

## Deferring Social Impact: Conceptions of ICTD and Computing Careers

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### Abstract

*This paper contributes to the conversation about undergraduate students' conceptions of computing and career pathways. We present a qualitative study of undergraduate involvement on a software research project in the Information and Communication Technology for Development (ICTD) subfield of computing. We analyze interviews with nine students who worked on the project in a capstone course and/or as volunteer research assistants. We contribute (1) a new angle on students' conceptions of computing and the ICTD subfield, which reveals that interest in "social impact" motivates their involvement in ICTD, in contrast to a perceived default computing career path at large tech companies; and (2) an articulation of the phenomenon we call deferring social impact, which describes student researchers' intentions to eventually find the social impact they desire despite following that default career path.*

### 1. Introduction

Information and Communication Technology for Development (ICTD, ICT4D) is a young interdisciplinary field which features prominently computer scientists and their (our) attempts to "do good" around the world. Heeks defines ICTD as "the application of any entity that processes or communicates digital data in order to deliver some part of the international development agenda in a developing country," although many include social and economic development applications of digital technology in any location [1, p.10]. As ICTD scholars, we are reflexively interested in how our subfield reproduces itself. To this end, our overarching research question is the following.

RQ1: How do undergrads understand their involvement in ICTD research?

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Both authors contributed equally to this research.

For this paper, we choose to write to a general software engineering and computer science education audience to discuss the close interrelation of the students' views of ICTD and their views of computer science careers.

RQ2: How do undergraduates involved in ICTD research reason about their career goals in computer science and engineering?

We address these research questions through a qualitative interview-based study of a multi-year ICTD research project about a data collection and visualization tool for vaccine cold chains.

### 2. Background

The capstone course in which the Cold Chain Information System (CCIS) visualization dashboard originated has been taught in different forms in the past. Prior papers by Ruth Anderson et al. describe the pedagogical approach and its motivations in detail [2, 3, 4]. Since the present paper focuses on students' experiences, readers interested in organizing such courses should refer to this prior work. Here we provide some background on the course and how it was set up, as well as some background on the CCIS project to which the students we interviewed contributed code and other work.

The course began with the instructors pitching a series of ICTD projects to the students who then selected their preferred projects and formed teams around them. One of the projects pitched was the CCIS dashboard project. Professor Anderson, the instructor of the course, told us he selected this project because it was a reasonable scope to prototype in one quarter and because it built on an existing project with strong partnerships, so it could contribute to a future deployment. The project drew substantial interest and a team of five students spent the rest of the quarter developing a working demo of a dashboard that aggregated and visualized information about the conditions of vaccine refrigerators and freezers. The dashboard is intended to display data collected via an

Android application developed by others in the research group (the capstone focused on the visualization dashboard, two of the students involved later contributed to the data collection side of the project).

Rather than focusing on familiarity with ICTD as a field, the learning objectives of the capstone focused on teamwork and software engineering. Students learned about the global health domain and background on ICTD and vaccines during the first weeks, mainly in order to motivate their engineering work. Instructors met with each team weekly, but did not help directly with programming. At the end of the quarter the students produced a demo (presenting a demo was a learning objective of the course) and were subsequently invited back as volunteer research assistants. Other undergraduates joined the project under Professor Anderson's guidance. The students contributed to a paper on the design of CCIS, including the visualization dashboard, and work on the dashboard is continuing [5].

### 3. Related Work

Our research questions are informed by prior studies of conceptions of CS. The roles, images, and stereotypes of computer scientists have been discussed in a significant body of literature. The early work on conceptions of CS highlighted problematic stereotypes of computing as masculine and anti-social, while recent research has sought to understand students' nuanced conceptions of the field and their place in it. Martin's early work, for instance, asked students to "draw a computer scientist," and their students in introductory courses uniformly drew nerdy men, while a small handful of students doing CS research went firmly against that trend [6]. Similarly, Carter's survey of 836 high school students highlighted a common image of computing as sitting in front of a computer and programming [7]. Another study of 133 students' biographies about computing describes in detail the differences between students who see themselves as "insiders" in CS and as "designers" of computing technology, on the one hand, and those who position themselves as "outsiders" and "users" on the other [8].

