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A Comprehensive Analysis of Students' Experiences of Belonging to the CS Community

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ABSTRACT

Developing a sense of belonging to the community in CS departments during the first year plays a vital role in students' retention decisions. This research plan outlines both belonging as a psychosocial construct framed within higher education and issues related to it in computer science. The fully mixed sequential dominant status design will be used to understand and quantify belonging from both the students' and faculty's perspective. Pedagogical actions to improve belonging will be studied and disseminated.

CCS CONCEPTS

• **Social and professional topics** → **Computer science education**.

KEYWORDS

Sense of Belonging; Freshmen; Computer Science Education

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1 CONTEXT, MOTIVATION & BACKGROUND

1.1 Belonging as a psychosocial construct

Belonging as a feeling is a basic psychological need for an individual in the path to self-actualization [9]. Therefore, it is also considered as an essential human motivator [2]. Over the years, the sense of belonging has been referred with seemingly distinctive but contextually interchangeable terms. Among them, the literature has highlighted the following terms utilized to refer to the sense of belonging: affection need among individuals [12], the need for social approval [14], the need for relatedness [3, 15, 19] and affiliation motivation [10]. In general, the sense of belonging can be defined as an individual's perceived feelings of connection, affiliation, and relatedness to their social surroundings.

1.2 Belonging in transition to higher education

The sense of belonging might be simultaneously experienced in different levels and towards various institutions of society such as family, work, and education. Transitional stages between and within these social institutions are crucial points for developing a sense of belonging. When education as a social institution is examined, the sense of belonging is shaped as "the extent to which students feel personally accepted, respected, included, and supported by others [...]" [4]. Since significant transitions in educational levels result in multiple changes in an individual's social and physical learning surroundings, individuals need to reconsider and develop their sense of belonging towards their current and new environments.

One of the most crucial transitional stages in an educational path is the transition from high school to university level. During such a transition, individuals experience distinctive stages, one of which is adjustment [20], corresponding to their first year at the university. Here, developing a positive and strong sense of belonging towards their departments plays a vital role in their decisions to persist or leave [13, 17]. After a successful adjustment phase, students are more familiar with their surroundings and stabilize their actions to achieve desired outcomes and avoid unwanted consequences. For that reason, institutional actions regarding the adjustment phase, including paying attention to and examining how this phase proceeds in departmental levels, are vital duties of the higher education departments for their students' persistence, success and personal and career development [18].

1.3 Belonging in Computer Science

In Computer Science (CS), belonging may be examined under two prominent characteristics of incoming students: (1) the gaps in their previous experiences related to the field [16] and (2) their interpersonal skills [1, 5, 21]. Some scholars propose that having previous experiences related to the field does not necessarily provide students with a possibility to succeed in academic terms [8, 11]. Yet, it undeniably helps them create social relations with others holding the same experiences in the department, which results in the creation of homogeneous circles of affiliation and therefore might cause the rise of a social polarization such as experienced and inexperienced circles of peer affiliations.

At the same time, the literature emphasizes the technicality of computer science as a field [1, 5] and CS students' preferences on socialization through learning experiences [21]. First, as the technicality of the field is apparent in the instructional implementation of CS curricula – that is the selection of individual learning experiences – it does promote individualization over socialization.

Second, as CS students might possess different levels of social skills [21], they might prefer working alone and value product over process. Within such occurrence and possibilities, students might lack opportunities to form psychosocial attachments within the department and therefore fail to develop a sense of belonging during their adjustment stage.

2 PROBLEM STATEMENT

The overarching theme within this research study is *understanding and improving students' sense of belonging in computer science departments in higher education*. The results of the work might feed into the issue of low retention experienced often by first-year students of computer science, which has been extensively studied e.g. from the technical perspective of seeking to identify at-risk students or predicting academic performance [6]. At the same time, little work that seeks to profoundly examine this specific psychosocial construct in the computer science context exists in the related literature.

3 RESEARCH QUESTIONS & METHODS

The research questions are as follow: (RQ1) What is the experience of first-year CS students at a Finnish university from the perspective of building a sense of belonging to the community?; (RQ2) How are their first year belonging experiences related to other individual characteristics?; (RQ3) How do the instructors in the CS department at a Finnish university contribute to their students' sense of belonging?; (RQ4) What kind of pedagogical actions can be effective to improve the experience of belonging of first-year CS students to the CS academic community?

This study will employ the fully mixed sequential dominant status design [7]. The RQ1 will be answered through thematic analysis of data collected with semi-constructed interviews. Using the revealed definition and variables from the results, the scale development process will be initiated and an ad-hoc scale of sense of belonging will be developed just for estimation of the feeling at the department. After a pilot study, quantitative data for the RQ2 will be collected using the developed scale and both descriptive and inferential statistical analyses will be employed to explain to what extent individual variables predict the students' sense of belonging. Then, the RQ3 will try to shed light upon how the instructors in the department of CS at a Finnish university contribute to their students' sense of belonging. To provide answers, semi-constructed interviews will be carried out with the instructors in the department. Nurturing from all previous findings, the RQ4 will list the effective pedagogical/instructional actions to improve the experience of belonging of first-year CS students to the CS academic community.

4 EXPECTED CONTRIBUTIONS

The impact of this study might be examined under academic, institutional, and individual aspects. First, the outputs disseminated from this research study will not only add upon available knowledge on a fundamental psychosocial construct, sense of belonging in this case, experienced by students of computer science but also comprehensively enrich the related literature with the subtopics

this study looks at. Second, at the institutional level, the Department of Computer Science at a Finnish university will have an opportunity to comprehend the current psychosocial state of students and its relationship with the first-year curriculum. Moreover, the academic staff in the department will have pedagogical actions precisely defined for their use to foster the development of the sense of belonging of their students in the adjustment stage. Last but not least, at the individual level, as much as the academic staff employs the proposed pedagogical actions, students might benefit the fruits of improved learning experiences and may proceed in their adjustment stages as smoothly as possible.

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