A Grounded Theory of Computing Professional Identity Formation

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ABSTRACT

Computing professional identity formation is critical for curriculum decision-making, workforce development, and retaining students in computing degree programs. However, we have limited knowledge of how computing professional identity develops. My research focuses on filling this gap by empirically understanding how undergraduate computing students form their professional identity through their negotiations in formal and informal learning environments. The end goal is to generate and test a theory, grounded in data, which can help Computer Science departments to design interventions for fostering computing professional identity formation.

CCS CONCEPTS

• **Social and professional topics** → Computing education

KEYWORDS

Identity; Grounded theory; Computing professional identity

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1 CONTEXT AND MOTIVATION

Research has shown that professional identity enables a person to be technically competent, self-confident, and experience a sense of belongingness to the profession [9,14]. Thus, as academic institutions, our role is to create pathways for professional identity development through our degree programs to ensure students' have a solidified computing professional identity before they graduate. However, we have a limited knowledge of how computing professional identity develops in undergraduate students. With regard to these limitations, CS Education researchers have expressed the need for a theory on computing identity [13] and argued for domain-specific theories in computing [10]. My research focuses on one facet of computing identity formation: *computing professional identity.*

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2 BACKGROUND

2.1 Identity. The operational definition of identity put forth in the Handbook of Identity Development by Schwartz, Luyckx, and Vignoles frames personal identity as "*the confluence of the person's self-chosen or ascribed commitments, personal characteristics, and beliefs about themself; roles and positions in relation to significant others; and their membership in social groups and categories (including both their status within the group and the group's status within the larger context)*" [14]. 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 [6]. Socio-cultural identity theories suggest that identity is constructed through the interactions an individual has with a community [7]. Further, Marcia's Identity Theory suggests that commitment and exploration of careers is important when studying professional identity formation. These two factors are related to agency and social interaction [8]. Therefore, my dissertation research will focus on understanding CS students' *agency* and *social interactions* in CS degree programs and contribute a theory on the formation of computing professional identity.

2.2 Computing identity and professional identity. Computing identity is defined as the extent to which a student sees themselves as a computer scientist [12]. Research on formation of computing identity is limited [13] and includes Peter's longitudinal study at Uppsala University [12] which drew on social identity theory and found seven ways in which students experience CS/IT: creating, using, learning about technology, problem solving, problem solving for others, creating new knowledge, and contributing to society. She also found that students begin computing programs with broader interests but end with strict technical identities, rejecting their broader personal identities. Research on professional identity in CS includes McCartney and Sanders' case study which found peer interactions, courses, internships, interviews, and jobs influencing students' professional identity [9]. Parker also did a study to investigate professional identity formation for software engineering students and devise instruments for operationalizing identity [11]. Thus, prior work provides a foundation for my research and highlights an overall lack of research focused on understanding the formation of computing professional identity when CS students' consider careers in different computing sub-disciplines. My dissertation research will focus on the broader computing professional identities including specialized identities such as data scientists, web developers, user experience (UX) professionals, etc. and fill this gap by generating a theory of computing professional identity formation.

3 PROBLEM STATEMENT

We define computing professional identity *as the transformation of a person's interest in computing into a person's self-identification as someone who engages in computing professionally through one or more computing sub-disciplines and career paths* [3]. 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]. My research focuses on answering the following research questions:

RQ1. How do CS undergraduate students' form their computing professional identity?

RQ1a. What role do CS degree programs play in supporting CS students' computing professional identity formation?

RQ1b. What roles do social interactions in informal learning environments play in supporting CS students' computing professional identity formation?

RQ1c. What role does agency play in students' computing professional identity formation?

4 RESEARCH GOALS & METHODS

Previously computing identity has been explored using qualitative methods including narratives [2], case studies [9], and phenomenology [12]. The end goal of my research is to generate and test a theory, grounded in data about students building their professional identities. This research can help CS departments to design interventions for fostering students' computing professional identity formation. To achieve this goal, I will use the grounded theory methodology [15], an iterative and inductive approach for forming theories. I will design a cross-sectional study consisting of a survey and interviews. The survey will be used to recruit interview participants equally representing gender and academic standing and gather information-rich cases through purposeful sampling. The interviews will be semi-structured and guided by the research questions but unstructured enough to allow the discovery of new information [15]. I will analyze the data using inductive coding and ensure the reliability of the coded data, by performing inter-rater reliability and member checks [1].

5 CURRENT & EXPECTED CONTRIBUTIONS

I am a second-year doctoral student, and my advisor, Dr. Christina Gardner-McCune and I conducted a pilot study in Spring 2016 at the University of Florida to understand the formation of computing professional identity. We found that CS undergraduate students professionally identify themselves as software engineers and with several specialized computing professions such as Web developers, UX Professionals, etc. [3,4]. We also found that students explore computing professions through their involvement in professional development activities, informal activities, coursework and negotiations with people in the broader community [5]. During this exploration process, they self-evaluate taking into account both intrinsic factors such as ability and enjoyment and discipline-specific factors such as utility to either continue exploring the discipline or committing to a specific computing profession. Their commitment subsequently leads to focused exploration to attain competence in their chosen profession [5]. We are currently in the process of running a multi-institutional study to understand the formation of computing professional identity across the United States. Through my dissertation research, I expect to contribute to the computing education literature:

1. A theory of computing professional identity formation,
2. A list of avenues that foster the formation of computing professional identity,
3. Degree/program-level opportunities for supporting the formation of computing professional identity,
4. Course-level opportunities that foster CS students' professional development.

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