertone that it is completely ok if I want to start improving my professional skills from scratch."* And *"[this] guide helped me fight with imposter syndrome. There were pieces of information for dealing with stress and burnout that can be applied to anything."*

5.2.5 ***Critiques and suggestions for improvement.*** Our survey prompt also asked for feedback on shortcomings of the guide. Students left 117 total pieces of feedback involving critiques or suggestions for improvement (some gave more than one piece of feedback). The most common categories were:

- Aesthetic critiques (23% of feedback): This category included responses like *"I feel like it could be much more visually appealing. This could also leave room for more visual/design elements and creativity, as Google Docs formatting can be somewhat limiting."* Despite these aesthetic critiques, others liked having the guide be a Google Doc since it felt more relatable (like it was written by a classmate rather than professional staff) and made it easier for peers to give feedback by adding comments directly in the document.
- Wanted step-by-step instructions for more topics (17%): Some students wanted us to add instructions for certain tasks that caught their interest, such as how to prepare for front-end software engineer interviews or how to use certain LinkedIn features. Our guide already provides some step-by-step instructions (such as how to approach recruiters at a career fair), and we plan to address this feedback by adding links to external tutorials rather than writing it all ourselves since the guide is already long (see next bullet point).
- Length and broad scope (13%): Some students reported feeling overwhelmed at both the length of the guide (a 50-page Google Doc) and the breadth of topics it covers. One wrote, *"This guide is very detailed and comprehensive, but this format of a long document also can be quite anxiety inducing, given that all the pages suggest new action items that students could do."* Some suggested breaking it up into smaller sub-guides, formatted as pages within a unified website; those sub-guides could then go into more depth on niche topics.
- Too much focus on early-stage students (8%): Some 3rd- and 4th-year students felt like the guide was mainly speaking to early-stage students. Similarly, transfer students (e.g., those who transferred in from community college) or those who switched into the major late wanted to see more specific advice catered to their paths.

6 DISCUSSION

Our interview and survey results indicate that students found our guide to be relatable, that it provided them with emotional reassurance, and that it gave them ideas for specific next steps to take. While we acknowledge that we wrote only one guide for one specific department in one school, our intuition is that the learner-centered design workflow we developed (Figure 1) can be applied more generally across different settings. For instance, several students in our survey (Section 5.2) who were from different departments but taking this particular class mentioned they wished a similar guide would be made for their major.

6.1 The Importance of Emotional Resonance

The most inspiring and heartwarming aspects of this project were getting to hear firsthand from students (via both our formal reader interviews and informally from students contacting the first author) about how this guide emotionally resonated with them. Students

reported 'feeling seen' from reading the guide and a sense of belonging, remarking how the guide makes them feel like someone understands where they are coming from. This reinforces our thesis that a peer-written guide with local context can resonate well with undergraduate students.

Building on the above points, our hunch is that this sort of emotional resonance may make it more likely for students to absorb the factual knowledge within the guide. This potentially emulates what a good peer mentor does – first establishing a rapport with a mentee and then providing them with information. Although we have not empirically tested this hunch, we believe that the exact same information (e.g., how to interact with recruiters at a tech career fair) would not be internalized as well if it were presented in a dry, disconnected format that did not resonate with students.

6.2 On Scalability and Timelines

One of the benefits of a peer mentoring guide versus live human mentors is the potential for greater scalability. Once created, a single guide could impact hundreds or even thousands of students at a university over several years without much additional maintenance effort. Of course, the tradeoff for such scalability is lower fidelity – it is hard to replace a human mentor working one-on-one (or even in a small group) with students.

Another dimension of scalability is how well our *learner-centered workflow itself scales* as a design methodology. Since our goal is to make it easy for every department at every institution to have their own bespoke guide catered to the nuances of their own local hidden curriculum, that requires someone available locally to implement such a workflow. By having the guide be led by a student (workflow Step 1: Setup) and not professional staff, that greatly increases the number of potential authors. However, what kind of time commitment would a student need to make to create such a guide? The longer it takes, the harder it would be to find students willing to take on this volunteer effort, and the less this methodology would scale. To address this question, we give an indication of the time commitment for creating our guide.

Based on the time each step of the workflow took for the lead student author, we established a tentative timeline required for each task. Although some steps might appear lengthy, we intentionally spread out the deadlines to distribute the workload more evenly throughout the student's quarter or semester, taking into account schedule constraints of them likely taking a full load of courses.

1. Setup: variable time but no direct student time commitment

- Observation is done in advisor's class and office hours to identify potential students who might be a good fit to lead this project.

2. Needfinding: ~2 months

- Weeks 1–4: Lead student's personal frustrations are noted, outreach is done to both newer and more experienced students for conversations, an understanding is gained of the department through the lens of different student perspectives.
- Weeks 5–8: Questions are generated, then lead student engages in conversations with students at different stages in the major.

3. Creating (and testing): ~2 months

- Week 1: Themes are grouped together, interviews and trends are analyzed, and an outline of topics is created for the guide.
- Weeks 2–4: Initial hidden curriculum guide content is written.
- Weeks 5–6: Feedback is gathered from readers, the advisor's classes, and students at different stages of the major.
- Weeks 7–8: The guide is revised and if desired, more feedback is collected for another iteration. The final steps involve grammar and fact-checking.

4. Distributing: most effective during the first 2 weeks of every quarter/semester in introductory classes.

5. Maintaining: ~1 month (happens a year or more later)

- Week 1: Latest available resources for students are reviewed and updated.
- Weeks 2–3: New interviews or surveys may be conducted.
- Weeks 3–4: The guide is updated with refreshed information and new details are added.