More recently, Hewner's study of 37 Georgia Tech students and advisors described three conceptions of CS: the first focuses on theory and mathematics, the second on programming, and the third on interdisciplinarity and "a wide variety of applications." Hewner further argues that the students' conceptions of CS lacked detail and showed confusion about curricular choices [9]. Additional studies have investigated the relationship between students' conceptions of CS and their degree choices [10, 11] or attitudes toward programming [12].

We note the gap that student conceptions of the subfield of ICTD has not yet been explored, though ICTD curricula have [2, 3, 4].

Our study's aim to explore how undergrads understand their involvement in ICTD research also builds upon prior work that has studied service learning and the value of social good in broadening participation in computer science education. Both the ICTD capstone and the undergraduate research work are strategies for deeply involving students in computing for social good through service learning. Prior work in computer science education asserts the value of computing for social good in CS curricula. For instance, Goldweber et al. recommend "motivating computer science students by adding the context of social good to introductory computing assignments" to "exploit the finding that students' desire to have a positive societal impact is a strong determinant regarding their selection of a major" [13]. This claim that computing for social good can make CS more appealing to diverse groups of students has been taken up in the CS education literature [14, 15, e.g.]. Notably, Sax et al. conclude from a logistic regression of long-term national US survey data that "women's relatively stronger social activist orientation serves as one of the key explanations for the gender gap in computing," which they interpret to mean that "efforts to attract women to computer science will need to highlight the ways in which the field positively impacts communities—locally and globally" [16]. With such significant expectations for the role of computing for social good, it is crucial to understand in detail students' experiences of "CSG-Ed [CS Education for Social Good] endeavors."

Such calls in the literature have been reflected in course offerings for CS undergraduates. ICTD courses are offered at the undergraduate level in a number of CS departments, and CS courses based on a service learning model are also not uncommon. Leidig et al. describe one such CS capstone, emphasizing project management skills (e.g., requirement gathering, project scoping, communicating timelines) as key learning objectives [17, 18]. Buckley et al. describe a software engineering capstone using "socially relevant" projects; they emphasize how effectively the chosen projects motivated their students [14]. The most in-depth way to include computing for social good in CS curricula has been through capstone courses. In a mechanical engineering context, Shekar investigated students' perspectives on and understanding of humanitarian engineering. Based on a feedback survey at the end of their course, Shekar argues that their students expanded their views of the role of engineers [19]. Hislop et al. provide valuable survey data about Humanitarian

Free and Open Source projects in software engineering courses across six institutions, finding a positive effect on student learning and motivation/interest [20]. The survey method however does not reveal what students' participation in the course means to them. Building on these arguments, our study addresses the gap in empirical understandings of CSG-Ed courses from the perspective of students, locating ICTD as an example of CSG.

Theoretically, we build on the *career funneling* concept developed by Binder et al. Based on interviews with students at Harvard and Stanford, they define career funneling as the process by which "student cultures and campus structures steer large portions of anxious and uncertain students into high-wealth, high-status occupational sectors," specifically finance, consulting, and "high-tech jobs" [21]. Their analysis revealed several mechanisms by which students learn to value a narrow set of careers: the low knowledge of career possibilities that undergraduates possess when they enter college; the competitive drive at recruitment season when certain industries dominate career fairs and on-campus interviewing; and the internalized and reinforced social pressure to attain a career worthy of one's elite degree. All of these work together to rule out other careers as worthy of pursuit.

In the CS context, Cui identified a career funneling pattern into a small set of "Big Tech" companies, "including but not limited to Google, Facebook, Apple, Microsoft, and Amazon" [22]. Cui argues that the process happens implicitly, as a common-sense default path, rather than as a specific conscious decision [22].

