Gender differences in the ICT profile of university students

Abstract

This study responds to a call for research on how gender differences emerge in young generations of computer users. A large-scale survey involving 1138 university students in Flanders (Belgium) was conducted to examine the relationship between gender, computer access, attitudes, and uses in both learning and everyday activities of university students. The results confirm that women have a less positive attitude towards computers in general. However, their attitude towards computers for educational purposes does not differ from men. In the same way, being female is negatively related to computer use for leisure activities, but no relationship was found between gender and study-related computer use. Based on the results, it could be argued that 1) computer attitudes are context-dependent constructs and 2) when dealing with gender differences, it is essential to take into account the context-specific nature of computer attitudes and uses.

Key words: ICT, Computer use, Computer attitudes; Gender; University students, Survey, Path analysis

Introduction

Culture is defining computers as preeminently male machines.

What accounts for this, and what are the consequences?

Marlaine E. Lockheed, 1985, p. 116.

Thirty years after the development of the first personal computer, it is impossible to imagine society without it, as much in our personal lives as in the workplace and in schools (OECD, 2005). According to authors (2007), these changes clearly offer further opportunities, but also a number of risks. To illustrate, the first arrival of computers in the UK created fear among employees because of the assumption that computers would eventually replace people (Garland & Noyes, 2008). This gave rise to the need to measure and review computer attitudes and explore the impact of subsequent problems (cf. Mikkelsen et al., 2002). Just like with work situations, researchers have measured computer attitudes in the context of education (Bovée, Voogt & Meelissen 2007; Sáinz and López-Sáez 2010). As will be discussed later, several of these studies build on the assumption that the use of computers is beneficial for learning and that the impact of computers is dependent on the computer attitudes of the students (Kubiatko & Haláková, 2009; Meelissen & Drent, 2008).

In general, the findings confirm that computer attitudes play a crucial role in the acceptance of computers in the context of teaching and learning (e.g., Authors, 2008; Shapka & Ferrari, 2003). Based on a meta-analysis of English and American studies on gender differences and computer attitudes, Whitley (1997) concludes that in general, females have less positive computer attitudes than males. More recently, in a group of secondary students in Spain, Sáinz and López-Sáez (2010), found more positive computer attitudes in boys than in girls.

Most of these studies, which will be reviewed in more detail in the background section, support the idea that our culture is defining computers as pre-eminently male machines (cf. Lockheed, 1985). However, some studies found no gender difference for computer outcomes. A Canadian study among teacher candidates for instance did not establish a difference in attitudes between men and women (Shapka & Ferrari, 2003). As the computer becomes more and more integrated into society and more people, both men and women, have access to and use computers, the so-called gender gap, if it did exist, would narrow (Authors, 2011). But here, too, there is no consensus. This leads to a question concerning the extent to which computer attitudes differ between people.

It remains unclear whether the gender differences in computer attitudes can be generalized across younger generations of men and women and across countries. Clearly, more research is needed on the relationship between gender and specific computer attitudes and uses in an educational context (cf. Goode, 2010). Apart from a British study among undergraduate students (Selwyn, 2007), little empirical evidence exists of gender differences in the computer profile of the new generation of undergraduate students. In this respect, it is useful to examine whether the stated gender difference in computer attitudes can be found in very specific contexts, such as a university in Flanders. At universities, as in other educational settings, ICT applications such as digital learning environments are more and more present, and the use of it is mandatory, or at least highly recommended, to obtain a degree (e.g., Voogt & Pareja Roblin, 2012).

In this respect, it is very important to make sure no one gets excluded because of less favorable computer attitudes, eventually resulting in avoiding computer use, a possible risk for women, as they are shown repeatedly to have less positive computer attitudes. Therefore,

the main objective of this large-scale empirical study was to 1) find out if there is a gender difference in computer attitudes in general, and in study-related attitudes in particular, and 2) explore the complex relationships between gender, the computer attitude variables and two computer-use variables: computer use for leisure activities and study-related computer use. Before describing the empirical study, we examine research about the relationship between gender and computer attitudes. In the next section, we describe the development approach. First, a one-way multivariate analysis of a variance model was conducted to test the assumption that there are differences between male and female students in one or more dependent computer profile measures, building on a survey conducted among 1138 university students. Second, a structural equation modeling technique was applied to model the relationships between gender, the computer attitude variables and the two computer-use variables. The article concludes with some practical implications and recommendations for further research.