6.3 Challenges and Limitations

Since our thesis is that a guide to the hidden curriculum should be student-written, one limitation is that it may contain inaccurate information or bad advice. Note that this is a risk shared by *any* peer-created resource such as wikis, forums, and blogs. As we described in Section 4, we addressed this risk by having a trusted lead student write the guide and then curate feedback from her classmates. Also, a faculty advisor is involved whose role is to meet regularly with the lead student to discuss updates and check over the guide's contents (while at the same time being careful not to impose their faculty-oriented views on this student-written guide). We further include a disclaimer on the first page that this guide is an unofficial student-created resource and is not meant to replace official university resources.

Another risk of a student-written guide is that it may degrade into gossip about professors or student organizations, reminiscent of anonymous forums such as RateMyProfessors.com that have been reported to be biased and discriminatory [12, 23]. To address this risk, we took a firm stance that the guide should not talk about specific individuals (e.g., faculty, staff, student group leaders).

Next, as mentioned above in our scalability discussion, the main limit to scaling our workflow is needing to find a lead student. Thus, there is also the potential of not being able to find a student in the department willing to put the time and energy into creating such a guide purely for the sake of helping fellow students. Although they should ideally be intrinsically motivated, one can offer additional incentives such as them being able to use this project as a portfolio piece, for independent study class credit, or as a paid research opportunity funded by the faculty advisor or department. An alternative approach to having a lead student could be for the department to hire a professional writer to interview students and then work alongside student volunteers to curate a diverse variety of student voices for such a guide.

To advance the goals of equity, we wanted to get this guide into the hands of students who need it the most, which are students who are likely not going to be proactively looking for mentoring

resources. We tried to distribute this guide more equitably (Section 4.4) by having instructors of introductory courses in our major send it out on their class forums. But in the future we can take even more proactive steps by reaching out to certain groups of students or holding workshops where we introduce the guide in a human-to-human context instead of just sending out a URL online.

We found that one of the most challenging aspects of evaluating this project is that it can be hard to measure success in a rigorous manner. Ideally we would have wanted to hear students reporting that they directly got an internship or full-time job by following the advice in our guide, but that rarely came up in conversation since the guide's impact may be indirect and therefore harder to attribute. For instance, a student who reads the guide may have gotten a small self-confidence boost that motivates them to talk to their TA after class one day, which then leads to them to the professor's office hours, which then leads to a conversation about interesting job opportunities in a sector that the student had not originally considered, which then leads to them applying for an internship there.

We opted for an informal evaluation of impact (Section 5) by interviewing and surveying students; but such responses may be overly-optimistic since students know that this guide was written by one of their peers and may thus want to appear supportive. A more rigorous evaluation of impact needs to both consider a more representative sample of students and compare against post-graduation outcomes of those students who did *not* read the guide.

Although we developed a field-independent workflow for creating peer mentoring guides (Section 4), we have so far only created one guide for a Cognitive Science / HCI major at our own university. Thus, we do not know how well this workflow actually generalizes to other contexts different from our own. Trying to replicate this workflow to create guides for other majors and types of institutions could reveal whether it generalizes well and in what ways it may fall short. More broadly, we want to see how it might apply to institutions that differ from our own large public U.S. university.

Lastly, we acknowledge that a mentoring guide like ours can be a starting point but alone cannot solve the deeper structural problems related to the hidden curriculum, such as systemic inequities that certain groups of students face more than others. We believe that continuing structural changes [26, 30, 35] must be pursued at the level of educational institutions.

7 CONCLUSION AND OPEN QUESTIONS

This paper presented the learner-centered design process behind a peer mentoring guide to help students navigate the hidden curriculum of an interdisciplinary computing HCI major at our university. From these experiences we derived a five-step design workflow for creating such guides (Figure 1). Here are some open research questions that could inform future research along this direction:

- Right now, our design workflow places the responsibility of creating such a guide on one lead student. Are there ways to meaningfully distribute this workload? Perhaps we can find ways to incorporate contributions from students who have struggled the most throughout the major and may thus be more relatable to their peers?
- Currently we are relying on students to discover this guide on their own or via word-of-mouth. Can we pair this guide with a seminar class given to first- or second-year students? That way we can reach those who may need it the most and also do more longitudinal forms of research to track the progress of students in the years after they take the seminar.
- Our current evaluations are anecdotal in nature. Can we make more rigorous measurements of the guide's impact using qualities that are predictive of future success in computing, such as *sense of belonging* [24, 32, 37]?
- Can we incorporate such a guide as supplemental material into some of the more challenging courses within a department (e.g., those with high failure rates or drop-offs) to see if it can help motivate students to persist and succeed?
- How can we turn this sort of bottom-up, student-driven initiative into something that can enact long-term change at the department or institutional level to remove some of these barriers exposed by the hidden curriculum?

While these questions are not specific to a particular field, prior research along with personal experience have shown the importance of mentorship in computing education in particular due to the implicit knowledge gaps that exist between students who come in with lots of prior exposure to computers and technology culture and those who do not [27–29]. Thus, these future research directions can extend our work to make individual departments' experiences more equitable for students who do not have the benefits of extensive prior exposure to computing. Each department faces unique challenges, and it is unlikely that a single guide would work everywhere. So we hope the ideas presented in this paper can inspire students to design locally-focused mentoring guides and researchers to more formally study the efficacy of such guides. Ideally everyone would have a mentor to personally advise them through these challenges, but having a relatable peer-written guide is one way to get started even without an available mentor.

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