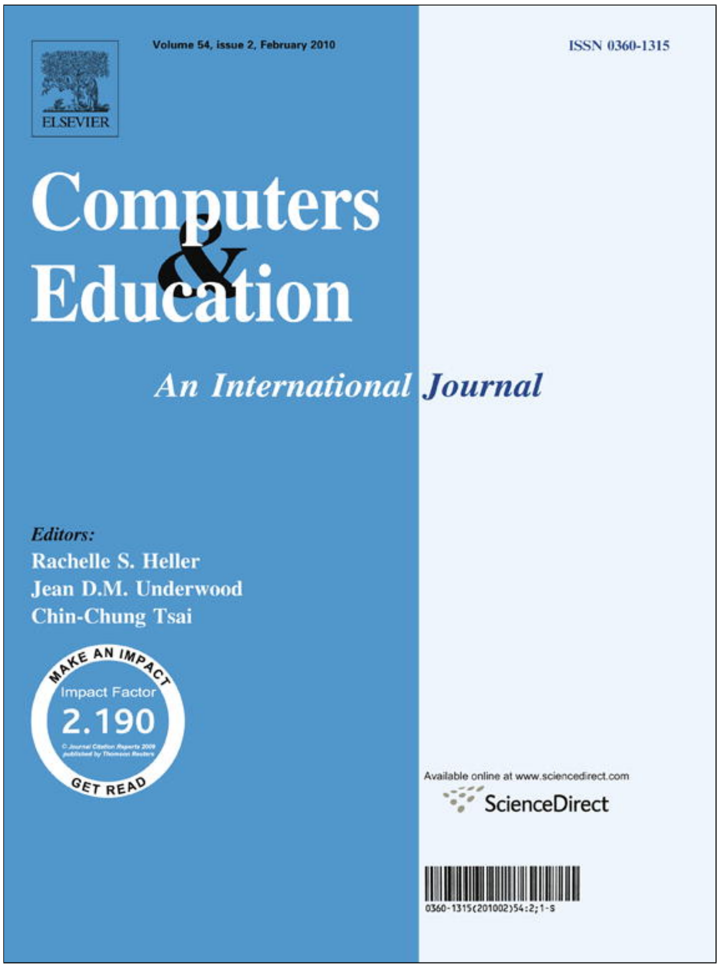
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Gender differences in computer attitudes and the choice of technology-related occupations in a sample of secondary students in Spain

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A B S T R A C T

The dearth of women in technology and ICT-related fields continues to be a topic of interest for both the scientific community and decision-makers. Research on attitudes towards computers proves that women display more negative computer attitudes than men and also make less intense use of technology and computers than their male counterparts. For this reason, the main aims of this study are threefold. Firstly, to analyze the existence of gender differences in three dimensions of computer attitudes in a group of 550 secondary students in Spain (mean of age = 15 years old; SD = 1.73). Secondly, to study the moderating influence of a group of contextual variables on those gender differences in computer attitudes. And thirdly, to examine the predictive role of computer attitudes on the intention to pursue technology-related occupations. Some of the analyses of variance carried out show more positive computer attitudes in boys than in girls. These differences are more salient among students coming from rural areas and the upper social class, who are also enrolled in the domain of technology in secondary education, and whose mothers have no occupation outside the home. Finally, simple logistic regressions were carried out in order to prove that all dimensions of computer attitudes predict the enrollment intentions to pursue technology-related occupations. Nonetheless, gender only moderates the relationship between the cognitive dimension of computer attitudes and the enrollment intentions to pursue technology-related occupations.