The connection between student conceptions of CS and their subsequent career pathways, especially those around social impact careers, is understudied. Our study refines the theory proposed in these papers and illustrates one way in which the theory plays out in the context of social impact careers and CS undergrads.

#### 4. Methods

Overall, our study design—including the choice of interviewees, the interview method, and the data analysis—uses an interpretivist, constructivist approach [23]. The data for this study focuses on interviews with affiliates of the CCIS project. The CCIS project is a useful case to study because it seems successful on a number of factors: students have chosen to continue participating for multiple quarters, they are generally quite enthusiastic about the project, and their contributions are directly enabling deployment of the system nationally in Uganda. We interviewed every student who was working on the CCIS project during Summer 2020, as well as all five students from the

2019 capstone course who worked on the project (nine students total). To supplement this data, we also interviewed the instructor and graduate teaching assistant from the capstone course.

Interviews were conducted by both authors together in Summer 2020. Though this was a full year after the capstone concluded, all five of the students from the capstone continued with the project until at least Fall 2019, with one continuing through Summer 2020. The five capstone students had graduated by the time of our interviews and were on their way to full-time software jobs; the four other research assistants are still UW students. More details on the interviewees is in Table 1. Because our data collection is a year removed from the capstone course itself, we report on students' involvement in the CCIS project as a whole, including the significant work that came after the capstone.

Interviews were semi-structured with open-ended questions about their experience, approximately 30-60 minutes. We opened each interview by broadly asking each participant, "Tell us about your involvement in the cold chain project?" Then we followed up by asking how students came to be involved in the project, what they got out of it, the challenges they faced, critiques they may have had of the project, and their thoughts on ICTD and development, which often became discussions about "social good" in computing. We also asked students if they felt their views of CS had changed as a result of being involved in ICTD. The data used in this paper are a subset of the data for our larger project, an in-depth study of all the stakeholders in the CCIS project, both at the University of Washington (UW) and beyond. We use pseudonyms for all participants.

After fully transcribing interviews, we analyzed the interview transcripts through collaborative open coding based on in-depth discussions about each paragraph of each transcript, focusing on our research questions about conceptions of ICTD and computing careers. For example, codes included, "baseline is working at a tech company," "shared values with other students," and "adoption is success." Quotes are edited to remove repeated words and filler words (e.g., "like"). Through our detailed discussions, we identified patterns in narratives, justifications, assumptions, and word choice across individual codes. We used these patterns to synthesize the argument presented in this paper, including the development of the concept "deferring social impact." Our interpretive stance was to treat interviewees' statements as true accounts of their experience and seek multiple perspectives. Our goal is first to present an empirical account faithful to our participants, and second to reflect

on how undergraduates conceptualize CS and ICTD. Throughout the paper, we use the terms “social good” and “impact” because these are the terms in which students understand their work.

**4.0.1. Author positionality** These interviews were particular sorts of conversations conducted over the internet during a global pandemic. Like any conversation, the interviews were indelibly shaped by the relationships between the interviewees and interviewers. We account for the conditions under which our interviews were conducted in pursuit of feminist objectivity. Feminist objectivity asserts that *all* knowledge is situated and advocates for the contextualization of knowledge rather than the denial of its constructedness [24]. The following positionality statement contextualizes our knowledge claims.

Years ago, both authors were exposed to ICTD through a project-based undergraduate computer science course, in a manner similar to our interviewees. Our experiences with ICTD are necessarily part of our interpretation of the data. Philip is also a research assistant on the CCIS project, though he was not involved until after the completion of the capstone course. We were wary that this position may make participants more inclined to present their experiences in a positive light, so Lucy asked direct questions about students’ concerns with the project and their work on it. The instructor of the capstone is Philip’s PhD advisor. Lucy is based in a separate university and unaffiliated with CCIS. For our analysis, these are valuable complementary positions: Philip’s context and relationships to participants ease understanding of the data, while Lucy brings an outsider perspective.