Background

The current study can be situated in the tradition of the Technology Acceptance Model (TAM). TAM emerged from two distinct research theories: the social psychology theories (e.g. Social Cognitive Theory) on the one hand and sociology with the Diffusion of Innovations Theory (Rogers, 2004) on the other hand (For an overview see Pynoo, 2012). The Technology Acceptance Model posits that users acceptance is determined by two key dimensions, namely “perceived usefulness” and “ease of use” (Venkatesh et al., 2003). These dimensions are included in the computer attitudes scale used in this study.

Following the TAM, Venkatesh et al. (2003) reviewed the existing models and developed the Unified Theory of Acceptance and Use of Technology (UTAUT). Gender was added to

UTAUT as an important construct that have received little attention in the context of this research field. Given the fact that the gender's role is often missing within the technology acceptance theory, in this study, we explore the relationship between "gender", "computer attitudes" (including ease of use and usefulness) and two types of computer use. In the next section, we review the empirical literature grounding the importance of this relationship. In particular, we concentrate on studies that link these variables to the role of education.

Computer attitudes

Attitudes towards computer use may be defined as specific feelings that indicate whether a person likes or dislikes using computers (Simpson et al., 1994). Consequently, measuring computer attitudes can be seen as an evaluation whereby individuals respond favorably or unfavorably to computer use. Researchers developed and validated a considerable number of attitude scales between 1980 and the beginning of 2000, such as the Computer Attitude Scale (Loyd & Gressard, 1984) and the General Computer Attitudes Scale (Authors, 2003). Much of the computer attitude scales are still based on the underlying dimensions "fear". In recent years computers have become more accessible, and computer use is almost universal in Western countries. This implies that attitude scales are often not specific enough to differentiate between individuals. Therefore, a scale is used in this study that includes a broad spectrum of dimensions such as "usefulness", "ease of use", "interest", and "pleasure".

Although each of the available instruments enriches the whole picture, it is important to ascertain their relevance and general applicability over and over again. Hence, an attempt is made in this study to address the context-specific nature of computer attitudes and to look for specific types of computer attitudes (cf. Goode, 2010). According to Talja (2005), individual attitudes are context-dependent constructs: contextuality means that individuals can produce

different types of computer attitudes in different contexts. As early as two decades ago, Hawkins (1985) argued that it would be necessary to examine how *gender differences emerge in relation to the functions computers serve.* Also Kay (1993) stated that it would be best to be as specific as possible about the content of the attitude object, if we expect to be able to predict behavior toward that object. Following Kay (1993), it seems that a scale designed to assess computer attitudes *towards education* would be expected to provide accurate predictions of whether students would use computers in education, the focus of this study.

Gender and computer attitudes

Since the 1980s, much research has been done on the relationship between computer attitudes and gender (Cooper, 2006; Jenson & Rose, 2003; etc.). It is generally demonstrated that girls and women would have a less positive attitude towards computers than boys and men (Cooper, 2006). Computers were perceived as belonging to the male domain of mathematics, science, electronics, and machinery (see Jones, 1986). A major concern in this respect has been the gender gap in computer attitudes and its implications for the exclusion of women from areas of the workforce (Balka & Smith, 2000; Sáinz & López-Sáez, 2010) and from the benefits available from the use of computers in domestic and leisure settings (Vekiri & Chronaki, 2008).

