Understanding Professional Identities and Goals of Computer Science Undergraduate Students

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ABSTRACT

Understanding professional goals and identities of undergraduate Computer Science (CS) students is critical for curriculum decisions, workforce development, and retention programs. This paper aims to explore the ways in which undergraduate CS students describe their professional goals and identities, and gauge how these goals and identities vary across gender and academic standing. This paper is part of a larger study aimed at understanding how students form their professional goals and identities. In the study presented in this paper, we surveyed 109 CS undergraduate students and interviewed 14 CS undergraduate students across gender and academic standing. The data were qualitatively analyzed using inductive coding and thematic analysis. Our findings indicate that most students identify themselves professionally as software development professionals, various specialized CS professionals, and by their majors. We also found that both male and female students were interested in becoming entrepreneurs, and females were more likely to have professional goals to move into management. This paper contributes to the fields' growing knowledge of undergraduate students' professional goals and professional identities. This knowledge can help CS departments to better align their degree programs, curriculum, and specialization tracks with student goals. Such an alignment has the potential to increase retention in the major as well as prepare students to be competitive in the workforce.

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1 INTRODUCTION

Computing professionals are diverse and form intersecting communities of practice. While there are official pathways to earning credentials to become part of most professional communities of practice, participation in the community is essential for membership within the community [13]. Lave & Wenger's theory of Legitimate Peripheral participation [6] suggests that most people start off on the periphery of communities of practice. In the context of undergraduate degree programs, courses, projects, internships, research, and full-time employment offers a student an initial opportunity to participate in computing communities of practice. As academic institutions, our role is to create pathways for career preparation through our degree programs to help students gain entry into various computing communities of practice. Thus, we play a role in the initial development of students' professional identities.

Professional identity enables a person to be technically competent, self-confident, and experience a sense of belongingness to the profession [9]. We know from prior research that students are more likely to persist in CS1 when they are able to make connections between computing concepts and their goals and life experiences [7]. We also know that we experience attrition during the first two years of our degree programs as students re-evaluate their interest and fit [1]. While research has linked persistence among women and underrepresented minorities to belongingness [12], there is also research that suggests that students of both genders often leave because of their perceptions of computing, the computing community, and its alignment with students' lifestyle goals [2].

Therefore, we argue in this paper, that it is necessary to understand the development of students' professional identities, career goals, and degree expectations over the span of their 4+ years in our undergraduate CS programs as it shifts and changes. The research presented in this paper is part of a larger study aimed at understanding students' computing professional identity and goals through the development of their technical competency and confidence gained through their degree experiences, professional experiences, independent skill development, and social supports. For this paper, we focus on identifying students' professional goals and identities.

2 BACKGROUND

Identity theory research describes identity and identity development as multiple dimensional. The operational definition

of identity put forth in the Handbook of Identity Development by Schwartz, Luyckx, and Vignoles [10] states *"viewed through the lens of an individual person, identity consists of the confluence of the person's self-chosen or ascribed commitments, personal characteristics, and beliefs about herself; roles and positions in relation to significant others; and her membership in social groups and categories (including both her status within the group and the group's status within the larger context)"* [10].

Theories of personal identity tend to focus especially on individual-level processes and often emphasize the agentic role of the individual in creating or discovering his or her own identity [5]. Marcia's identity status theory suggests that professional identity is just one facet of an individual's identity that also includes an individual's social, personal, and cultural identity. Marcia suggests that professional identity is formed usually between the ages of 17-23, traditional college age [5]. Marcia's theory proposes that a well-developed professional identity gives a sense of one's strengths, weaknesses, and individual uniqueness [5]. Marcia's Identity Status theory also suggests that identity changes over time based on a person's active or passive exploration and commitment to their chosen profession [8]. We believe this theory offers insight into how and why undergraduate students' awareness and development of their professional identity and goals changes during their 4+ years in our degree programs.

We define *Computing Professional Identity* as the transformation of one's interest in computing into seeing one's self as a person who does computing and self-identifies with one or more computing sub-disciplines and career paths. Evidence of computing professional identity development is demonstrated by a commitment to develop technical competencies and skills and to engage in continued professional development within one or more computing fields, or an interest in using technical skills and knowledge to solve problems and/or generate new knowledge with computing approaches, techniques, and tools.