## 5. Findings

Our findings first discuss the students’ conceptions of CS and ICTD. We find a trend that students believe ICTD work has social impact, in contrast to mainstream CS, which they associate with large tech companies and for-profit motivations. Students also reflected that much of their CS curriculum did not expose them to ICTD or social impact applications of CS. The second section of our findings focuses on the students’ anticipated career paths. Most students took or planned to take jobs as programmers at large tech companies. Some students planned to defer the social impact they desire by leaving such jobs later, while others hope to find a way to contribute to social impact within industry. The students who wanted to center social impact in their careers considered going into academia since it seemed the most feasible path to continue to do so. These findings are of interest to software engineering and computing

educators since they raise questions about how and why we include computing for social good in our curricula.

### 5.1. Conceptions of ICTD and CS

Our interviews found that students had common conceptions of the field of CS. Students associated CS with gaming, innovation, and industry jobs as programmers, affirming prior findings [7]. They contrasted these with social impact and ICTD. Behind this conception of CS as affiliated with gaming and industry is a critique voiced by some of the students that CS is oriented to profit and service to the wealthy. Some students put it more mildly by noting the difference between technology developed for people who “need” it and products for resource-rich users. The students noted that the path through their undergraduate education does not make social applications of computing an obvious component of CS, and that they had to seek out opportunities to become involved in ICTD, which “opened their eyes” to a broader conception of CS.

#### 5.1.1. Contrasting conceptions of CS and ICTD

When students reflected on how their views of CS were impacted by their involvement in the cold chain project, some students described prior conceptions of CS as associated with gaming, innovation, and automation. For example, Kushal says,

I remember, you know, just [thinking] like, oh, CS, I can make this game. We can write the cool script and automate things and everything. But I never really thought about [CS] from the perspective of how you can actually make someone else’s life better by just using the technology that you have available to you.

In characterizing their experiences with ICTD, students explicitly used industry programming jobs as a foil. As Shen Wen says,

It’s not like industry because compared to my previous internship experience [it’s] kind of different from this one because for this we kind of work for social good. . . An ordinary computer science path will be after [you] graduated, you will be working like a software developer.

Ramita similarly positioned her experience with the cold chain project in contrast to her past schoolwork and internships.

Our findings reveal a pattern in which students see their conceptions of CS in general as a foil to their understanding of ICTD. Associating CS with games, automation, and software development careers confirms

Name	Pronouns	Year in program (as of Fall 2020)	Took the capstone?
Amy	she/her	Graduated	Spring 2019
Shen Wen	she/her	Graduated	Spring 2019
Sam	she/her	Graduated	Spring 2019
Deepak	he/him	Graduated	Spring 2019
Joe	he/him	Graduated	Spring 2019
Priya	she/her	2nd year	No
Ramita	she/her	2nd year	No
Kushal	he/him	2nd year	No
Katie	she/her	5th year Masters'(Electrical Engineering)	No

**Table 1. Interviewees' pronouns, year in program, and involvement in the 2019 capstone course**

prior work, and the consistency with which students related CS and ICTD as contrary rather than hierarchical or compatible is a novel finding from this study.

**5.1.2. Critiquing profit orientation of CS** Some students emphasized that ICTD work does not fit the for-profit orientation they see as dominant in CS. Katie shared her view of the dominant values of CS when she explained how she had come to find ICTD after considering dropping out of engineering.

I was considering if I should drop out of engineering, because everybody's so into making the next biggest thing to become richer... to me it's unimportant, things to make the world better for people who are rich. And I'm like, oh, maybe I should just not do this because I don't think my values align with the work that I'm doing.

Katie is negotiating the tension between her critical analysis of computing and her participation in the field. Joe shared a similar sentiment when we asked about his thoughts on ICTD.

Well, at least among my peers in UW, a lot of people in UW, when they do computer science, it's always for profit. Money, because all these big tech companies in Seattle give six figure jobs for new grads. It's very tempting to just take it, they're like, "I don't even need to get promoted. I'm already getting 6 figures." Well, when you work for a nonprofit organization or like what we're doing, we're doing it for free. It's not rewarding in a physical sense, like you don't get money. You're putting time to something that's not going to pay you... it's very hard for someone to choose getting paid very little... So I think this kind of software and helping, building technology for these kind of problems that no one wants to help because you can't profit from it.