As stated before, the findings of several studies confirm the existence of gender differences in computer use (Goode, 2010; Meelissen & Drent, 2008; Sáinz & López-Sáez, 2010; Authors, 2004). Research in a number of countries has found that females still hold less favourable attitudes towards computers than do males (e.g., Bovée et al., 2007). Although much of the research has been conducted in the United States, data from other nations show a similar gender divide. Research in Sweden and Japan (Makrakis & Sawada, 1996), the Netherlands

(Meelissen & Drent, 2008), and Belgium (Authors, 2010) all come to the same conclusion. In this respect, Cooper (2006) argues that there is little question that a stereotype exists that links the use of computers to gender. As early as 1985, Hawkins argued that the design, development, and repair of technical equipment, have been stereotyped as masculine. In that same year, Hess and Miura (1985) state that "Women have related to these areas of activity as consumers, driving cars they did not repair and using typewriters they did not design" (Hess & Miura, 1985, p. 193).

According to advocates of socialization theory, men and women confront computers in different ways and with different perceptions, based on social expectations from others, including parents and peer groups (Shashaani & Khalili, 2001). To illustrate, the results of the Vekiri and Chronali (2008) study in Greek elementary schools confirm the effect of different socialization experiences and gendered social expectations by family and peers on computer attitudes among students. They found, for instance, that parents' expectations and support in learning about computers emerged as one of the most important determinants of boys' and girls' beliefs about their computer self-efficacy and values.

Gender and computer attitudes in education

As stated before, several studies build on the assumption that the use of computers is beneficial for learning (Kubiatko & Haláková, 2009; Meelissen & Drent, 2008). For instance, Jonassen (1996) has indicated that computer use helps students develop higher-order thinking and problem-solving skills. Other benefits derived from computer use are that it fosters collaborative learning and flexible learning opportunities, independent from time and place (Authors, 2006). As technology has become an integral part of instruction in most Western countries, it is believed that computer attitudes play an influential role in determining the

extent to which students accept the computer as a learning tool.

The research findings confirm that computer attitudes also influence the acceptance of computers in the context of teaching and learning (e.g., Ferrer et al., 2011; Vekiri & Chronaski, 2008). Having more negative attitudes towards computers may lead female students to avoid experiences that could help them develop computer competence, and this, in turn, might influence negatively their academic choices and, as stated earlier, limit their future career opportunities in information technology (Vekiri & Chronaki, 2008). Many educators, including female teachers, are not aware of the dangers of perpetuating the female stereotype. In the context of secondary education in the Netherlands, teachers have been reported to play a role both in perpetuating gender socialization and impacting negatively on girls' experiences with computers (Volman & van Eck, 2001).

The Abbiss (2009) study reported findings derived from qualitative research relating to gender and students' experience in a naturalistic setting of ICT classrooms in the New Zealand context. This case study demonstrates how gender socialization can be an underlying force behind gender inequities relating to ICT and education. The case study of Goode (2010) illustrates how three students, who were given vastly different learning experiences at home and school, develop different relationships with technology. When each of these three students entered college, they found their previous relationship with technology was reinforced by the university. In this study stories are accounts of complex, daily interactions with technology which continually inform and shape how the students view themselves as college students. These accounts highlight how understanding one's nuanced relationship with technology provides a much richer measure for studying multifarious dimensions of the digital inequity in a particular setting (Selwyn, 2007).

It has to be stated that not all studies show consistent results (see Authors, 2008; Cooper, 2006). Shapka and Ferrari (2003), for instance, found no gender difference for computer attitudes and computer outcomes in the computer profile of teacher candidates in Canada and argue that gender differences are gradually dissipating. They stipulate that gender differences might still exist in the use of computer applications that are less familiar. The Authors et al. (2004) study show that in Belgium gender differences gradually disappear as teachers become more acquainted with the educational potential of computers. In this respect, it could be stated that as the computer becomes more and more integrated into society and more people – both men and women – have access to and use computers, the so-called gender gap, if it did exist, would narrow.

According to Selwyn (2007), a more equal division in the use of computers does not automatically mean that the attitudes of men and women are the same. He argued that the focus of the research must shift; not only does one have to look for gender differences in computer use and attitudes, but also for differences in attitudes towards specifics types of use – such as study-related computer attitudes. In this respect, it could be argued that individual attitudes are context-dependent constructs (Talja, 2005): someone describing the development of an online learning environment might portray him or herself as a forerunner, but when the same individual talks about, say, setting up homepages on the Internet, a female might more readily describe herself as someone uninterested in technology. This brings us to the purpose of this study.