1. Introduction

It is frequently observed all over the world that the rate of women enrolled in degrees in Technology, Physics, Engineering or ICT-related studies (basically, Telecommunications Engineering and Computer Science) remain scarce, especially when these rates are compared with the high participation of women in university studies. On average, only 24% of university degrees and advanced research qualifications in computing were awarded to females. In contrast, when considering all fields of study, 56% of higher academic qualifications were awarded to females (UNESCO, 2007). For instance, in Spain, the share of female students enrolled in university studies during the academic year 2008–2009 is 54% while, on the contrary, 17% and 26% of all students enrolled in Computer Science and Engineering Telecommunications, respectively, are women (Instituto de la Mujer, 2009). Simultaneously, in the European Union, graduate women represent 39.17% of the total number of graduates in Science, Mathematics and Computer Science and 18.32% in Engineering. On the contrary, women represent 66.42% in studies related to Health Sciences (Eurostat, 2008).

Nonetheless, despite low representation of women in technological fields even within technical programs, girls tend to select less-technical subjects and specialties than boys. This pattern occurs even though girls have better grades than their male counterparts (which means that they have enough qualifications to undertake technical studies), and despite the initiatives carried out by different universities to change the image of technology to encourage girls to take an interest in technological studies.

This tendency begins during adolescence, when girls tend to choose subjects within the Humanities and Social Science domains, while planning their academic and professional future congruently with existing gender roles in our society. In this sense, and according to data

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by the Spanish Ministry of Education (MESDP, 2009), only 3% of girls enrolled in the Technological *Bachillerato*[1] whilst they enrolled in much greater numbers in the Humanities, Social Sciences and Health Sciences *Bachilleratos*: 57.4% and 35.1%, respectively. For this reason, many authors have reached the conclusion that early adolescence is a critical period, with respect to how the adolescent perceives other significant people's views about them (family, friends, teachers, among others), which influences their future career plans and the ultimate academic decisions they make (Bandura, 1997; Eccles, Barber, & Jozefowicz, 1999). The stereotypical beliefs regarding female's lower mathematical and technical talent also has an influence on parental and school expectations about female performance and achievement, which further lowers girls' self-esteem, their final performance and academic choices (Bandura, 1997; Eccles, 2007; Hackett, 1999).

1.1. Computer attitudes and their role in women's low participation in technology-related studies

The scarce representation of women in highly technical fields is associated with women's lower perception of their scientific and technical abilities, and negative attitudes towards technology and scientific fields, as well as a lower utility of scientific and technical fields and, in general, their lack of interest in these fields (Ayalon, 2003; Zarrett and Malanchuk, 2005). Women's negative computer attitudes have been associated with their scarce representation in technology and ICT-related studies (Anderson, Lankshear, Timms, and Coutney, 2008; Ayalon, 2003; Creamer, Lee, & Meszaros, 2006; Eccles, 2007; Volman & van Eck, 2001; Zarrett & Malanchuk, 2005; Zarrett, Malanchuk, Davis-Kean, & Eccles, 2006).

Some of these studies have utilized *the model of task achievement* (Eccles, Frome, Suk Yoon, Freedman-Doan, & Jacobs, 2000; Eccles et al., 1999) as a theoretical background to explain women's lack of interest in pursuing technology and ICT-related studies. This approach comprises two main components: the subjective task value and the expectancy component. According to this model, people only choose studies that they think they can master and that have a high value for them (Wigfield & Eccles, 2000). For instance, in one of the studies carried out under this model's approach, boys were found to choose computing courses more frequently than girls and also to perceive more value of computer courses by themselves and their parents than their female counterparts (Dickhäuser & Stiensmeier-Pelster, 2002; Dickhäuser & Stiensmeier-Pelster, 2003). This model has inspired the present research and for this reason the three dimensions of computer attitudes could be considered as part of the subjective task value component in the model that predicts the enrollment intentions to pursue technology-related occupations (Sáinz and López-Sáez, submitted for publication).

In this sense, the low participation of women in computing and technical fields demonstrates the persistence of gender differences in computer attitudes, concluding that women hold more negative computer attitudes than men (Colley, 2003; Colley, Hill, Hill, & Jones, 1995; Dickhäuser, 2001; Dickhäuser & Stiensmeier-Pelster, 2003; Madell & Muncer, 2004; Makrakis, 1993; Meelissen & Drent, 2008; Ruiz-Ben, 2003; Schumacher & Morahan-Martin, 2001; Sáinz, 2006; Volman & van Eck, 2001; Volman, van Eck, Heemskerk, & Kuiper, 2005; Woodrow, 1991). The social image about computer scientists as geeks, nerds or socially isolated people and the general conception that computer science is a male-dominated arena seem to influence girls' negative attitudes towards computers (Creamer et al., 2006; Margolis & Fisher, 2003; Sáinz, 2006).