Some students acknowledged that working on enterprise projects could still potentially affect some people's lives for the better. But they contrasted the kind of impact that one would have shipping code for a tech giant that serves well-resourced groups with the impact one could have working on ICTD projects for people who "need" the results. Amy elaborated this perspective when sharing her thoughts on ICTD.

... people are doing these projects to make the world better in places that are not just our community. So I'm happy I was able to contribute to something that is not just like cloud storage for people that need more storage and stuff even though that's really cool. But it's also just the different audience and not making an impact in, to every—to lots of people.

While not denying the impact that mainstream software development careers can have, students voiced a critique that such careers only served wealthy consumers. Such critique is important for CS educators to understand and grapple with in the pursuit of a robust and diverse experience of CS undergraduate education.

**5.1.3. Discovering ICTD** Students noted that this default conception of CS as associated with programming jobs in industry and gaming-oriented innovation was not unsettled by the standard courses and requirements of the CS curriculum. Kushal pointed out that his extracurricular choices to be involved in social impact hackathons helped him to discover the world of ICTD.

I think it really opened my eyes, opened my eyes to this other side, of CS, that I did not know. But my formal education, I don't think it... exposes us in such a way that we actually think about those things. I guess it was the choices that I made along the way.

Deepak also uses the language of “eye-opening” to describe his experience with ICTD, contrasting it to the “tech bubble” where resource-rich CS students do not have many opportunities to consider how the “rest of the world” functions.

I feel like people should go through that. Even working with non-profits, they just give you that kind of experience where you get out of the tech bubble a little bit and you’re just like, oh, my God. Like the rest of the world doesn’t function how we think it functions, which is eye opening to some extent. And it’s important to consider even when you’re in that tech bubble.

Katie, an electrical engineering major who had considered leaving engineering altogether, only found out about ICTD through the instructor of one of her introductory programming classes, when she had lamented to him the misalignment of her values with what she saw as the dominant values of the field.

And then he was like, honestly, you are like completely wrong. There is work out there within CS or electrical engineering and engineering in general that work for global good. And he told me about ICTD.

For Katie, the mainstream view of CS/electrical engineering was demotivating, but the possibility of global good work led her to stick with it. Katie’s trajectory parallels that of a high school student featured in a recent case study [25]. The high school student initially viewed her activist political identity as incompatible with the values of CS and “unfeeling oppressive corporations.” However, like Katie, she saw her activist identity as more compatible with CS after engagement with technology-for-social-good projects.

Students who use programming or gaming to characterize their prior conception of CS align with prior literature. However, the critical position that CS in general is *not* associated with social impact but rather with earning money by serving the wealthy is less documented in prior research. This finding enriches our understanding of why students might leave computer science (or, in Katie’s case, electrical engineering). Students who feel this way may provide some explanation for the statistical finding of Sax et al. that social activist values are a strong predictor of not majoring in computer science [16]; future research could try to understand the shape of such values in more detail. Despite the capacity of ICTD to help students with social activist values continue in computing majors, students are not initially aware of the subfield. This aligns with Hewner’s broader finding that undergraduates often are unaware of subfields of CS [9].

## 5.2. Deferring social impact

Students told us they would take or had already taken a corporate tech job but had concerns about how they would feel having chosen a path that does not center social impact. Several students were hopeful that their computing work could continue to serve a diverse global audience in the future. These students planned to establish more skills and/or financial resources first. Though the students generally saw corporate jobs as incompatible with social impact, one student asserted that he had continued on the social impact path at such a job where he got to work on pro bono projects. Two students who expressed tension between social impact and industry careers considered going to graduate school since they saw academia as the only way to continue to center social impact in their work. We propose the concept of *deferring social impact* to describe this phenomenon in our data.