3 METHODS

3.1 Study Design

The study presented in this paper focuses on identifying the professional identities and goals of CS undergraduate students and investigates the variation of CS professional identity and goals across gender and academic standing. The study was approved by our university Institutional Review Board. We surveyed and interviewed students enrolled in an undergraduate CS degree program at the University of Florida, Gainesville in the United States. The university has a population of 1700 undergraduate CS majors. The degree program does not offer a specialized track in any subdomains of CS. The average age of the participants was 18 to 23 based on our enrolled population. Our study explored the following research questions:

RQ1. What are CS students' professional identities?
RQ2. What are CS students' five-year professional goals?
RQ3. How do CS students' professional identities and goals vary across gender and academic standing?

3.2 Participants

Surveyed Participants

Students were recruited from our university's CS1, data structures, software engineering, AI for Computer Games, and senior design courses, as well as several HCI and CS technical electives. The survey participants were given extra credit for participating in this study - not more than 1% towards their final grade based on pre-approval by the respective course instructors. The second author was one of the instructors who offered extra credit in the software engineering course, but the data was collected by the first author and not shown to the second author until after grades were submitted for the course. 148 students responded to our survey: 115 students completed the survey, 32 completed less than 18% of the survey, and 1 participant did not consent to research. Out of the 115 students, 6 students did not major or minor in CS or Computer Engineering (CE). We chose CE students to include in our sample population as both CS and CE degree programs are offered through the CS department at our university. Thus, we were left with 109 survey participants who completed the survey and were CS or CE majors/minors. These 109 survey participants were undergraduate students who majored in CS (61.5% n=67), CE (33.0%, n=36) or double majored in CS and another subject (3.7%, n=4), or minored in CS (1.8%, n=2). 84 males, 24 females, and one student who did not specify gender participated in the survey. Other demographic details are shown in Table 1.

Table 1: **Demographics of Study Participants**

	Academic Standing (By Year)					Gender	
	Year 1	Year 2	Year 3	Year 4	Year 5-6th	Male	Female
Survey (N=109)	18.3% n=20	14.7% n=16	30.3% n=33	32.1% n=35	4.6% n=5	77.1% n=84	22.0% n=24
Interview (N=14)	21.4% n=3	21.4% n=3	21.4% n=3	35.7% n=5	-	57.1% n=8	42.9% n=6

Interviewed Participants

The interviewed participants were recruited by email, flyers, and a separate question at the end of our survey which asked them if they were willing to participate in an interview. A pool of 14 participants was chosen from 56 students, ensuring that we had a representation of gender, academic standing, and degree program. The interview participants were given a $10 gift card for their participation in a 45-minute interview. The 14 interviewed participants were CS majors (50.0%, n=7), CE majors (42.9%, n=6) or CS minors (7.1%, n=1). Other demographics of interview participants are shown in Table 1.

3.3 Data Collection

We used Qualtrics to administer the survey and gain consent for the study participation. Before the survey and the interviews, participants completed a consent form, followed by a demographic questionnaire. The surveys were completed on average within 24 minutes and each interview session lasted around 35-45 minutes. For the larger study, the survey

participants were asked 12 qualitative questions along with 39 multiple answer questions, and the interview participants were asked 27 open-ended questions, regarding their sense of professional identity, degree experience, professional experience, and social supports. For this paper, we focused our analysis on 2 qualitative questions from the interviews, as well as 1 qualitative and 1 quantitative question from the survey which are relevant to answer our research questions. We interviewed the participants to get a richer data set of students' goals, experiences, and expectations to complement our larger survey data set, and to ensure we were capturing students career interests accurately in the survey. The semi-structured interviews were conducted in person by the first author. The interviews were audio recorded, then transcribed by a commercial transcription service, and reviewed for accuracy by the first author.

3.4 Data Analysis

For this paper, we analyzed student responses to the following two questions asked in the interviews as well as the survey:

Q1. How do you identify yourself professionally?

Q2. Where do you see your career going three to five years after you graduate?

On the survey, Q1 was presented as a multiple select question with a textbox that allowed students to select multiple professional interests (e.g., software engineer, web developer, data analyst, networks engineer, etc.) or add unlisted options to the textbox, and Q2 was an open-ended question. The options on the survey for Q1 were selected using the knowledge areas specified in the ACM 2013 CS Curricula report [14]. 109 participants answered Q1 in the survey, while 107 participants answered Q2 (2 responses were random words). In the semi-structured interviews, these questions were open-ended.

