

Chapter 11

The Role of Self-Efficacy in Fostering a Sense of Belonging in Computing Education

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ABSTRACT

This chapter outlines a conceptual framework for the relationship between student self-efficacy and sense of belonging in computing education. The proposed framework assumes the relationship as bi-directional given feedback loops mediated by student affective and emotional experiences as well as their beliefs, goals, and motivations. The effects of both dimensions are examined in terms of academic achievement outcomes, interest, and retention, while confounding factors include the mediating roles of the nature and outcomes of learning activities, social support, and individual differences. The authors substantiate these claims based on the review of the learning literature, identify gaps where more work is needed, and raise a significant methodological issue in the current body of literature. Based on the review, they derive recommendations for instructors to create a supportive classroom environment and for investigators to conduct novel research.

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INTRODUCTION

For students in the computing disciplines, non-cognitive processes are of critical importance. During their first year, students often enter the discipline with limited exposure to the field beyond coding and an enthusiasm for solving problems. Consequently, the acquisition of skills in this discipline requires extensive practice and repeated feedback. Because of the inherent challenges in performing such tasks, and the resulting successes and failures, these experiences shape their beliefs towards the field and elicit emotional reactions¹ that influence their progress along the path to becoming more proficient. It is therefore important to gain insights into how students perceive these experiences, and the support they receive from others, as they navigate these challenges.

The significance of these affective and motivational states experienced by students in the early stages of their studies in computing is the focus of this chapter. We consider the learning research literature that has examined student self-efficacy and sense of belonging to gain insights into the low rate of participation by women and other minorities in the field (Rosson, Carroll, Sinha, 2011). On the one hand, student beliefs about their own skills have been shown to be critical to academic achievement outcomes (Lishinski & Yadav, 2019; Malmi et al., 2020). Studies have consistently shown that student confidence in their ability to learn a programming language and solve problems enhances positive attitudes towards the value and relevance of engaging in such learning experiences and towards disciplinary practices (Anastasiadou & Karakos, 2011; Gurer, Cetin, & Top, 2019). On the other hand, belonging is mentioned as one of the most important factors mentioned by women in computing who made the decision to switch from computer science to a different major. Perhaps belonging is a significant factor overall, not just to specific gender identities, considering that retention remains a significant issue for first year courses in general (Biggers, Brauer, & Yilmaz, 2008). Students who leave computer science compared to those who graduate with computer science degrees often perceive the discipline as being asocial and irrelevant to performing authentic, *real-world* tasks; a perception that stems largely due to the programming-focused first-year courses (see Cheryan et al., 2013).

This chapter is organized as follows. The first section defines both sense of belonging and self-efficacy as well as situates the definition of each of these concepts in terms of the broader learning literature in computing and its evolution within this discipline. The second section addresses basic assumptions pertaining to the relationship between sense of belonging and self-efficacy. We place a focus on gaining an understanding of individual characteristics that underlie these relationships, examining the mitigating effects of gender, culture, and ethnicity. The remaining sections elaborate on issues and challenges facing researchers in

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