**5.2.1. Ambivalence about career choice** When we asked students about whether they planned to continue to be involved in ICTD, almost all of the students shared that they planned to work at a large tech company as their first job after graduation. Students felt ambivalence about this career path, expressing concerns about feeling a lack of fulfillment since they believed industry jobs would not allow for the kind of social impact they appreciated about ICTD work. Amy’s reflections on her career plans capture this ambivalence.

I don’t know. I’d like to [continue doing ICTD]. At the career fair there seemed like there were some companies that had an option like that [referring to social impact], but most of them were more like not that. If the opportunity arises, I think that’d be really cool. I don’t know, I’m just starting my career. So we’ll see where it takes me for a little bit. I was a little worried about computer science being not fulfilling and feel[ing] like I’m not, like I wouldn’t be giving back. So I think if I start to feel like that, I might try and return, see what’s out there.

Amy highlights the central role of the career fair in her decision making, which aligns with the career funneling theory. At the time of our interview, Amy had just graduated and accepted a full-time job offer from a large tech company.

The explanation proposed by the career funneling theory suggests one plausible interpretation of Amy’s ambivalence—that she ended up in a Big Tech job not because it was what she was most excited about but because of the structure and norms of job seeking at

UW. Similarly, Kushal told us that he wanted to have an industry job even though he also hopes to continue to be involved with ICTD work.

I think at least part of me would be involved [with ICTD] in some or the other way. I do want to go to industry and see what's in the industry. I haven't had my first proper exposure to the industry yet. So I am planning to take a sneak peek and see what's happening out there. But other than that I feel like even if I do go in that direction, I still will at least, a part of me, in some way or the other, would be involved with trying to get the best out of technology for other people.

Kushal's reasoning for seeking a Big Tech job is more explicit, but his belief that one should have a "proper exposure to the industry" indicates that that career path is a default.

**5.2.2. The timing of social impact** To manage her concerns about her upcoming job "being not fulfilling," Amy articulated a long-term strategy in which she may try to find other jobs that better match her values, to "see what's out there." In a similar vein, Katie reflected on advice she received about her potential career paths to defer her interest in technology and global health.

I wonder what the best would be in the end, whether it's more appropriate to go somewhere to learn more technical skills before I jump in [to ICTD]. 'Cause I think some realistic advice that people would give me who are not in this, they're like, just do that when you retire or do it when you're old.

The logic of this advice, Katie elaborated, is that in ICTD (or related fields) it is hard to get paid well and hard to get technical mentorship, so one should first accumulate those resources elsewhere.

Professor Anderson told us that he has heard such advice is often given—that one should become settled financially and also gain experience as an engineer working on large scale products. Though skills from industry may be a good way to be more effective later as an engineer doing social good, in all likelihood many of those who go to industry are not going to return to ICTD because, as Professor Anderson put it, "life takes over."

Sam saw her new Microsoft engineering job as a way to gather resources, including the institutional support of her employer (emphasis added).

I definitely see myself being involved in some way in the future, even if right now that's

currently, I have a pin on it because I'm just starting my first full time engineering job at Microsoft, and yeah, which is, it's been great, but it's something where *once I start becoming more comfortable and start seeing the time and the resources, I can start pursuing and seeing where those other opportunities lie*, and maybe see how a company like Microsoft could help with it. How maybe I can be involved later or take a sabbatical.

In this way, accumulating resources is seen as a reason to defer impact. For Shen Wen, conditions of her scholarship required her to take a job at a bank in Malaysia (her home country). She wants to propose mobile banking at her company to help the unbanked, thus also planning to keep some involvement with from within industry. And she wants to eventually teach CS in Malaysia—which she identifies as a developing country—to build capacity. Sam and Shen Wen's perspectives indicate that, while they do not see social impact immediately in their careers, they hope to be able to incorporate it in the future.

**5.2.3. Alternate Pathways** Some students' discussion of their career paths did not fit the trend of deferring social impact. In contrast to the other eight students, Deepak saw his work at Microsoft as contributing to social impact already because he was able to get assigned to Microsoft's relatively rare projects in the public and nonprofit sectors.