Student responses to Q1 were used as evidence to explore professional identities (RQ1). Likewise, Q2 was used to explore professional goals (RQ2). Further, Q1 and Q2 were used as evidence to explore the variation of students' professional identities and goals across gender and academic standing (RQ3).

We analyzed our data using inductive content analysis and thematic analysis in Microsoft Excel 2016. We were following a grounded theory process of inductive coding [11]. We started with the raw data and created codes inductively using words from participants responses. The first author created primary codes and the second author reviewed the codes and data until a consensus was reached about the code accuracy and reliability. The primary codes were then clustered to form categories, and these categories formed the basis of our codebook. From survey/interview questions Q1 and Q2, we identified 23 categories for each question from our data. From these categories, 5 themes were identified for Q1 and 10 themes for Q2. Table 2 highlights an example of our inductive content and thematic analysis [11].

We then combined categories into themes. This was followed by a frequency analysis of responses within each theme. We counted unique participants when computing these frequencies, to avoid counting multiple responses from the same participant within any theme. The frequency analysis was done separately for the survey and the interview data. In presenting our findings we include the percentage of both survey and interview participant responses to highlight the representative nature of our interview quotes to the larger participant pool of our survey participants.

Table 2: **Inductive Content and Thematic Analysis example**

Where do you see your career going three or five years once you graduate?			
Raw Data	I've always wanted to have my *own company*, just because like I never really liked the idea of like working under someone.	What I want to do is get some experience, and really like hone my skills and then try to *make my own business.*	I'm starting out by doing something stupid and going into independent game development. If everything goes well, I would be *self- employed making games.*
Primary Code	Entrepreneur /Startup	Work at a company - prior to business	Self-employed - making games
Categories	Entrepreneurship		Self Employed
Themes	Entrepreneurship/Self-Employed		

4 FINDINGS

We identified 5 themes for professional identities and 10 themes for professional goals across our survey and interview data. Table 3 represents the themes found in our study. Given the space constraints of this paper, we will highlight prominent trends within each theme in the narrative text and use Table 4, 5, 6 and 7 to summarize our frequency analysis across gender and academic standing for both the survey and the interviews.

Table 3**: Themes for Professional Identities and Goals**

Identities	**Goals**	
Software Development	Getting a job/ Working in industry	Area: Software
Specialized CS/CE	Graduate school/ Research	Area: Specialized CS/CE
Identification by major	Other goals: location, success, etc.	Area: Management
Indecisive/ Unknown	Entrepreneur/ Self-employment	Area: Non-CS
Non-CS	Indecisive/Unknown	Area: Technical

4.1 Professional Identities

In both the survey and the interviews, the participants described their professional identities as software development professionals, specialized CS/CE professionals, and by their majors. However, there were a small number of participants who were indecisive about their professional identity, or identified themselves as non-CS professionals. In the following sections we will present the findings for each of the identity themes.

Software Development

"I would wanna be a software engineer at this point. That's like where I would go towards. I'm not really a hardware person. Like I like the idea that, sort of, like actually making the systems and stuff. I really like the coding and programming aspect."

- Student A, female, freshman

Like Student A, 50.0% of the 14 interviewed participants (n=7) identified themselves as software professionals, in particular, they identified themselves as software engineers, software developers, or software programmers. Likewise, 81.7% of the 109 survey participants (n=89) described a similar identity. We found that the majority of both male and female participants in the survey identified themselves as software professionals: 79.2% females (n=19) and 82.1% males (n=69) identified themselves as software professionals. Similarly, across academic standing over 77% of participants in the survey identified themselves as software professionals (Table 5).

Specialized CS/CE Professional

"I think the coolest thing is augmented reality, and just augmenting people, in general. So that's my goal, probably."

- Student B, male, sophomore

We also found a dominant theme around students describing themselves professionally as specialized CS/CE professionals. 42.9% of the 14 participants (n=6) in the interviews and 58.7% of the 109 participants (n=64) in the survey were interested in pursuing careers in specialized CS or CE. Subfields in CS/CE or cross-disciplinary fields, including cybersecurity, data science, web development, and product management were included in the specialized CS/CE theme. Out of 64 students in the survey who identified themselves as specialized CS/CE professionals, Web Development (62.5%, n=40), Computer Security (20.3%, n=13), and UX Design (18.8%, n=12) were the most prominent professional interests. Further, most females (54.2%, n=13) and males (60.7%, n=51) in our survey identified themselves as specialized CS/CE professionals. Results from our surveys show a growing interest in CS/CE specializations from 45.0% during freshman year to 71.4% during the senior year.