Context of the study

In the current study we use data from a single country sample, namely Belgium. Among the

high human development countries, Belgium ranks at the higher end of both the Gender Development Index and the Gender Empowerment Index (ranks 14th and 7th respectively among 70 high human development countries; UNDP 2008), and it shows to have a fairly egalitarian gender ideology (Halman, et al. 2005)". In Belgium, 58.3% of all women between fifteen and sixty-four years old are on the labor market, either working or job-seeking. For men this proportion is much higher, 73.6%.

There are significantly less self-employed women (6.3%) than self-employed men (11.7%), and men are more likely to be employed in the private sector (42.3% vs. 29.8%). In the private sector, 71.1% of the women work as clerks, while 54.8% of the men are laborers. Men working in the public sector are more often appointed (77.9%) than women (59.7%). Men are mostly employed in 'hard' sectors such as production, metal industry, telecommunication, transport, car and motor business or energy, while women are the majority in sectors such as education, health care, social services, and clothing manufacturing (Kuppens et al. 2006).

This study is carried out at Ghent University, a university in Flanders—the northern, Dutch-speaking part of Belgium—offering academic bachelor's and master's in all fields of study and representative for Flemish universities. In tertiary education in Flanders a common distinction is made between colleges for higher education, offering professional bachelor's degrees, and universities, offering academic bachelors and master's degrees. Any student with a diploma of secondary education may start at university, and fees are relatively low. There are five Flemish universities, all offering alpha, beta, and gamma fields of study.

In Flanders we do not distinguish between state schools and elite universities such as the "Ivy League" in the US. Ghent University has 11 faculties and 130 departments and is, with more than 38000 students and 7100 staff, one of the largest universities in Flanders and the Netherlands. Since the academic year 1999-2000 female students have been the majority in Bachelor studies. In 2010-2011 and 2011-2012, the proportion of female students was 55% and 56% respectively. This evolution follows the international trend (Gerber and Cheung 2008). Male and female students are not equally divided in the various fields of study, though. A distinction can be made between 'masculine' fields of study, enrolling a majority of male students, and 'feminine' fields of study, enrolling a majority of female students. The masculine fields of study are often referred to as the STEM-fields, namely Science, Technology, Engineering and Mathematics. Typical feminine fields of study are educational studies and pedagogy, language and arts, and a number of health related and bio sciences (Gerber and Cheung 2008). At Ghent University, the most feminine field of study—that is, with the highest proportion of women enrolled—is 'language therapy and audiology' (97% female students), followed by 'psychology and pedagogical sciences' (79%), whereas on the other end of the continuum 'engineering' (85% male students) is the most masculine field.

Purpose

From this background, it is useful to examine whether the stated gender difference in computer attitudes can still be found in a specific context, such as a school context. Therefore, the first aim of this research is to determine if there is a gender difference in computer attitudes in general and in study-related computer attitudes in particular. Study-related computer attitudes refer to *students' attitudes toward the effects of adopting computers in education*. The second aim is to explore the complex relationships between gender, the

computer attitudes variables and two computer-use variables: “computer use for leisure activities” and “study-related computer use”.

Method

Procedure and sample

A large-scale online survey was conducted, involving 1138 first-year undergraduate university students in East Flanders, one of the five provinces of Flanders, the Dutch-speaking region of Belgium. The Student Barometer is an annual survey among the students (bachelor, master and postgraduate, excluding PhD students and incoming guest and exchange students) at Ghent University. In 2011, students were invited to participate by a personalized email to their mail-account (see Appendix A). The survey was described as a questionnaire that addresses general topics related to student life and academic activities. After completing the questionnaire, students (if they provided a valid email address) could win a laptop or a voucher at a local shop. The survey, however, is voluntary and anonymous.

