Gender Differences in the ICT Profile of University Students: A Quantitative Analysis

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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 show that women have a less positive attitude towards computers in general. However, their attitude towards computers for educational purposes does not differ from men's. 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 computer attitudes are context-dependent constructs. When dealing with gender differences, it is essential to take into account the context-specific nature of computer attitudes and uses.

Keywords: computer attitudes, computer use, gender, ICT, path analysis, survey, university students

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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 Tondeur, Sinnaeve, Van Houtte and van

Braak (2011), these changes not only offer further opportunities but also present a number of risks. For instance, 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). Researchers have measured computer attitudes in the context of work situations and education (Bovée, Voogt & Meelissen 2007; Sáinz and López-Sáez 2010). Several of these studies build on the assumption that the use of computers is beneficial to 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. Shapka & Ferrari, 2003; Tondeur, Valcke & van Braak, 2008). 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 girls. Most of these studies support the idea that our culture is defining computers as pre-eminently male machines (cf. Lockheed, 1985). However, some studies found no gender difference in computer behavior. A Canadian study among teacher candidates, for instance, did not establish a difference in computer attitudes between men and women (Shapka & Ferrari, 2003). As the computer becomes more and more integrated into society and as more people have access to and use computers, the so-called gender gap, if it existed at all, would now be narrowing (Tondeur et al., 2011). But here, too, there is no consensus. This leads us to question the extent to which computer attitudes differ between men and women.

It remains unclear whether 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 specific contexts such as 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 a new generation of undergraduate students, born in the 1990s. In this respect, it is useful to examine whether gender differences in computer attitudes can be found among university students in Flanders, Belgium. At universities, as in other educational settings, ICT applications such as digital learning environments are increasingly present; a suitable use of them is mandatory, or at least highly recommended, to obtain a degree (e.g. Voogt & Pareja Roblin, 2012). For this reason, it is 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 shown in the studies cited above.

In 2011 the authors conducted a large-scale empirical survey among Flemish university students. Its main objective was (1) to find out whether there is a gender difference in computer attitudes in general, and in study-related attitudes in particular among students, and (2) to 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.

This article first offers an overview of the research about the relationship between gender and computer attitudes. It then describes the adopted 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. The analysis built on the results of a survey conducted among 1138 university students enrolled in a Flemish university in 2011. 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.

1. 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) and sociology with the Diffusion of Innovations Theory (Rogers, 2004).[1] 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 has received little attention in the context of this field. Given the fact that gender is often missing within technology acceptance theory, 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.

1.1. 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 (van Braak, Tondeur & Valcke, 2004). In recent years computers have become more accessible, and computer use is almost universal in Western countries. As a result, 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. 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. Already three decades ago, Hawkins (1985) argued that it would be necessary to examine how gender differences emerge in relation to the functions computers serve. Similarly, Kay (1993) states 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 towards that object. Following Kay (1993), it seems that a scale designed to assess computer attitudes towards education would be expected to provide accurate predictions as to whether students would use computers in education.

1.2. Gender and computer attitudes

Since the 1980s, much research has been done on the relationship between computer attitudes and gender (e.g. Cooper, 2006; Jenson & Rose, 2003). It is generally accepted that girls and women have a less positive attitude towards computers than boys and men (Cooper, 2006). Computers are perceived as belonging to the male domain of mathematics, science, electronics, and machinery (cfr. Jones, 1986). A major concern 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).

The findings of several studies confirm the existence of gender differences in computer use (Goode, 2010; Meelissen & Drent, 2008; Sáinz & López-Sáez, 2010; Tondeur, Valcke & van Braak, 2008). Research in a number of countries has found that females still hold less favourable attitudes towards computers than 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. Researchers in Sweden and Japan (Makrakis & Sawada, 1996), the Netherlands (Meelissen & Drent, 2008), and Belgium (Tondeur, van Braak & Valcke, 2008) all come to the same conclusion. 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 "[w]omen 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). The results of the Vekiri and Chronali (2008) study in Greek elementary schools, for instance, confirm the effect of different socialization experiences and gendered social expectations by family and peers on computer attitudes among students. Vekiri and Chronali found 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.

1.3. Gender and computer attitudes in education

As stated before, several studies build on the assumption that the use of computers is beneficial to learning (Kubiatko & Haláková, 2009; Meelissen & Drent, 2008). For instance, Jonassen (1996) indicates 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 of time and place (Tondeur, van Braak & Valcke, 2007). 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 in this study 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 com-

puter 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 in perpetuating gender socialization and in impacting negatively on girls' experiences with computers (Volman & van Eck, 2001).