Identification by major

"I feel like a computer scientist, not a software engineer."

- Student C, male, senior

Some students like Student C explicitly described their professional identity by their degree major. The categories that were included as a part of this theme included identification as CS/CE Engineer, well-rounded professional in CS and Electrical Engineer (EE), and Computer Scientists. 42.9% of the 14 interview participants (n=6) and 17.4% of the 109 survey participants (n=19) described their identity by their major. We also observed in the interviews that more males (50.0%, n=8) were prone to designate themselves by their majors when compared to females (33.3%, n=2). In addition, juniors (100%, n=3), and seniors (60%, n=3) were more likely to define their professional identities by their majors when compared to freshmen (0%, n=0) and sophomores (0%, n=0). These findings were consistent with the survey (Table 5).

Table 4: **Themes for Professional Identities in Interviews**

Themes	N=14	Academic Standing				Gender	
		Year 1 n=3	Year 2 n=3	Year 3 n=3	Year 4 n=5	Male n=8	Female n=6
Software	50.0%	100.0%	33.3%	33.3%	40.0%	37.5%	66.7%
Specialize CS/CE	42.9%	66.7%	66.7%	0.0%	40.0%	37.5%	50.0%
Major	42.9%	0.0%	0.0%	100.0%	60.0%	50.0%	33.3%
Indecisive	14.3%	0.0%	33.3%	0.0%	20.0%	0.0%	33.3%
Non-CS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5: **Themes for Professional Identities in the Survey**

Themes	N=109	Academic Standing				Gender	
		Year 1 n=20	Year 2 n=16	Year 3 n=33	Year 4 n=35	Male n=84	Female n=24
Software	81.7%	90.0%	81.3%	81.8%	77.1%	82.1%	79.2%
Specialize CS/CE	58.7%	45.0%	50.0%	54.5%	71.4%	60.7%	54.2%
Major	17.4%	10.0%	12.5%	21.2%	20.0%	19.0%	8.3%
Indecisive	5.5%	5.0%	12.5%	9.1%	0.0%	3.6%	12.5%
Non-CS	1.8%	5.0%	0.0%	0.0%	0.0%	2.4%	0.0%

Indecisive/Unknown

"That's a question I've just been asking myself recently as I near graduation and as of right now, I find it kind of hard to decide."

- Student D, female, senior

Similar to Student D, 14.3% of the 14 interview participants (n=2) and 5.5% of the 109 survey participants (n=6) were not sure about their professional identity. They either reported that they were trying to explore and figure out their identity, or perceived that they were too inexperienced in CS to decide their professional identity. 8 participants: 33.3% of 6 females (n=2), 0% of the 8 males (n=80) in the interviews, 12.5% of 24 females (n=3) and 3.6% of 84 males (n=3) in the survey, reported that they were indecisive about their professional identities.

Non-CS Professionals

"History, law" *- Student E, male, freshman*

Two male students like Student E, 1.8% of the 109 students in the survey (n=2) described their professional identities as Non-CS professionals including occupations like a lawyer, and a historian. 1 of these participants was a freshman double major in CS and history, while the other was a 5th year CS major.

4.2 Professional Goals

In both the survey and the interviews, the participants were asked to describe their 3-5-year career goals. We identified 10 themes shown in Table 3. These themes were divided into two aspects: their career goals and the areas of interest in their workplaces. Most of the career goal areas aligned with their professional identities. A frequency analysis of these themes for the interviews and the survey is shown in Table 6 and Table 7 respectively. Two male students, a freshman, and a junior responded random words as their professional goals in the survey and were excluded from the frequency analysis leaving the total survey participants to 107 for professional goals.

Getting a Job/Working in Industry

"Straight into industry. Maybe will have worked at two different companies 5 years after graduation."

– Student A, male, junior

Like Student A, 85.7% of the 14 students (n=12) in the interview expected to work in the industry after they graduate. Similarly, in the survey, 64.5% of 107 participants (n=69) preferred to work in the industry. Out of these 69 survey participants, 55.0% participants (n=38) aspired to work in any type of company, 27.5% had career goals to work for an established corporation (n=19), 13.0% wished to work for a start-up (n=9), 4.3% for a small company (n=3) and 1.4% for a nonprofit (n=1). The ranking of the type of workplaces was consistent across the interviews. Over 63% of the males and females expected to get a job. Across academic standing, more than 71% seniors expected to work in the industry.