In total, 1138 students participated (response-rate 24.13%). All students with a study delay of two years or more were excluded to ensure the sample was limited to young undergraduates. In total, 78.5% of the students were 18 years old, 2.0% were 17 and 19.5% were 19 (M=18.83, SD=0.43). The sample included 811 female students (71.3%) and 327 male (28.7%) students. The students represented a variety of disciplines within the humanities (38.2% law and criminology, 26.1% psychology, 14.1% pedagogy, 7.5% economy, 7.5% sociology and political sciences, 6.1% communication, and 0.6% moral sciences). More demographic information is included in Table 1.

INSERT TABLE 1 HERE

Most of the students reported having their own computer (95.7%), and 94.2% of the respondents have their own computer with Internet access. On average, university students in this sample report to use the computer for 17.76 hours (SD=15.60) a week, mostly for leisure activities (M=11.65 hours; SD=12.83) and to a lesser extent for educational use (M=6.10 hours; SD=6.52). Only 0.32 % of the sample reported never to use computers for educational purposes, compared to 1.60% never using computers for leisure. A gender difference in computer ownership is not identified ($\chi 2 = 0.45$, $p = 792$). More information on the computer profile of the sample is presented in Table 2.

Instruments

The first instrument employed in this study is the "General Attitudes toward Computers Scale", an eight-item scale designed and described by Evers et al. (2009). It comprises items relating to interest (e.g., "I want to know more about computers"), pleasure (e.g., "I like to talk about computers to others"), usefulness (e.g., "The use of a computer is useful to me"), ease of use (e.g., "I feel comfortable when I use computers"). All items followed a five-point Likert response format (strongly disagree, disagree, neither agree/disagree, agree, strongly agree). The scale showed a high internal consistency, with Cronbach's α =.82.

The second instrument assesses attitudes toward the use of computers in education. The "Attitudes toward Computers in Education Scale" measures *students' attitudes toward the effects of adopting computers in education*, including the same spectrum of dimensions: "interest", "ease of use", "pleasure" and "usefulness" (Evers et al. 2009). The "Attitudes toward Computers in Education Scale" include items such as: "The computer is an important

tool for my studies" (relevance), "I have confidence in my abilities to use the computer for my studies" (confidence), or "I always want to learn more about how I can use computers for my studies" (interest). The instrument contains eight Likert-items that showed a high internal consistency (α = .80). To measure the two types of computer use, respondents were asked to indicate how many hours a week they use a computer 1) for school related activities and 2) for leisure-related activities. The responses on both scales were averaged, so that higher scores indicated more positive attitudes. The descriptive statistics on the computer use measures and gender comparisons are presented in Table 2.

INSERT TABLE 2 HERE

Data analysis

Next to the bivariate correlation analysis, a multivariate analysis of variance (MANOVA) model was conducted to test the assumption that there are differences between male and female students in one or more dependent computer profile measures. Also a structural equation modeling (SEM) technique was applied, using AMOS 21 (Arbuckle 2011). It is a methodology for representing, estimating, and testing a network of relationships between variables (for more information see Kline, 2011). In this study, SEM was used not only to assess the differences between male and female students; the path model made it possible to see differential effects gender predictors of the two types of computer attitudes ("computer attitudes in general" and "study-related computer attitudes") on the two types of computer use ("computer use for leisure activities" and "study-related computer use"). Relationships among variables were calculated as correlation coefficients (r) and direct effects on endogenous variables as standardized beta-weight (path coefficients or β*'s*).

Results

Correlations

In Table 3, an overview of the bivariate correlation coefficients among the four computer profile measures is presented. Only the two attitude measures are strongly correlated (r=.68, p<.001); the other measures are moderately correlated with each other.

INSERT TABLE 3 HERE

Multivariate analysis of variance

Table 2 presents the descriptive statistics of the attitude and use measures. A one-way multivariate analysis of variance (MANOVA) model was conducted to test the assumption that there are differences between male and female students in one or more dependent computer profile measures. The results of the MANOVA test showed that men and women differ significantly in terms of computer usage and attitudes, $F(4, 1103) = 43.23$, $p<.001$, Wilk's λ =.864. Post-hoc ANOVA tests showed gender differences in two of the four computer profile measures: computer use for leisure activities and general computer attitudes. The largest difference between male and female students was found on the general computer attitude measure, $F(1,1106) = 95.21$, $p<.001$): males, M=3.00, SD=0.97 versus females, M=2.44, SD=0.82. The Cohen's d coefficient was 0.62, indicating a medium-effect size. Male students (M=17.27, SD=17.60) also reported spending about 80% more time on computers for leisure activities compared to female students (M=9.51, SD=9.50), a difference which is also statistically significant $F (1,1106)=89.01$, $p<.001$), with a medium-effect size (Cohen's d=0.55).

