Boys' and girls' ICT beliefs: Do teachers matter?

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A R T I C L E   I N F O

A B S T R A C T

This exploratory study took place in the context of middle school information science in Greece, to examine possible relations between boys' and girls': value and efficacy beliefs about computers and information science; perceived parental support; perceived teacher expectations; and perceptions of the nature of information science instruction. The participants of the study were 301 (135 male and 166 female) students who responded to a self-report questionnaire. Regression analysis showed that perceived teacher expectations were positively associated with students' ability beliefs, perceptions of learning activities as creative and personally meaningful was a significant predictor of students' interest in computing, and perceived parental support was related to both value and efficacy beliefs. Unlike previous research, the findings of this study did not support the conclusion that boys have more positive ICT self-efficacy and value beliefs than girls. They indicated however, that boys' and girls' beliefs are differentially affected by parents, teachers, and school IS instruction.

1. Introduction

The introduction of information and communication technologies (ICTs) in the educational system of many countries has been accompanied by a proliferation of research on ICT attitudes and beliefs (i.e. Moos & Azevedo, 2009; Volman & van Eck, 2001), documenting their significance for learning about and with ICTs. Students who have confidence in their computer abilities can successfully perform learning tasks that involve ICT use (Moos & Azevedo, 2009), and those who enjoy and value using computers pursue activities, courses, and academic programs that will help them improve their skills (Dickhäuser & Stiensmeier-Pelster, 2003; Selwyn, 1998) and prepare for a professional career in the ICT field (Zarrett, Malanchuk, Davis-Kean, & Eccles, 2006). For a large number of young people exposure to computers begins at home, at an early age. Research has shown that out of school computer experiences are strongly related to student attitudes and relationship with technology (Moos & Azevedo, 2009; Selwyn, 1998; Vekiri & Chronaki, 2008), and that gendered socialization processes may differentially affect the development of ICT beliefs in boys and girls (Barker & Aspray, 2006; Margolis & Fisher, 2002; Volman & van Eck, 2001). Less is known, however, about the role of teachers and formal school instruction. In this exploratory study, which took place in Greece in the context of introductory information science (IS) at the lower secondary school level (Gymnasium), student questionnaire data were collected to examine possible relations between boys' and girls': value and efficacy beliefs about computers and information science; perceived parental support; perceived teacher achievement expectations; and perceptions of the nature of information science instruction.

2. Theoretical framework

Research has highlighted the importance of ability and value beliefs for student motivation and learning. Students' perceptions of their ability to successfully perform tasks in a particular academic domain, defined as self-efficacy beliefs within the framework of Bandura's social cognitive theory (Bandura, 1993), are significant predictors of student activity choices, effort, persistence and use of self-regulation strategies (Zimmerman, 2000). Self-efficacious students are not afraid to undertake challenging tasks, invest effort and do not give up easily when they encounter difficulties, and are motivated to use cognitive and metacognitive strategies when they learn (Zimmerman, 2000). According to value-expectancy theory (Wigfield & Eccles, 2000), the influence of ability beliefs on motivation and performance is moderated by students' value beliefs, as the latter affect students' task choice and engagement. Value beliefs are students' views about the importance (attainment value), the usefulness (utility value), the enjoyment or interest (intrinsic value), and the cost involved in performing

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tasks of a particular domain (Wigfield & Eccles, 2000). Students are more likely to engage in academic tasks and to pursue activities that they consider interesting, useful and important to them (Wigfield & Eccles, 2000). Both value and self-efficacy beliefs have a significant effect on the quality of student learning (Pintrich & DeGroot, 1990) and are important predictors of students' future academic choices and career paths (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001; Eccles, 1994; Zarrett et al., 2006).

There is considerable research showing that boys and girls differ in their ability and value beliefs for academic domains that are traditionally gender-typed as "male" or "female", in patterns that are consistent with gender norms and stereotypes (Meece, Glienke, & Burg, 2006). In particular, research on ICT learning shows that girls tend to have less positive beliefs about the value of ICT and their own ICT skills compared to boys (Volman & van Eck, 2001; Whitley, 1997). Boys' and girls' motivational beliefs are shaped by their experiences and may follow different developmental paths as a result of gendered socialization processes (Eccles, 1994; Meece et al., 2006). According to value-expectancy theory (Eccles, 1994), parents and teachers can have a positive influence on young people' ICT ability and value beliefs by providing learning opportunities and by encouraging engagement in ICT activities, by expressing positive expectations and positive values about the importance, usefulness and appropriateness of computing, and by modeling ICT use. Research on student ICT use outside school has shown that, compared to girls, boys have more opportunities to experience success with ICTs, and, therefore, they are more likely to develop positive ability beliefs: boys are more likely than girls to have access to a personal computer at home, to use computers in the context of peer activities, and to attend computer clubs (Barker & Aspray, 2006; Volman & van Eck, 2001). In addition, boys are more likely than girls to have access to same-gender parental role models (Margolis & Fisher, 2002) and to receive encouragement from their parents to improve their knowledge about ICT (Vekiri & Chronaki, 2008), which, in turn, may result in boys' developing more positive beliefs about the appropriateness and value of computing, compared to girls. These findings about the role of parental support are consistent with research regarding other male-typed domains, such as math, showing that parents who espouse gender stereotypes have lower expectations for their daughters' math abilities, and that parental views and expectations have long-term effects on children's motivational beliefs and academic choices (Bleeker & Jacobs, 2004; Eccles, Adler, & Kaczala, 1982).