Table 6: **Themes for Professional Goals in Interviews**

Themes	N=14	Academic Standing				Gender	
		Year 1 n=3	Year 2 n=3	Year 3 n=3	Year 4 n=5	Male n=8	Female n=6
Industry/Job	85.7%	66.7%	100.0%	66.7%	100.0%	87.5%	83.3%
Grad School	14.3%	0.0%	0.0%	66.7%	0.0%	12.5%	16.7%
Other	21.4%	0.0%	0.0%	0.0%	60.0%	25.0%	16.7%
Indecisive	14.3%	33.3%	0.0%	33.3%	0.0%	12.5%	16.7%
Entrepreneur	28.6%	66.7%	0.0%	0.0%	40.0%	37.5%	16.7%
Areas							
Software	50.0%	33.3%	33.3%	33.3%	80.0%	50.0%	50.0%
Specialize CS/CE	64.3%	66.7%	66.7%	66.7%	60.0%	50.0%	83.3%
Management	57.1%	66.7%	66.7%	33.3%	60.0%	25.0%	100.0%
Non-CS	7.1%	0.0%	0.0%	33.3%	0.0%	12.5%	0.0%
Technical	21.4%	33.3%	0.0%	33.3%	20.0%	25.0%	16.7%

Table 7: **Themes for Professional Goals in the Survey**

Themes	N= 107	Academic Standing				Gender	
		Year 1 n=19	Year 2 n=16	Year 3 n=32	Year 4 n=35	Male n=82	Female n=24
Industry/Job	64.5%	63.2%	75.0%	56.3%	71.4%	63.4%	66.7%
Grad School	24.3%	10.5%	31.3%	28.1%	22.9%	18.3%	41.7%
Other	17.8%	21.1%	18.8%	12.5%	17.1%	18.3%	16.7%
Indecisive	15.0%	21.1%	6.3%	15.6%	17.1%	12.2%	25.0%
Entrepreneur	12.1%	15.8%	12.5%	9.4%	14.3%	12.2%	12.5%
Areas							
Software	21.5%	15.8%	18.8%	28.1%	22.9%	22.0%	20.8%
Specialize CS/CE	18.7%	5.3%	18.8%	15.6%	31.4%	19.5%	16.7%
Management	6.5%	5.3%	12.5%	12.5%	0.0%	6.1%	8.3%
Non-CS	6.5%	15.8%	0.0%	3.1%	5.7%	7.3%	4.2%
Technical	0.9%	0.0%	0.0%	0.0%	2.9%	0.0%	4.2%

Graduate School/Research

"I plan on going to grad school and getting an MBA in Information Systems. I would like to be a Database Administrator"

- Student B, female, junior

We found that 14.3% of 14 students (n=2) in the interviews, and 24.3% of 107 students (n=26) in the survey, described their career goals as pursuing graduate school. Out of these 26 students who wanted to pursue graduate school, 61.5% wished to pursue a master's degree (n=16), 26.9% Ph.D. (n=7) and 11.5% MBA (n=3). Further, female students were inclined to pursuing graduate school as compared to males: 41.7% females (n=10) and 18.3% males (n=15) in the survey and 16.7% females (n=1) and 12.5% males (n=1) in the interviews.

Other Professional goals: location, success, creating an impact, major, working on projects, etc.

"Hopefully somewhere I can get a job in the southeastern US."

- Student C, male, junior

We also found a dominant theme around students who defined their career goals in terms of their motivations: working at a specific regional location, being successful, or working on impactful projects: 21.4% of 14 students (n=3) in the interviews, and 17.8% of 107 students (n=19) in the surveys.

Indecisive/Unknown

"As I am only a sophomore, I feel that I am not close enough to determine my career path within the scope of CS just yet since I have yet to take the more specialized courses within my major."

- Student D, male, sophomore

Some students like Student D were not sure about their professional goals. They mentioned that they were not sure or were exploring options. These included 14.3% of the 14 interview participants (n=2) and 15.0% of the 107 survey participants (n=16). Altogether, 11 males and 7 females were indecisive about their career goals. Out of these 18 students, 6 students were seniors, 6 juniors, 1 sophomore and 5 were freshmen.