No significant differences were found between male (M=3.66, SD=0.65) and female students

(M=3.58, SD=0.57) in relation to study-related computer attitudes, F(1,1106)=3.31, p=.069, Cohen's d=.13. Female students on average reported using the computer more frequently for study-related activities (M=6.06, SD= 6.00) compared to male students (M=5.97, SD=7.88), but again, the differences were not statistically significant, F (1,1106)=0.04, p=.842.

Path modeling

A first goal was to estimate the predictive power of the model. Cut-off criteria for fit indexes recommended by Hu and Bentler (1999) were used: 1) the χ^2 statistic and corresponding *p*-value; the *p*-value should not be significant; 2) the Adjusted Goodness of Fit Index (AGFI) should be at least 0.9; 3) the Comparative Fit Index (CFI) should be close to 0.95; and, 4) the Root Mean Square Error of Approximation (RMSEA) should have a value of 0.05 or less. All the goodness-of-fit indices are in line with recommended benchmarks for acceptable fit: χ^2=26.189 (*df*=3; *p*=.000), CFI=.977, AGFI=.954, RMSEA=.084. Secondly, the strength of the direct and indirect effects was assessed.

The full path model is depicted in Figure 1. More specifically, this figure includes a visual representation of the direct effects on the two types of computer use reported, but also provides additional information on the indirect effects and the interactions among "gender" and the two attitude scales. "Gender" is associated with different ICT-related variables. The results confirm that women have a less positive "attitude towards computers in general" than their male counterparts (β =.-24). The relationship between "gender" and "study-related computer attitudes" might be surprising (β=.12): female students possess more favorable "study-related computer attitudes" when controlled for "general computer attitudes".

INSERT FIGURE 1 HERE

Furthermore, the results of the path analyses indicate that "gender" has a significant direct effect on "computer use for leisure activities": males report more intensive use of computers. But no significant direct relationship was found between "gender" and "study-related computer use". The model also reveals that "general computer attitudes" contribute significantly to the explanation of "computer use for leisure activities" (β=.-22). Finally, an effect was found of "study related computer attitudes" on "study related computer use" (β=.16).

Discussion

Research in a number of countries has found that females hold less favourable attitudes toward computers than do males (e.g., Volman & van Eck, 2001). However, it remains unclear whether there are certain circumstances in which females develop more positive attitudes toward computer use. As it has been suggested that once females become convinced of the usefulness of computers, they are more inclined to make use of them (Abbiss, 2008; Selwyn, 2007), it is interesting to examine whether gender differences in computer attitudes can be found in specific contexts, such as a school context. Several studies argue that the use of computers will be directed toward students' attainment of 21st century goals, such as creativity, critical thinking, productivity, and problem-solving (Voogt & Pareja Roblin, 2012). Therefore, the main objective of this study was to 1) find out if there is a gender difference in university students' computer attitudes in general, and in study-related computer attitudes in particular, and 2) to explore the relationships between gender, the computer attitudes variables and *computer use for leisure activities* and *study-related computer use*.

The findings of this study confirm that women have less positive general computer attitudes than their male counterparts (cf. Cooper, 2006; Sáinz & López-Sáez, 2010), but no gender

differences were found in study-related computer attitudes. In the same way, being female seems negatively related to computer use for leisure activities, but no relationship was found between gender and study-related computer use. Based on these results, it cannot be assumed that, even though female university students in Flanders have less positive general computer attitudes than male students, their attitudes towards computers are negative. The results of the current study are consistent with the study of Vekiri and Chronaki (2008) showing that, although it appeared that computers were less important in the girls' everyday activities, there was no difference between female and male students' use of computers for schoolwork in elementary schools in Greece.