Although research so far has established a relationship between boys' and girls' ICT ability and value beliefs and their home ICT experiences, little is known about students' classroom experiences and the role of their teachers. The present study aims at (a) exploring two teacher factors, teacher expectations and pedagogy, which, based on previous research, are expected to relate to student ICT beliefs, and (b) examining the relative importance of these teacher factors compared to parental support.

As sources of authority and expertise, teachers are likely to exert a powerful influence on boys' and girls' ability beliefs about technology through the achievement expectations they communicate. Classroom research has shown that teacher–student interaction is gendered (Aukrust, 2008; Jones & Dindia, 2004) and that teachers' tend to have differential achievement expectations for boys and girls in male-typed academic domains (Fennema, Peterson, Carpenter, & Lubinski, 1990; Li, 1999). However, little is known about teacher expectations regarding boys' and girls' ICT use and about the influence of teacher expectations on student ability beliefs. Observational studies in the context of school ICT use (Singh, 1993) and information science instruction at the college level (Clegg, Trayhurn, & Johnson, 2000) have shown that teachers' behavior often reflects stereotyped beliefs and communicates gendered expectations, which become visible to the students. Shashaani (1993) found that high-school students perceived their teachers to have stereotyped views about the appropriateness of computer science for males and females. Research shows that teacher expectations affect student achievement and that girls in gendered domains such as mathematics are more susceptible to teacher underestimates of their ability (MCKown & Weinstein, 2002). Positive teacher expectations and support, on the other hand, may have a positive effect on female students' motivation. In a 3-year study of girls' participation in single and mixed-gender high school information science classes, Crombie, Abarbanel, and Trinneer (2002) found that girls in the all-female classes perceived higher levels of teacher support and expressed more positive efficacy beliefs than girls in the mixed-gender classes.

Also, teachers may influence student beliefs about the value of ICTs through their pedagogical practices. Research has shown that teachers can enhance student motivation for learning using challenging and authentic tasks that provide opportunities for exploration and collaboration, are connected to the real-world, and appeal to student interests (Blumenfeld et al., 1991; Bransford, Brown, & Cocking, 2000; Schunk, Pintrich, & Meece, 2007). However, studies in various countries (Clarke & Teague, 1996 in Australia; Goode, Estrella, & Margolis, 2006 in the US; Kordaki, 2001 in Greece) indicate that information science instruction tends to be teacher-centered and to focus on the development of decontextualized technical skills, providing students with few opportunities for collaboration and engagement in challenging, creative, and personally meaningful tasks. This approach may have differential effects on boys and girls' motivation because boys and girls are attracted to different aspects of ICTs and differ in their instructional preferences. Boys tend to be interested in the technical aspects of computing more than girls (Brunner, Bennett, & Honey, 1998) and prefer discovering things and solving computer problems on their own (Ching, Kafai, & Marshall, 2000). Girls, on the other hand, are interested in the creative aspects and real-life applications of technology (Brunner et al., 1998; Lynn, Raphael, Olefsky, & Bachen, 2003), and prefer instructional formats that enable them to collaborate and to share what they learn (Ching et al., 2000; Clegg et al., 2000; Volman, van Eck, Heemskerk, & Kuiper, 2005). It appears that although "traditional" instruction might not be detrimental for boys' interest in computing, it could be a turnoff to girls. Moreover, this approach to information science instruction has been criticized for communicating stereotypical images of computing as "purely technical, menial, and disengaged from the social world" (Clarke & Teague, 1996; Crombie et al., 2002; Margolis & Fisher, 2002). This image of computing is incompatible with the personal values and long-term plans of girls, who rate social values high and prefer to study academic subjects that have social applications and, in the long-term, would enable them to "do something worthwhile for society" (Eccles, 1994). Therefore, by failing to show the collaborative nature of computing, its relevance to many disciplines, and its contribution to the solution of everyday problems, traditional instruction may have negative effects on girls' beliefs about the personal importance and usefulness of computing.

It has been argued (Crombie et al., 2002; Goode et al., 2006; Lynn et al., 2003) that girls would develop more interest in ICTs if school learning valued their academic interests and were aligned with their instructional preferences. Based on the above, a gender-inclusive pedagogical approach to computer learning would be student-centered. Information science teachers could motivate both boys and girls through inquiry-based and exploratory tasks that are relevant to everyday life, encourage collaboration and creativity, and take into account student interests. It is also possible that, by demonstrating the social applications of technology through such activities, teachers could help girls realize that studying computing is not inconsistent with their personal values and long-term academic plans.

Research so far indicates that teachers might influence girls' relationship with technology, both with their teaching practices and with the expectations they communicate. However, few studies investigated these hypotheses (i.e. Shashaani, 1993) and much of relevant