Nonetheless, as there is not a unique nor universal definition of the construct computer attitudes (Richter, Naumann, & Groeben, 2000; Smith, Caputi, & Rawstorne, 2000) and following MacGuire's theoretical model (1985) on attitudes, a threefold perspective has been regarded as the most suitable approach to deal with the construct computer attitudes in this study. MacGuire defended that attitude structure can contain up to three evaluative components: cognitive (thoughts or ideas expressed as beliefs), affective (feelings and emotions regarding an attitude object) and behavioral (observable behavior or intention to act). Although an attitude can contain all three elements, it can be also largely or solely based on one of them. Congruently with this threefold model, the cognitive dimension of computer attitudes refers to stereotypes or beliefs about computers and computer science professionals. On the other hand, the affective dimension of computer attitudes is related to computer comfort and computer enjoyment; and finally, the behavioral dimension of computer attitudes refers to daily and weekly computer use.

Despite the context conditions of the formation and development of computer attitudes in men and women, few studies have incorporated contextual variables in the analysis of gender differences in computer attitudes. Deaux and Major (1987) developed the *model of social interaction,* in order to underline how the situation contributes to making gender stereotypes more salient. Within Spain, there is also a dearth of studies empirically exploring these aspects (De la Fuente, 2007; López-Sáez, Morales, & Lisbona, 2008). Thus, in this study some variables of importance within the Spanish context (such as the difference between rural and urban areas, social class, degree of occupation of the mother and the modality of studies chosen and to be chosen in secondary studies) have been selected in order to examine their moderating role played in the relationship between gender and computer attitudes.

In conclusion and congruently with the aforementioned explanations, the aims of this study are threefold:

- Firstly, to analyze the existence of gender differences in computer attitudes in a sample of Spanish secondary students. Boys are expected to hold more positive computer attitudes than girls.
- Secondly, to study the moderating role played by a group of contextual variables of relevance within the educational system in Spain in the contrast of gender differences in computer attitudes. It is hypothesized that boys and girls will differ in their computer attitudes, especially when coming from different contexts.
- And thirdly, to test the role played by the three dimensions of computer attitudes in the prediction of the intention to pursue technology-related occupations. Boys will have more positive computer attitudes than girls and therefore they will have higher expectations to enroll in technology-related occupations in the future.

[1] The Spanish Secondary System (ESO) is compulsory till the age of 16. It is comprised of four courses (from the 1st to the fourth course) where students' ages range between 12 and 16 years old. After ESO, students can choose between *Bachillerato* or FP (the professional path). *Bachillerato* is the 2 years of non-compulsory secondary education previous to University Studies: the first and second course of *Bachillerato*. Students can choose four domains in *Bachillerato*: Technology; Humanities and Social Science; Nature and Health Science and Arts.

Table 1
Means and standard deviations (in brackets) of computer attitudes in boys and girls. Zero order correlations between all dimensions of computer attitudes by sex ($N = 550$).

	Mean and SD		Correlations					
	Boys	Girls	1	2	3	4	5	6
1. Cognitive (total)[a]	2.30 (.53)	2.32(.42)	–	.76**	.79**	.45**	−.44**	−.22**
2. F1: social skills[a]	2.23 (.80)	2.13 (.65)	.82**	–	.37**	.03	−.18**	−.10
3. F2: computer vision[a]	2.20 (.64)	2.25 (.45)	.86**	.54**	–	.14*	−.47**	−.27
4. F3: intellect aptitudes[a]	2.63 (.71)	2.73 (.66)	.54**	.16*	.37**	–	−.22**	−.03
5. Affective	3.22 (.71)	2.98 (.72)	−.40**	−.22**	−.41**	−.21**	–	.44**
6. Behavioral	1.61 (.65)	1.44 (.53)	−.24**	−.28**	−.35**	.−21**	.91**	–

The upper part of the table is for correlations for girls and the lower part of the table is for boys.
[a] The lower score, the more positive computer attitude.
* Correlation is significant at 0.05 (bilateral).
** Correlation is significant at 0.01 (bilateral).