The differences between male and female students' computer attitudes could be a sign that they differ in their motivations and interests in considering the utility of computers, as well as the role computers play in their lives (cf. Sáinz & López-Sáez, 2010; Volman et al., 2005). Selwyn (2007) argued that the utility and perceived usefulness of the different aspects of technology lay at the heart of much of the gendered nature of the data: what is useful for men and what is useful for women were often seen as very different. Also Ferrer et al. (2011) argue that boys and girls in public schools in the region of Aragón (Spain) make different uses of ICT and also apply different value to the relationship between ICT knowledge and their subsequent incorporation into the labor market, according to careers of varying technological levels. Based on the results of this studies, it could be suggested that females take a more pragmatic stance toward computer use, meaning that they are likely to develop positive attitudes toward forms of computer use – attitudes towards computers in education in this case – that they deem to be useful. Abbiss (2008) described females as "task-oriented users" who focus on utilitarian functions of computers and on the end product. In contrast, males are described as "power users" who are machine oriented and for whom the computer is a toy to

be manipulated for its own sake.

According to Selwyn (2007), the alignment of females with purposeful applications of technology was apparent throughout the results of his British study among undergraduate students, as was the alignment of masculinity and more technological, perhaps less useful, applications. According to this author, the young women appeared not to be technophobes or technophiles but *techno-realists* as they reflected their everyday experiences of how computers are used in contemporary society. Female students in this study might be more critical toward computers, but this does not mean that they dislike or reject computers. If computer use has proven to be useful to obtain a certain objective – such as schoolwork – females' attitudes toward computers are not that different from those of males. To the contrary: whereas females score more negatively on general computer attitudes or computer use for leisure activities, they score more positively than males on study-related computer attitudes. The observed gender differences seem to occur as a result of "their different interests and not as a consequence of a lesser education of one of the two groups" (OECD 2005, p. 221).

It should also be kept in mind that these more positive study-related computer attitudes might also be a reflection of the difference in general school attitudes between males and females. Various studies have shown that males are less motivated than females and have less positive attitudes toward school (e.g., Authors, 2004; Francis, 2000). In general, females were found to spend more time doing homework, display less disturbing behavior in the classroom and are truant less often. Females have higher expectations of themselves and are more enthusiastic about continuing their studies. Males work less hard and are distracted more quickly (e.g., Warrington et al., 2000). Their study in East Anglian schools found that males more than

females consider educational achievement as not 'cool', which might explain their less positive study-related computer attitudes in comparison with females (cf. Francis, 2000). Therefore, it is important for educators and policymakers to understand how various factors interact with student characteristics to influence the teaching and learning process involving the use of computers (Teo & Noyes, 2008).

An important question is to whether female students report less favorable computer attitudes because of expectations guided by gender roles and whether these differences affect proper functioning in an educational setting and a knowledge-based society? Sáinz and López-Sáez (2010) for instance argue that stereotypical beliefs regarding female's limited technical talents also have an influence on parental expectations about female performance and achievement, which further lowers girls' self-esteem, their final performance and academic choices (cf. Eccles, 2007). It seems that the gender stereotypes are further emphasized through formal schooling where boys are thought to be more competent in masculine subject matter domains than girls (Cooper, 2006). Furthermore, the majority of software and Internet-based utilities that enhance learning productivity in daily lives are designed by a male dominated industry (e.g., Ahuja, 2002). According to Huang, Hood and Yoo (2013), these factors inevitably construct an Internet world that is unwelcoming to female users. It is in these differences that research can document the broader implications of gender differences in computer attitudes and use (see also Author et al. 2009).