Abbiss (2009) reports findings derived from qualitative research relating to gender and students' experiences in a naturalistic setting of ICT classrooms in New Zealand. This case study demonstrates how gender socialization can be a force underlying 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 in school, develop different relationships to technology. When each of these three students entered college, they found that university education reinforced their previous relationship with technology. As shown by Goode, daily interactions with technology continually inform and shape how students view themselves as college students. Both case studies 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 is important to acknowledge that not all studies show consistent results (see Cooper, 2006; Tondeur, Valcke & van Braak, 2008). Shapka and Ferrari (2003), for instance, found no gender difference for computer attitudes 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. Van Braak et al.'s (2004) study shows 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 as more people – both men and women – have access to and use computers, the so-called gender gap is narrowing.

However, according to Selwyn (2007), a more equal use of computers does not automatically mean that the attitudes of men and women are the same. Selwyn argues 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 specific 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). For instance, 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.

2. 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 (14th and 7th respectively among 70 high human development countries; UNDP 2008). In addition, it has a fairly egalitarian gender ideology (Halman, et al. 2005). The study was carried out at Ghent University, a university in Flanders—the northern, Dutch-speaking part of Belgium—offering academic bachelors and masters in all fields of study, and representative of all 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. In Flanders, there is no distinction between state schools and elite universities such as the "Ivy League" in the US. There are five Flemish universities, all offering alpha, beta, and gamma fields of study.

Ghent University has 11 faculties and 130 departments. It 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's 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 across fields of study. A distinction can be made between "masculine" fields of study, in which a majority of male students are enrolled, and "feminine" fields of study, in which a majority of female students are enrolled. The masculine fields of study coincide with the STEM-fields, namely Science, Technology, Engineering, and Mathematics. Typically feminine fields of study are educational studies and pedagogy, languages 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, the field with the highest proportion of women enrolled – is "language therapy and audiology" (97% female students), followed by "psychology and pedagogical sciences" (79%). At the other end of the continuum "engineering" is the most masculine field (85% male students).

3. Purpose

Considering 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 an educational context. The first aim of this study is to determine whether 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 towards 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".

4. Method

4.1. Procedure and sample

A large-scale online survey was conducted, involving 1138 first-year undergraduate university students at Ghent University. The Student Barometer is an annual survey among 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 sent to their email-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 was 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.

Most of the students reported having their own computer (95.7%), and 94.2% of the respondents had their own computer with Internet access. On average, university students in this sample report using 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

Table 1. Breakdown of age and ethnic origin in the sample

	Overall	Female Students	Male Students
Total, %	1138	811 (71.3 %)	327, 28.7 %
Age	18.82	18.86	18.73
SD	(0.43)	(0.41)	(0.46)
Ethnic origin			
Belgium	1063 (93.4 %)	759 (93.6 %)	304 (93.0 %)
Other European country	27 (2.4 %)	20 (2.5 %)	7 (2.1 %)
Outside Europe	44 (3.9 %)	31 (3.8 %)	13 (4.0 %)
Unidentified	4 (0.4 %)	1 (0.1 %)	3 (0.9 %)

ANOVA revealed that age did differ by gender ($F(1,1136) = 19.59$, $p < .000$) with ηp_2 (partial eta squared)= .017. Ethnic origin was measured through the place of birth of the grandmother. Chi-square test revealed that ethnic origin did not vary by gender ($\chi^2 = 4.31$, df = 3, p = .230).

never using 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.

4.2. 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 includes 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 (a = .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.

Table 2. Descriptive statistics on the computer profile measures and gender comparisons

	Overall (n=1138)		Male (n=327)		Female (n=811)		*F*	*d*	*p*
	M	**SD**	**M**	**SD**	**M**	**SD**			
Study-related computer use	6.03	6.59	5.97	7.88	6.06	6.00	0.04	-0.01	.842
Computer use for leisure activities	11.73	12.86	17.27	17.60	9.51	9.50	89.01	0.55	.000
Study-related computer attitudes	3.61	0.64	3.66	0.65	3.58	0.57	3.31	0.13	.069
General computer attitudes	2.60	0.90	3.00	0.97	2.44	0.82	95.21	0.62	.000

Theoretical ranges for the independent variables were study-related CU (0.00-108.00) CU leisure activities (0.00-140.00), study-related CA (1.00-5.00), general CA (1.00-5.00).