I started at Microsoft and the first thing I did was look for this kind of work. And I don't know why I am so interested in it or why it's so fun for me, but it's almost something that, like, I need to do, at least for some of my time.

Though most of the students described Big Tech jobs in opposition to social impact, Deepak has found a way to do work that aligns with his values.

On the other hand, Katie and Priya shared that they were considering going into academia or pursuing a PhD as it was the most viable path they saw to centering social impact as their career. In Priya's words,

I also feel like the opportunities in this field are pretty limited as far as I know. . . . I really don't know if I would pursue a Ph.D. or a Masters or continue in a lab or continue this research or try to go into industry. So I feel like if I go down the research route, there are so many opportunities for computing in development. But if I go down the industry route, it might be difficult for me to

continue this because I don't know if there are a lot of companies...

For Katie, despite the advice she received about going to industry to get money and experience, her ideal path would be to become a professor and run an interdisciplinary engineering lab focused on global health technology. To pursue that, she was considering applying for PhD programs.

Through their reflections on ICTD research involvement, students contrast their desire for social impact (which they see as being realized through ICTD work) with traditional CS jobs, yet they still take the traditional jobs through patterns of career funneling recognized in prior work. Even though most do not intend to do the social impact they desire immediately, they all hope to include (or even center) social impact in their jobs eventually. We refer to this as deferring social impact. Investigating students who instead eschew the default CS career path, Cui argues that, "The legitimization of alternatives is a crucial step to transitioning students from reluctantly recruiting for Big Tech companies to confidently pursuing alternatives." Among students we interviewed, ICTD and related areas were described to us as valuable and interesting, but when it came to career decisions, mainstream industry jobs won out. It is one thing for alternative fields to be legitimated broadly, but legitimating specific career paths for new graduates is another.

Finally, we caution that these findings should not be read as a general fact about CS students interested in social impact, but as an interesting phenomenon among some. In contrast, when reporting on an earlier iteration of this same capstone course a decade ago, Anderson et al. stated "Several students from the course are planning to continue work in ICTD in graduate school, another accepted an ICTD-related internship" [2]. Conversely, it may be the case that some of our interviewees saw us as "doing ICTD" and therefore presented themselves as more likely to pursue social good work.

## 6. Discussion

### 6.1. Deferral and other careers

Although they contrast social impact with mainstream engineering jobs, most students still took or planned to take jobs as programmers at large tech companies. Most students planned to defer the social impact they desire, either by leaving such jobs later or by seeking a way to contribute to positive social change within industry. The students who wanted to center social impact in their careers in the short-term saw academia as the most feasible path. We do not

seek to make normative judgements about students' career choices; students with more privilege may feel less pressure to select a high-paying job. Identifying the deferring social impact phenomenon contributes an elaboration of the career funneling theory introduced by Binder et al. who traced linkages between prestige, job recruitment, and insecurity [21]. And the concept is not entirely new, even if the name is; Giridharadas's portrait of Hilary Cohen documents in detail her decision to defer her plans to contribute to social change [26].

Binder et al. [21] focus their career funneling theory on mechanisms that explain why undergraduates value a narrow set of careers as prestigious. As a follow-on to their main findings, Binder et al. note that students also deferred the career they really wanted in favor of a more prestigious first job. They note that "the belief they could later get the career they really wanted undergirded interviewees' justifications for taking jobs they felt compelled toward now—jobs that shored up prestige and kept fears of the inscrutable job market at bay." We see a similar pattern in our data, where students end up taking a job at a large tech company despite their concerns about their ability to have social impact with such careers. Our findings show students' belief that this work experience will enable them to make social impact later, since they may become more skilled at software engineering through their work experience or may have access to more resources through their affiliation with a large company.