2. Methodology

2.1. Participants

The sample comprised 550 secondary students (580 students were targeted and the response rate reached 94.82%): 252 boys (46%) and 298 girls (54%), with ages ranging between 12 and 20 years (mean age = 15 years old; SD = 1.73); 42% come from rural areas. They were enrolled in the four courses of ESO (compulsory secondary education) and the two courses of *Bachillerato* (prior to university studies) in four high schools located in the metropolitan area of Madrid (58%) and in a rural area of Northern Spain (42%). Our participants (87.6%) reported to have at least one computer at home. Most of the students who do not have a computer at home come from rural areas and from intermediate and low social class and use computers mostly at school and in Internet Cafés. At the time of data gathering, 12.02% participants were enrolled in the first year of ESO, 8.38% in the second year, 32.6% in the third year and 9.29%, in the fourth year. 23.5% enrolled in the first year of *Bachillerato* and 14.21% in the second year of *Bachillerato*.

Students enrolled in ESO were asked about whether their interest was to pursue any of the four modalities of *Bachillerato* or to enroll in professional studies or not continue studying at all. 34.51% students of ESO planned to choose Technology in *Bachillerato*; 34.15% to choose Nature and Health; 15.85% to choose Humanities and Social Science; 12.68% to choose Arts and 2.82% informed their intention of dropping their studies. Among the students enrolled in *Bachillerato*,[2] 54.84% of the students were enrolled in Nature and Health Science; 32.8% in Humanities and Social Science and 12.37% in Technology.

2.2. Instruments

We delivered a survey that included sociodemographic and attitudinal variables.

2.2.1. Sociodemographic data

The variable place of origin, social class and occupation of the mother were categorized in order to simplify the data treatment and their posterior analyses. With regard to the variable place of origin two categories were obtained: 1 for rural and 2 for urban areas. In order to create the variable social class, the profession of the father was considered and was classified in three categories: 1 for high, 2 for intermediate and 3 low social class. The high social class comprised top professions, such as managers, small business owners or liberal professionals. The intermediate social class integrated the occupations of sales personnel, officers, white-collar workers and security corps. Finally, the low social class was composed of blue-collar workers and those currently unemployed (such as jobless or retired).

With regard to the mother's occupation, the job type was converted into a dichotomous variable: category 1 grouped those mothers with occupations outside the home and category 2 included those students whose mothers performed exclusively domestic tasks.

2.2.2. Scale on the cognitive dimension of computer attitudes

This scale is a translation of the original scale formulated by Eccles and her research team. It is comprised by 17 items, with values ranging between 1 – complete agreement – and 5 – complete disagreement (Zarrett & Malanchuk, 2005).

To explore the structure of this scale we carried out a factor analysis under the principal components and varimax rotation procedure with all items of this scale. The factor solution with three factors explained 40.25% of the global variance. Eigenvalues of the three factors are the following: 3.85 for factor 1; 1.73 for factor 2; and 1.26 for factor 3 (see Table 1). The internal consistency of the resulting scale with 17 items is satisfactory ($\alpha = .74$).

Scale factor 1 (F1) is comprised of six items with an acceptable internal consistency ($\alpha = .74$), which refers to attitudes towards computer science professional's social skills. Some sample items are: "*The only people who go into computer science are geeks*" and "*People who like computer science are only interested in gadgets*".

Scale factor 2 (F2) encompasses seven items alluding to participants' vision of computers, with a moderate internal consistency ($\alpha = .64$). Sample items read: "*Computers are interesting in and of themselves*" and "*Computers are a tool to be used to get other things done*".