4.3. Data analysis

In addition to the bivariate correlation analysis, a multivariate analysis of variance (MANOVA) model was used to test the assumption that there are differences between male and female students in one or more dependent computer profile measures. A structural equation modeling (SEM) technique was applied, using AMOS 21 (Arbuckle 2011). This is a methodology for representing, estimating, and testing a network of relationships between variables.[2] In this study, SEM was used to assess the differences between male and female students; the path model made it possible to see the differential effects gender predictors of the two types of computer attitudes ("computer attitudes in general" and "study-related computer attitudes") had 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 *b's*).

5. Results

5.1. 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.

Table 3. Pearson Correlations associated with the computer profile measures

	(1)	(2)	(3)	(4)	(5)
(1) computer use for leisure activities	1.00	.18**	.10*	.23**	.00
(2) study-related computer use	.29**	1.00	.24**	.14	-.02
(3) general computer attitudes	.09	.10	1.00	.70**	-.03
(4) study-related computer attitudes	.23**	.01	.68**	1.00	.00
(5) age	-.11*	-.10	.02	.03	1.00

Upper diagonal indicates correlations for female students; lower diagonal indicates correlations for male students
* Correlation is significant at the .01 level (2-tailed) ** Correlation is significant at the .001 level (2-tailed).

5.2. 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 used 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 computer usage and attitudes: $F(4, 1103) = 43.23$, $p<.001$, Wilk's $\lambda = .864$. 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 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: $F(1,1106)=0.04$, $p=.842$.

5.3. 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. It 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 men (ß=.-24). The relationship between "gender" and "study-related computer attitudes" is different (ß=.12): female students possess more favorable "study-related computer attitudes" when controlled for "general computer attitudes".

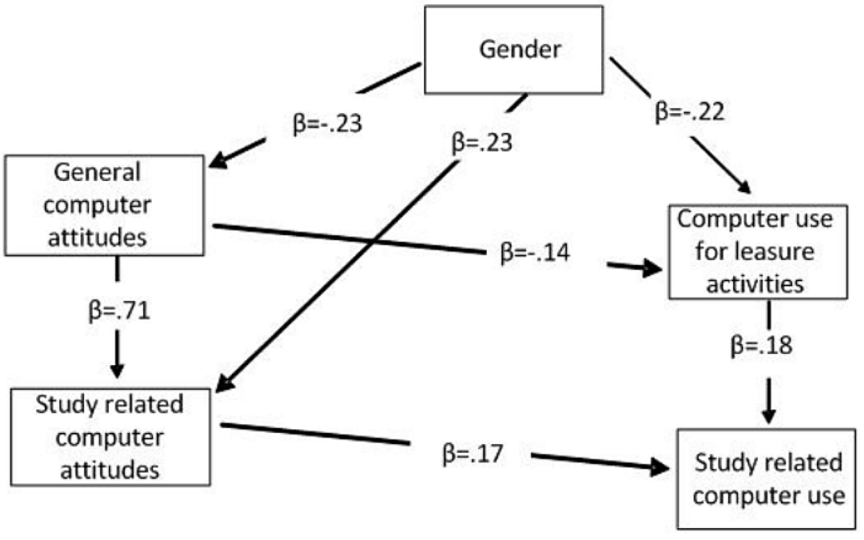

Figure 1

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. 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" (ß=.-22). Finally, an effect was found of "study-related computer attitudes" on "study-related computer use" (ß=.16).

6. Discussion

Research in a number of countries has shown that females hold less favourable attitudes towards computers than males (e.g. Volman & van Eck, 2001). However, it remains unclear whether there are certain circumstances in which females develop more positive attitudes towards 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 an educational 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).

The findings of this study confirm that women have less positive general computer attitudes than men (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 concluded 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). They show that, although computers were less important in 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 signify that they differ in their motivations and interests in considering the utility of computers. Additionally, there may be a difference in the role computers play in female students' lives (cf. Sáinz & López-Sáez, 2010; Volman et al., 2005). Selwyn (2007) argues that the utility and perceived usefulness of the different aspects of technology are at the heart of much of the gendered nature of the data: what is useful for men and what is useful for women is often seen as very different. Similarly, Ferrer et al. (2011) note that boys and girls in public schools in the region of Aragón (Spain) use ICT differently. They evaluate the relationship between ICT knowledge and the labor market differently. Based on the results of this study, it could be suggested that females take a more pragmatic stance towards computer use, meaning that they are likely to develop positive attitudes towards forms of computer use that they deem useful. Abbiss (2008) describes females as "task-oriented users" who focus on utilitarian functions of computers and on the end product. By 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 scholar, young women appeared not to be technophobes or technophiles but techno-realists: they reported on everyday experiences of how computers are used in contemporary society. Female students in this study might be more critical towards computers. This, however, 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 – women's attitudes toward computers are not altogether different from those of men. On the contrary, females score more positively than males on study-related computer attitudes. The observed gender differences seem to occur as a result of "[males' and females'] different interests and not as a consequence of a lesser education of one of the two groups" (OECD 2005, p. 221).