In any case, when dealing with gender differences in computer attitudes or computer use, it seems to be essential to take into account specific contexts, such as work or school, and specific uses. This study produced empirical evidence to argue that female students have a less positive attitude towards computers in general, but no relationship was found between

gender and study-related computer use. This finding is in line with previous research of Authors (2004), who found that, although male teachers in primary schools in Flanders (Belgium) possess more favorable general computer attitudes, no gender effect was found on attitudes toward computers in education. Moreover, it seems that a general measure of computer attitudes explains why students use computers for leisure activities, but is not powerful enough to explain a specific type of computer use, i.e. study-related computer use. According to Shapka and Ferrari (2003), the relationship between attitudes and behavior becomes more important when attitude measures are closely tied to the task. In this respect, the critical discourse suggests that the 'problem' of gender and technology may not be as simple as it first appears, and that it may relate as much to how we think about it as to specific evidence of gender differences (Abbiss, 2008). This brings us to the next section.

Limitations of the study and suggestions for future research

Although the present study has provided more insight in the relationship between gender and specific types of computer attitudes and uses, it also reflects some shortcomings. In the current study, we use data from a single country sample, namely Belgium, which raises the question whether the results can be generalized to populations outside of Belgium. Gender differences determined by this study might be expected to be more disparate in less egalitarian countries. As common in quantitative large-scale research, gender is seen as a binary feature, distinguishing between men and women, while neglecting the variance present in each gender. This limitation is obviously due to the fact that we are building on traditional research into the gender gap in ICT-use, which focuses on differences between genders, not within. However, it might be interesting in future research to explicitly take into account intrasexual variances, for example by applying gender identity theory (cf. Vantieghem, Vermeersch & Van Houtte, 2014).

A concern for internal validity rests in the nature of a self-reported survey. Only one measure was used to collect data on the research variables. Apart from the added value of seeking an evaluation of the 'gender gap' in other study fields and at other educational levels and outside the Flemish context, there is also the fact that responses to this study were voluntary and thus inevitably subject to self-selection biases. To remedy this, future research efforts should be conducted to test the proposed model using a random sampling approach. There is also the question of the independence of students as units of analysis. In their computer profile, students are probably not only influenced by individual factors but also by the (school) context (see Authors 2009).

Additionally, it should be noted that the model presented in this study was conducted with a snapshot research approach. First, not all possible variables from the technology acceptance theory have been studied. We did for instance not center on variables such as "subjective norms" (cf. Pynoo & van Braak 2014) or "social influence" (Venkatesh et al., 2003). Future research should therefore include a systematic evaluation of other aspects of TAM and adopt an iterative approach in developing the model. Also interpretative research is required to explore the reasons why gender differences exist in different contexts. Little research has systematically examined the implications of the unique uses that individuals make of computers and other technological devices such as mobile phone or tablet PCs. The study by Kennedy et al. (2003) for instance illustrates gender differences in terms of types of ICT use: women use the Internet more for social reasons, while men use it more for instrumental and solo recreational reasons.

What have mostly been left out in studies on technology acceptance, are contextual characteristics (Lin, 2003) that surround the emergence of a technology in a society (Baaren et al. 2009). These studies reveal that research on the relationship between gender and technology also requires a holistic and qualitative approach that takes into account the way in which teachers' work is mediated by a complex set of sociocultural beliefs and practices. Also Webb and Young (2005) suggest a research approach that enables the researcher to explore the perspective of the research participant and as a consequence offer some insight into the declining gender balance in the field of technology use offers significant benefits. Collecting more narratives and expanding the technology identity would be a useful exercise across a variety of educational and social contexts (cf. Goode 2010). An important question in this respect is to whether female students report less favorable computer attitudes because of expectations guided by gender roles and whether these differences affect proper functioning in an educational setting and a knowledge-based society? It is in these differences that research can document the broader implications of gender differences in computer attitudes and use (see also Author et al. 2009).

Conclusion

As in educational settings, such as universities, computer applications and digital learning environments are more and more present and the use of it is required to obtain a degree, it is important to make sure no one gets excluded because of less favorable computer attitudes resulting in evasion of computer use. This study shows that women, although they have in general less positive attitudes towards computers than men have, are not likely to be disadvantaged in educational settings, since their attitude towards computer use for educational purposes does not differ from men. We might conclude from this study that the

more pragmatic stance of women regarding computer use benefits them in an educational setting.

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