

Computer Science Identity Development in Diverse Student Populations: A Qualitative Study

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ABSTRACT

This qualitative analysis explores the development of Computer Science (CS) identity of university students majoring in CS and students participating in a novel CS minor geared toward students who have traditionally been underrepresented in the field. We examine student perceptions of their CS identity at two critical junctures: pre-CS exposure (initial interest in CS), and during early CS exposure (performance and competence). Findings demonstrate the different paths to CS identity that the groups take, and highlight the importance of the CS educational environment in efforts to diversify the field.

CCS CONCEPTS

- Applied Computing → Education
- Social and Professional Topics → User Characteristics

KEYWORDS

Computing, education, equity, identity

INTRODUCTION & BACKGROUND

Research shows that a diverse workforce tends to produce better and more effective solutions than a homogeneous one¹. Unfortunately, Computer Science (CS) is still one of the least diverse of the STEM fields, and the ever-present inequity in post-secondary CS education contributes to this problem². Research addressing low engagement and poor retention of underrepresented (UR) students in the field of CS has begun to focus on the role of identity development in students' learning and involvement in the discipline; unfortunately, the nature and trajectory of this identity development are still poorly understood³. Focusing on CS identity to address issues of underrepresentation and inclusion in CS, the present study investigates some of the factors that facilitate the process of CS identity formation. Qualitative analysis is used to explore and compare two aspects of the CS identity development of two groups of students at the same university: traditional CS major students, and students participating in a novel CS minor program that aims to increase diversity in computing and improve computing literacy for women and underrepresented minorities.

METHODS & RESULTS

Open-ended, written response survey questions were distributed via Google Forms to two groups: students in a traditional CS major during their sophomore year; and students participating in a diverse CS minor program aimed at increasing diversity in the field. These questions solicited feedback in the following areas: early exposure to computing that triggered students' initial interest in the field; and students' perceptions of their current skills and how this impacts their identity. The survey responses were analyzed using an integrated (inductive/deductive) method of code development paired with consensus coding⁴. A total of 63 students (26 CS majors and 37 minor program students) enrolled in CS courses at a diverse, urban university participated in this study.

The following themes emerged from the student responses about how students initially became interested in CS. These findings differed across groups:

***Self-Development:** More than half of the CS major respondents and approximately one-third of the minor students indicated that

they became interested in CS to learn new skills in the spirit of self-development.

***Exposure to Coding:** Half of the CS major respondents reported interest from an early encounter with coding. In contrast, a quarter of the CS minor students reported this was the source of their initial interest.

***Outside Influences:** A small number of respondents from both groups indicated that their interest originated from other people. However, CS majors tended to mention people who can be clearly identified as Computer Scientists and who have significant experience in the field (e.g. parents, teachers, developers), whereas those mentioned by the minor students were typically acquaintances or friends who were also studying CS.

***Functionality/ Relation to Future:** Most students from both groups chose to study CS because they believed it to be closely related to their career goals.

The following themes emerged from the data collected about how students feel about their performance and how this impacts their CS identity. These findings were similar across both groups of students:

***Uncertainty/ Self-Doubt:** About 40% of participants from both groups indicated that having difficulty solving a CS problem leaves them questioning themselves, their skills, and whether CS is the right field for them.

***Maintain/ Reinforce Identity:** Slightly more than one-third participants from both groups reported that having difficulty does not affect their CS identity.

*** Persistence/ Grit:** About 25% of participants from both groups indicated a sense of purposefulness and tenacity when faced with challenges. Most of these responses indicated a sense of working hard and having dedication to the field, in spite of difficulties.

*** Orientation to Growth:** Approximately 20% of the respondents from both groups indicated that when they encounter challenges, they tell themselves that difficulties are a natural part of the learning process, particularly early on. Several indicated that it is too early in their learning process to expect the work to be easy.

CONTRIBUTIONS & FUTURE WORK

While all respondents indicated a similar response to difficulties in their CS courses, the two groups reported different paths to the field. These findings highlight the role of interpersonal, near-peer relationships in UR students' early CS identity development, and can provide guidance for universities wishing to recruit UR students to their programs. Future work should focus on further expanding our understanding of how to create an environment conducive to the promotion of positive CS identity development for URM and female students, including the development of specific techniques for interpersonally-based recruitment.

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