It should be kept in mind that these more positive study-related computer attitudes might also be related to 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 towards school (e.g. van Braak et al., 2004; Francis, 2000). In general, females were found to spend more time doing homework, to display less disturbing behavior in the classroom, and to be 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). Warrington et al. (2000) found that more males 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). It is important for educators and policy-makers to understand how various factors interact with student characteristics to influence teaching and learning processes that make use of computers (Teo & Noyes, 2008).

An important question is 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 females' limited technical talents also have an influence on parental expectations about female performance and achievement, which further lowers girls' self-esteem and their final performance, and influences their academic choices (cf. Eccles, 2007). It seems that gender stereotypes are further emphasized through formal schooling where boys are thought to be more competent in masculine subject matter 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 dom-

inated 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 here that research can document the broader implications of gender differences in computer attitudes and use (cfr. Tondeur et al., 2011).

7. 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 has 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 category. This limitation is 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 would be interesting 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 fields of study, at other educational levels, and outside Flanders, responses to this study were voluntary and thus inevitably subject to self-selection biases. To remedy this, future research efforts should 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 influenced not only by individual factors but also by the (school) context (see Tondeur, Devos, Van Houtte, van Braak, & Valcke 2009).

Additionally, it should be noted that the model presented in this study was based on a snapshot research approach. First, not all possible variables from the technology acceptance theory were studied. We, for instance, did not focus on variables such as "subjective norms" (cf. Pynoo & van Braak 2014) or "social influence" (Venkatesh et al., 2003). Future research should include a systematic evaluation of other aspects of TAM and adopt an iterative approach in developing the model. In addition, interpretative research is required to explore the reasons why gender differences exist in different contexts. Few studies have examined systematically the implications of the unique uses that individuals make of computers and other technological devices such as mobile phones or tablet PCs. The study by Kennedy et al. (2003) 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.

Contextual characteristics that surround the emergence of a technology in a society have been mostly left out of studies on technology acceptance (Lin, 2003, 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 how computer use is mediated by a complex set of socio-cultural beliefs and practices. Webb and Young (2005) suggest an approach that enables the researcher to explore the perspective of the research participant; they offer some insight into the declining gender balance in the field of technology use. Collecting more narratives and expanding technology identity would be a useful exercise across a variety of educational and social contexts (cf. Goode 2010).

8. Conclusion

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

1. For an overview, see Pynoo, 2012.
2. For more information, see Kline, 2011.

Appendix A

Dear Student,

Why do students actually study? What are they doing in their leisure time? What could be improved at UGent? Is student housing too expensive?

These are questions that matter to us and probably to you. That's why we ask you to fill out the 'Student Barometer'. The 'Student Barometer' is a research project, organized every year for UGent students, which aims to get answers to questions like the ones above.

If you complete the questionnaire, you have the chance to win one of our prizes: a laptop or vouchers for FNAC or the cinema.

You may find our questionnaire by clicking on the link below.

Thank you for your participation.

Appendix B

General Attitudes toward Computers Scale (Evers et al., 2009)

Ik gebruik graag een computer.
I like using computers.

Ik vind het leuk om met anderen over computers te praten.
I like to talk about computers to others.

Ik wil graag veel over computers weten.
I want to know more about computers.

Het werken met computers interesseert me enorm.
I am very interested in using computers.

Ik voel me op mijn gemak als ik een computer gebruik.
I feel comfortable using computers.

Als ik een computer gebruik, heb ik schrik iets verkeerd te doen.
When using computers, I'm afraid of doing something wrong.

Het gebruik van een computer is nuttig voor mij.
Computers are useful to me.

Ik vind het belangrijk om computers te kunnen gebruiken.
I find it important to be able to use a computer.

Attitudes toward Computers in Education Scale (Evers et al., 2009)

Ik wil steeds meer weten over de mogelijkheden van computers voor mijn studies.
I always want to learn more about how I can use computers for my studies.

Computers interesseren me weinig in het kader van mijn opleiding.
I am not interested in using computers for my studies.

Ik zie mezelf in staat de mogelijkheden van een computer te betrekken op mijn studies.
I have confidence in my abilities to use the computer for my studies.

Ik studeer beter dank zij de hulp van computers.
Computers improve my ability to study.

Ik vind computers onmisbaar in het kader van mijn opleiding.
Computers are indispensable for my studies.

De computer is een belangrijke tool bij mijn studies.
The computer is an important tool for my studies.