Finally, scale factor 3 (F3) contains four elements that refer to computer science professional's intellectual aptitudes, with a low internal consistency ($\alpha = .49$). Items read as follows: "*Working on computers requires creativity*" and "*It takes competence and intelligence to work with computers*".

[2] All high schools where the study was carried out did not offer the domain of Arts.

2.2.3. Scale on the affective dimension of computer attitudes

This scale is comprised of two items, translated into Spanish from the original scale developed by Eccles and her research team, with values ranging between 1 – not at all – and 4 – much. Both items allude to the degree of computer enjoyment and comfort (Zarrett & Malanchuk, 2005). In order to calculate the global affective dimension of computer attitudes, we summed the values of both scales. The higher the score, the higher the emotional tie to computers. The internal consistency of the scale is satisfactory ($\alpha = .79$). Sample items read: "*How much do you enjoy using computers?*"; "*How comfortable you are with computers*?"

2.2.4. Scale on the behavioral dimension of computer attitudes

This scale is self-elaborated and consists of two items measuring daily and weekly computer use. Every item has three options with values ranging between the lowest (1) and the highest (3) intensity of computer use. In order to calculate the global scale of the behavioral dimension of computers attitudes, we summed the values of the three items. Therefore, the higher the value of the scale, the more intensity of computer uses. The internal consistency of the scale is high ($\alpha = .84$).

2.2.5. Intention to pursue technology-related occupations

This variable is dichotomous, where value 1 refers to lack of intention to pursue technology-related occupations and value 0 alludes indicates the intention to pursue technology-related occupations.

2.3. Procedure

Participants were encouraged to answer the questionnaire as honestly as possible, as there were no right or wrong answers. They were debriefed and also informed about the confidential and anonymous treatment of their responses to the survey. The survey was delivered in class during the academic year 2004–2005 and in order not to interfere with daily school life.

3. Results

As observed in Table 1, girls obtain the lowest scores in all dimensions of computer attitudes and their components, except in the perception of computer scientist professionals' social skills.

Simultaneously, when correlations are differentiated by gender, it is observed that boys obtain higher correlations than girls. Nonetheless, for girls there is no correlation between computer science professional's social skills and computer science professional's intellectual aptitudes. This finding could indicate that both variables measure different constructs, without any association between them.

3.1. Gender differences in computer attitudes and moderating influence of contextual variables

In order to expose the main results more clearly, the two first aims of the study will be presented simultaneously. The moderating variables are the following: place of origin (rural versus urban/metropolitan), social class (high, intermediate and low), occupation of the mother (mothers with and without jobs outside the home), and the *Bachillerato* modality already chosen and to be chosen (Technology, Arts, Humanities and Social Science, Nature and Health Science, and those who chose not to continue studying after *Bachillerato*).

When the influence of sociodemographic variables is not considered, one-way analysis of variance (ANOVA) renders a main effect of gender on the affective [$F(1, 521) = 14.531$, $p < .001$] and behavioral [$F(1, 519) = 10.666$, $p < .001$] dimensions of computer attitudes. Therefore, boys hold more positive emotional attitudes towards computers and use computers more frequently than their female counterparts (see Table 1). No statistical differences have been obtained in the global cognitive dimension of computer attitudes nor in its subscales ($p > .05$ in all cases).

In order to contrast the effect of the sociodemographic variables and their interaction with the gender variable, two factor analyses of variance have been carried out.

3.1.1. Place of origin

3.1.1.1. Cognitive dimension of computer attitudes. ANOVA (2×2) reveals a main effect of gender on beliefs about computer science professionals' social skills [$F(1, 485) = 4.169$, $p < .04$] and intellectual aptitudes [$F(1, 485) = 4.307$, $p > .04$] (see Table 2). Girls hold more positive beliefs about computer science's social skills than boys and, on the contrary, boys hold more positive beliefs about computer science's intellectual aptitudes than girls. The interaction effect of gender $\times$ place of origin on computer science professional's social skills is statistically significant [$F(1, 485) = 5.946$, $p < .01$].

