Chapter 4
Introducing the Computer-Related Self-Concept:
A New Approach to Investigate Gender Differences in Computing Careers

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ABSTRACT

The number of women in STEM fields, especially in computer science, is still very low. Therefore, in this chapter, the computer-related self-concept (CSC) is presented as a new approach to investigate gender differences in computing careers. The computer-related self-concept comprises computer-related attitudes, emotions, and behaviors, integrating different lines of research on computer-related self-cognitions. To establish connections with career development, an extensive online survey was conducted with more than 1100 male and female computing professionals. Results show that men have a significantly more positive computer-related self-concept than women. Furthermore, as hypothesized, the computer-related self-concept shows high correlations with career motivation. Therefore, it is concluded that the computer-related self-concept is a feasible approach to investigate and understand computer-related gender differences. Possible implications regarding measures to foster women's careers in computing are discussed along with prospects for future research.

DOI: 10.4018/978-1-5225-8933-4.ch004

INTRODUCTION

Even towards the end of the second decade of the 21st century, the number of women in STEM (Science, Technology, Engineering, Mathematics) fields is still very low. This holds especially true for Computer Science. Regarding western industrialized countries, the percentage of women in technical fields has stagnated at 10-20% or has even been declining (Black, Jameson, Komoss, Mehan, & Numerico, 2005; Galpin, 2002; National Science Foundation, 2011, 2014; Michelmore & Sassler, 2016; Zweben, 2011; Sax et al. 2016; Beyer, 2014). This is true despite many efforts in primary and secondary schools as well as universities to increase the number of female students.

Even worse, women who successfully graduated from a STEM-related course of study often encounter obstacles in their career development (e.g. Black et al., 2005) or even never take up a STEM-related job after graduation (Xu, 2017). In computing, women's career success is lower than men's both short-term and long-term, even though their qualification level is equal (Wolffram, Derboven, & Winker, 2009; Zweben, 2011, Fouad & Santana, 2017).

One reason for the lack of women in technical fields is that computers and information technology are still perceived as a traditionally male domain. Even though children today grow up as 'digital natives' with information technology omnipresent in their lives, girls and young women are still less confident and experienced in using computers and have lower interest in technology in general (Bamberg & Vincent-Höper, 2017; Miliszewska & Horwood, 2000; Symonds, 2000; Wetzel, 2002; Woodbury, 2002; Sassler, Glass, Levitte, & Michelmore, 2016; Sax et al., 2016; Beyer, 2014). In short, they seem to integrate computer-related activities and skills into their *self-concept* to a much lesser extent.

Therefore, in this paper we explore a new approach to analyze and understand gender differences in computing: The *computer-related self-concept (CSC),* which comprises all computer-related emotions, attitudes, and behaviors. Building on prior research on self-related cognitions and self-perceptions (Super, Starishevsky, Matlin, & Jordaan, 1963) we posit that computer-related self-perceptions will impact career choices and development in technical fields.

The chapter is structured as follows: In the Background section the related work regarding self-concept and career development is described. Building on that, we develop our model of the computer-related self-concept. Subsequently, we present the results of an extensive online survey that was conducted with over 1100 computing professionals. Using a newly developed and validated questionnaire to measure the computer-related self-concept, we investigated gender differences and the relationship with career motivation. We discuss practical implications of our findings and prospects for future research.

BACKGROUND

A person's *self-concept* is usually understood as representation of all of his / her self-referred attitudes and is seen as crucial determinant of human behavior. The self-concept is conceptualized as a multidimensional, hierarchical structure (Shavelson, Hubner, & Stanton, 1976). That means that the general self-concept is comprised of a multitude of specific self-referred cognitions which are related to different experiences and areas of life. An important aspect of the self-concept are so-called *ability concepts*, i.e. a person's notions about his/her academic performance in a variety of fields (e.g. how well one does