Entrepreneurship/Self Employment

"I want to own my own tech company where I invent different products ranging from software and devices for cybersecurity to devices for miscellaneous activities."

- Student E, female, freshman

We also found that some students were interested in becoming entrepreneurs, starting their own business, or working for themselves. 28.6% of the 14 interview participants (n=4): 1 female, 3 males; and 12.1% of the 107 survey participants (n=13): 3 females and 10 males. We observed from the survey data that the percentage of male and female students who wanted to become entrepreneurs was almost equal, respective to their population (Table 7). In addition to this, we found that freshmen and seniors were more likely to define their professional goals as entrepreneurship when compared to sophomores and juniors. This was consistent across both the survey and the interviews.

Areas to Work in – Software, Specialized CS/CS, Management, Technical, Non-CS

"I plan to work at a large tech company and earn my MBA, for experience to earn a managerial position."

- Student F, female, sophomore

We also found that some students described their career goals to work in specific areas in their career. In the interviews, students preferred to work in the following areas: 64.3% specialized CS/CE (n=9), 57.1% management (n=8), 50% software (n=7), 21.4% technical (n=3), and 7.1% non-CS (n=1). We also

found that females preferred moving into management when compared with males (Table 6, 7).

5 DISCUSSION AND IMPLICATIONS

Overall, we found that CS undergraduate students have various professional goals including pursuing careers in industry, entrepreneurship, graduate school, creating an impact, and as being indecisive about their professional goals. They want to work in areas defined by their professional identities such as software, specialized CS/CE fields, management, technical and non-CS. These goals were consistent with a similar study in Europe [4] in which the authors' observed students' affinity towards software professions, management, and entrepreneurship. Undergraduate CS students are also interested in specialty CS professional occupations. There is a need to prepare our students for these specialty occupations like Web Development, Information Security, Database Administration, etc. due to their self-interests and the demand in industry for these jobs which are projected to grow annually at 27%, 18%, and 11% respectively from 2014-2024 [3]. In addition, these results are consistent with McCartney et al.'s [9] findings that students relate their professional identities with jobs in the industry. Hence, there is a need to map our current curriculum of our degree programs to help our students accomplish their career goals by including specializations or cross-disciplinary tracks specifically tailored towards software development or subdomains in CS/CE.

Findings from our study also show that a substantial number of females preferred moving into management when compared with males, and freshmen and seniors were more likely to define their career goals as entrepreneurship when compared with sophomores and juniors. The former results are consistent with research that shows that women are interested in having socially impactful careers [12]. We believe participants' interest in management and entrepreneurship may be related to our universities' initiatives to promote these skills through cross-university programs and business incubators. Given students' interest and growth in these areas, universities may need to create incubation centers for startups to provide support for students to pursue entrepreneurial and leadership endeavors. We believe that these results can be leveraged to address retention rates of CS students especially females by incorporating aspects of technical management, leadership, and entrepreneurship into preliminary years of a CS degree programs.

Findings from our study also indicated that students in our study were interested in pursuing graduate school. Results from our study indicated that females were twice as likely to pursue graduate school when compared to males. We believe this may be due to our university's curricular requirement to participate in at least one semester of research. However, we still need to analyze whether these students have genuine interests to pursue a master's degree or Ph.D., or if it is due to a lack of confidence to get a job after completing their undergraduate degree. In the former case, this suggests that CS degree programs may need to ensure that their curriculum is preparing students to get into the best graduate schools in areas they want to work or conduct research in. In the latter case, the degree program, as well as the faculty, need to ensure that students participate in career support programs within the university to encourage student involvement in the communities of practice.

6 LIMITATIONS

The findings presented in this paper represent a snapshot of the current professional goals and identities of a sample of CS student population at the research university where the study was performed. A possible limitation of this study is that reported professional identities may be overstated because survey participants did not have distinct "Not known" or "Unsure" professional identity options available to them. Thus, both students who responded as unsure and unknown used the other's option and specified it qualitatively. Given that this study gave students extra credit at the end of the semester, the study participants could have either been high performing students that wanted to take every opportunity to secure a good grade in their course or low performing students that wanted an extra grade boost. Overrepresentation of any of these groups may skew the generalizability of these results. In the future, additional data on students' GPA, family background, and ethnic diversity might help to better characterize the population.

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