Table 2
Means and standard deviations (in brackets) of computer attitudes in boys and girls by place of origin.

Dimensions	Boys		Girls	
	Urban	Rural	Urban	Rural
Cognitive (total)[a]	2.22 (.44)	2.30 (.62)	2.20 (.40)	2.31 (.44)
Social skills[a]	2.15 (.67)	2.35 (.91)	2.18 (.65)	2.05 (.67)
Computer vision[a]	2.12 (.55)	2.25 (.70)	2.26 (.56)	2.24 (.52)
Intellect aptitudes[a]	2.61 (.69)	2.60 (.68)	2.63 (.59)	2.85 (.72)
Affective	3.23 (.69)	3.19 (.75)	3.02 (.73)	2.91 (.71)
Behavioral	1.79 (.64)	1.36 (.58)	1.54 (.55)	1.31 (.45)

[a] The lower score, the more positive computer attitude.

Girls from rural areas hold more positive attitudes towards computer science professional's social skills than girls from metropolitan areas. Nevertheless, boys from urban areas hold more positive attitudes towards computer science professional's social skills than boys from rural areas (see Table 2). The magnitude of gender differences is higher among adolescents from rural areas.

That girls from rural areas value more positively computer scientist's social skills than other adolescents could be a result of the salient influence of social skills in rural environments, where proximity and close social relations are more typical than in urban areas (Sáinz, 2006).

3.1.1.2. Affective dimension of computer attitudes. ANOVA (2 × 2) only renders a main effect of gender on the global affective dimension of computer attitudes [$F(1, 522) = 15.023$, $p < .001$] (see Table 2). Boys are more emotionally attached to computers than girls.

3.1.1.3. Behavioral dimension of computer attitudes. ANOVA (2 × 2) proves a main effect of gender on the behavioral dimension of computer attitudes [$F(1, 517) = 9.479$, $p < .001$] (see Table 2). Boys spend more hours daily and weekly using computers than girls. The variable place of origin has a main effect on the global behavioral dimension of computer attitudes [$F(1, 517) = 42.871$, $p < .001$]. Adolescents from urban places behave more proactively with computers than those from rural areas. The gender × place of origin interaction on the behavioral dimension of computer is statistically significant [$F(1, 517) = 3.836$, $p < .05$].

Boys and girls from urban areas are more proactive using computers than boys and girls from rural areas. The magnitude of gender differences is slightly higher among adolescents who are from urban areas. This finding could be a result of the lower access to computers in rural areas (Castaño, Martín, & Vázquez, 2008).

3.1.2. Social class

3.1.2.1. Cognitive dimension of computer attitudes. ANOVA (2 × 3) only illustrates a main effect of gender on computer science professional's social skills [$F(1, 448) = 7.100$, $p < .008$] (see Table 3). Girls hold more positive attitudes about computer science professional's social skills than boys. The effect of the variable social class is not significant when viewed alone nor when viewed together with gender ($p > .05$ in all cases).

3.1.2.2. Affective dimension of computer attitudes. ANOVA (2 × 3) evidences a main effect of gender on the affective dimension of computer attitudes [$F(1, 4) = 8.402$, $p < .004$] (see Table 3). Boys claim to feel more affection towards computers than girls. The effect of the variable social class is not statistically significant when considered alone and in interaction with gender ($p > .05$).

3.1.2.3. Behavioral dimension of computer attitudes. ANOVA (2 × 3) exhibits a main effect of gender on the behavioral dimension of computer attitudes [$F(1, 478) = 4.378$, $p < .04$] (see Table 3). Boys behave more proactively with computers than girls. Gender × social class interaction on the global behavioral dimension of computer attitudes is statistically significant [$F(2, 478) = 3.247$, $p < .04$].

