Students’ ICT self-efficacy and computer and information literacy: Determinants and relationships

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A B S T R A C T

Self-efficacy is an important concept for understanding learning and achievement. The concept covers students’ self-confidence and their expectations for future performance. Students’ learning experiences are crucial for the development of self-efficacy beliefs, which may affect students’ achievements. The present study explores how self-efficacy can be contextualized with information and communication technology in 15 countries. A theoretical model is built and tested in each country based on data from the International Computer and Information Literacy Study 2013. The analyses show that experience with technology, autonomous learning, and socioeconomic background explain the variations in ICT self-efficacy. Further, gender, self-efficacy, and socioeconomic background play important roles in understanding students’ computer and information literacies. This indicates that ICT self-efficacy is positively related to computer and information literacy when controlled for other student characteristics and background contextual variables. The results reveal a clear distinction between ICT self-efficacy and computer and information literacy.

1. Introduction

Self-efficacy is an important theoretical framework that can be used to understand students’ confidence and beliefs with respect to their capabilities to perform specific tasks or activities (Bandura, 1986). To our knowledge, only a few international studies on self-efficacy have analysed students’ confidence using Information and Communication Technologies (ICT) in relation to their digital literacy. In this regard, the recent International Computer and Information Literacy Study (ICILS) (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014), commissioned by the International Association for the Evaluation of Educational Achievement (IEA), represents a unique source of information to compare students’ ICT self-efficacy with their actual Computer and Information Literacy (CIL). According to Fraillon, Schulz & Ainley (2013, p. 17), CIL refers to ‘an individual’s ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in the community’.

To date, empirical work related to lower secondary students’ self-perceptions of ICT skills compared with their actual skills is sparse. Rohatgi, Scherer, and Hatlevik (2016) analysed Norwegian data from ICIL 2013 and found a positive relationship between ICT self-efficacy and CIL achievement. This topic is addressed herein by exploring ICILS student data from all participating countries (Australia, Chile, Czech Republic, Croatia, Denmark, Germany, Republic of Korea, Lithuania, Norway, Poland, Russian Federation, Slovak Republic, Slovenia, Thailand, and Turkey). Thus, the present study represents an extension of prior research.

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Our objective is twofold. First, we examine how personal characteristics and background contextual variables may affect students’ ICT self-efficacy and CIL. Second, we investigate how students’ ICT self-efficacy and CIL are related after controlling for relevant personal characteristics and background contextual variables. It is of particular interest to explore student characteristics, home environments, and students’ use of and experiences with ICT as factors affecting the results in different countries. This will be further elaborated in the next two sections.

2. Theoretical perspectives

This section introduces the two key concepts at the base of this paper: self-efficacy and Computer and Information Literacy.

2.1. Self-efficacy

The role of self-efficacy has gained considerable attention in research on students’ motivations and learning outcomes. Self-efficacy refers to ‘people’s judgements of their capabilities to organize and execute courses of action required attaining designated types of performances’ (Bandura, 1986, p. 391). It revolves around questions like, ‘Can I solve this problem?’ It must be emphasized that actual skills and self-efficacy beliefs are not synonymous in meaning; self-efficacy refers to persons’ perceived capabilities and reflects what individuals believe they can do with the skills they possess (Bandura, 1997), whereas actual skills refers to abilities objectively measured. In other words, self-efficacy is a belief about what one is capable of doing or learning and is not the same as knowing what to do. Central in Bandura's notion of self-efficacy is the idea that this personal belief is a major basis of and a direct determinant of an individual’s behaviour and actions. This means that students are more likely to pursue activities within their ranges of perceived competences; they tend to select tasks and activities in which they feel competent and avoid those in which they do not.

In education, self-efficacy has proved to affect students’ choices of activities, effort invested, persistence, interests, and achievements (Schunk & Pajares, 2009), as well as the use of self-regulatory processes (Zimmerman, 2000). Compared to students who doubt their capabilities to perform well, efficacious students work harder, persist longer, show greater interest in learning, and achieve at higher levels (Bandura, 1997). They are not afraid to undertake challenging tasks, and are motivated to use cognitive and metacognitive strategies when faced with obstacles or challenges in learning situations (Zimmerman, 2000). However, self-efficacy alone is not enough to produce a competent performance if students lack the needed skills to succeed.

It is important to emphasize that diversity exists in students' expectations about performance. While some students are rather modest to realistic in their perceived capacities, others are overconfident and thus have unrealistic expectations of what they can accomplish. Persons who lack confidence between their self-efficacy beliefs and their performance are considered poorly calibrated. According to Schunk and Pajares (2009), calibration is important in education. Students who overestimate their competences may sometimes fail, which can lower their motivation. On the other hand, students who underestimate what they are capable of doing may be unwilling to try, and they therefor reduce their acquisition of skills. Research also shows that self-efficacy beliefs can be related to gender and culture (Dettingen, 1995). Though girls perform as competently as or even better than boys in various academic domains, they are inclined to report lower self-efficacy, especially in mathematics and science (Schunk, Meese, & Pintrich, 2014).

According to Bandura’s social cognitive theory (1997), self-efficacy involves perceived capabilities in specific areas. Self-efficacy beliefs are regarded as context- or task-specific perceptions of what one can do. Research has consistently revealed stronger relations between specific self-efficacy beliefs and actual performance than between general judgments of one's skills and achievement measures (Schunk & Pajares, 2009). In school, the different subjects consist of several sub-domains. For example, in mathematics, students are able to make more precise perceptions of their skills in multiplication than they are of their general mathematical competences. This distinction has also been drawn between individuals' judgements of general computer competences and task-specific self-efficacy with computers (Marakas, Yi, & Johnson, 1998). Task-specific ICT self-efficacy is defined as perceptions of one's ability to perform specific computer related tasks, while perceptions of general computer competence is related to judgement of one's skills across multiple computer application domains. Furthermore, Hargittai and Shafer (2006) revealed how computer-related self-efficacy has been an important extension of the self-efficacy concept. In the domain of information technology, studies point to the crucial role self-efficacy has on individuals' behaviours in their uses of information technologies. A literature review concluded that computer self-efficacy plays a crucial role in students’ learning in computer-based learning environments (Moos & Azevedo, 2009). Results show that computer self-efficacy is related to both students' learning processes and learning outcomes.

Self-efficacy beliefs are developed through different sources (Bandura, 1997). Students' interpretations of their actual performances are important for their self-efficacy beliefs, and mastery experiences (i.e. performances interpreted as successful) are considered the most potent and salient source to gauge students' self-efficacy. In the domain of information technology, this implies that perceived mastery experiences in ICT use are important for students’ beliefs about their capabilities to succeed in specific digital activities or tasks. Based on a literature review, Moos and Azevedo (2009) emphasize that it is the quality, and not the quantity, of computer experiences that is the most critical determinant in computer self-efficacy. Quality of computer use may be related to technical support and mastery experiences with ICT. Social persuasion (e.g., verbal persuasion or encouragement from teachers, parents, or peers) has also proved an effective means to boost self-efficacy. However, it is important to ensure that the envisioned success expressed through positive feedback or verbal encouragement is attainable.

2.2. Computer and information literacy

The other central concept in the present study is CIL. Several concepts or terms have been used to identify and describe what
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