In Peters's longitudinal study of students' participation in CS, one student shifted away from trying to combine politics and computing since "he doubts he can find a job that 'is about saving the world'" [27]. This example parallels the experiences of the students described in section 5.2.3 who are interested in going into academia to pursue ICTD-adjacent work because they do not see such a career path in industry. In Peters's analysis, students' interdisciplinary interests are marginalized and "[p]erforming an identity as a (technical) problem solver helps to fit in."

The phenomenon of students who are motivated by social impact taking mainstream jobs is also reported by Giridharadas, with a case study in the consulting industry. He tells the story of Hilary Cohen's choice to go to Goldman Sachs after graduation [26, p.22].

She considered jobs in the nonprofit sector that had been advertised on campus or online. Somehow, though, they felt risky to her. Sure, she would be cutting to the chase of making a difference, but wouldn't she be forgoing the skill-building and self-cultivation offered by the big private-sector firms? Some of the NGOs she looked at seemed to have no career plan for



a young person, no promise of a trajectory of growing responsibilities and impact.

Giridharadas goes on to dismantle the claim that training in consulting is the best way to “change the world,” but the parallel in computer science is murkier: scholars disagree on whether software development skills learned in Big Tech may transfer to “social good” work.

## 6.2. Implications for Computing Education

Amid concerns about dropping enrollments, CS educators in the mid 2000s were concerned that students were not interested in the field. Schulte and Knobelsdorf motivated their 2007 paper citing these enrollment statistics and arguing that, “When looking at students in general, we have to admit that CS has never been popular” [8]. Four years later, Lewis et al. investigated CS enrollment with similar concerns and referenced “signs of a possible turnaround” [28]. In the context of both overall enrollment concerns and computing education’s persistent research focus on the gender gap in enrollment, computing for social good was presented as an antidote—a way to recruit more students to the field and appeal to more women. At UW in 2021, computer science is one of the (if not *the*) most prestigious and in-demand majors. Our data show that in this case many students reported that the involvement in ICTD research transformed (positively) their thinking about CS. Anecdotally, it seems that as a whole CS majors at UW are more likely to focus on Big Tech jobs than social impact—we hypothesize that this can be attributed to career funneling.

Sax et al. found that “social activist values” was the most statistically explanatory variable in their data for the gender gap in computing majors at the undergraduate level [16]. Our data suggest one possible explanation for this link: some students are concerned about the position of computing in global capitalism. In such students’ analyses, mainstream computing focuses on serving the needs of the wealthy. This is both a new contribution to the literature on conceptions of computing and a challenge for computing education and computing as a whole. In light of the gap between students’ desired social impact and their ambivalence about their career paths, as CS educators we should ask ourselves whether we teach computing for social good because we value its outcomes, or because we see it as a carrot to entice students (particularly women) into CS classrooms.

## 7. Conclusion

In response to RQ1 (how undergraduates understand their involvement in ICTD), we find that students narrate

their involvement in terms of social impact. They describe ICTD and social impact in contrast to the default values of computing, which several students critiqued for being overly invested in profit and serving privileged ends. The default pathway of software engineering does not perturb this view of computing as serving the privileged, and students described their encounters with ICTD as “eye-opening.”

In response to RQ2 (how the students reason about their career goals), we find that respondents tend to express ambivalence about their CS and software engineering career choices. All of the students expressed the hope to continue to combine social impact and computing work, yet they often chose to take mainstream jobs at big tech companies where they were concerned about not being able to make such impact. Several students voiced a plan to defer social impact until a time at which they had more resources and skills after working at a mainstream tech company. Those who did not plan to defer social impact sought academic paths.

Our findings suggest some directions for future work. Studies on the connections between CS students’ desires for social impact and career paths among other populations (e.g., other types of institutions, other countries) or over a longitudinal timespan could expand our understanding of the decision to defer social impact. Our findings demonstrate the importance of understanding the specific mechanisms of career funneling in computing, though this is currently limited to the work of Binder et al. [21] and Cui [22]. Moreover, computer science and engineering departments should be working to familiarize students with a diversity of computing careers, and future research can explore whether/how this can broaden conceptions of computing.

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