Boys from upper social class use computers more frequently than boys from intermediate and low social class. On the other hand, girls from intermediate social class use computers more frequently than girls from upper and low social class. The magnitude of gender differences is greater among adolescents from upper social class. A lack of main effect of the social class variable was observed in the behavioral dimension of computer attitudes ($p > .05$). Adolescents from lower social class use computers less frequently than girls from other social groups, which could be partly a result of their lower accessibility to computers (Castaño et al., 2008).

3.1.3. Occupation of the mother

3.1.3.1. Cognitive dimension of computer attitudes. ANOVA (2 × 2) renders a main effect of gender on the social skills associated with computer science professionals [$F(1, 462) = 4.060$, $p < .04$] (see Table 4). Therefore, girls hold more positive attitudes towards computer science professional's social skills than boys. The interaction of gender × occupation of the mother has a significant effect on the vision of computers [$F(1, 462) = 3.844$, $p < .05$] and on the global cognitive dimension of computer attitudes (beliefs about computers and computer science professionals) [$F(1, 462) = 5.247$, $p < .02$].

Boys whose mothers work outside the home hold a more positive vision of computers than boys with unemployed mothers. Girls whose mothers are unemployed hold a more positive vision of computers than girls whose mothers work outside the home. The magnitude of discrepancy between boys and girls is greater among adolescents whose mothers are unemployed.

Boys whose mothers work outside the home hold more positive beliefs about computers and computer science professionals than boys whose mothers are unemployed. Among girls, those whose mothers are unemployed hold more positive beliefs about computers and computer science professionals than those whose mothers work outside the home. The magnitude of gender differences is slightly greater among adolescents whose mothers are unemployed. Other effects regarding the cognitive scales of computer attitudes are not statistically significant ($p > .05$).

Table 3
Means and standard deviations (in brackets) of computer attitudes in boys and girls by social class.

Dimensions	Boys			Girls		
	Upper	Intermediate	Low	Upper	Intermediate	Low
Cognitive (total)[a]	2.17 (.39)	2.33 (.54)	2.31 (.55)	2.32 (.41)	2.40 (.47)	2.24 (.37)
Social skills[a]	1.99 (.50)	2.31 (.83)	2.24 (.77)	2.11 (.64)	2.22 (.70)	2.05 (.62)
Computer vision[a]	1.97 (.43)	2.23 (.55)	2.20 (.70)	2.29 (.53)	2.35 (.57)	2.13 (.49)
Intellect aptitudes[a]	2.79 (.67)	2.52 (.67)	2.62 (.69)	2.66 (.61)	2.73 (.65)	2.72 (.67)
Affective	3.23 (.77)	3.19 (.71)	3.12 (.57)	2.92 (.74)	2.99 (.70)	2.78 (.69)
Behavioral	1.72 (.69)	1.56 (.63)	1.42 (.67)	1.37 (.53)	1.50 (.53)	1.33 (.47)

[a] The lower score, the more positive computer attitude.

Table 4
Means and standard deviations (in brackets) of computer attitudes in boys and girls by occupation of the mother.

Dimensions	Boys		Girls	
	Occupation	Non occupation	Occupation	Non occupation
Cognitive (total)[a]	2.25 (.49)	2.39 (.56)	2.34 (.42)	2.26 (.39)
Social skills[a]	2.15 (.73)	2.21 (.76)	2.15 (.66)	2.05 (.59)
Computer vision[a]	2.11 (.53)	2.30 (.74)	2.25 (.56)	2.21 (.47)
Intellect aptitudes	2.55 (.70)	2.69 (.69)	2.72 (.65)	2.68 (.61)
Affective	3.27 (.71)	3.10 (.68)	2.96 (.71)	2.98 (.72)
Behavioral	1.63 (.64)	1.57 (.67)	1.41 (.53)	2.78 (.69)

[a] The lower score, the more positive computer attitude.

3.1.3.2. Affective dimension of computer attitudes. ANOVA (2 × 2) shows a main effect of gender over the emotional tie to computers [$F(1, 496) = 9.589$, $p < .002$] (see Table 4). Thus, boys are more emotionally attached to computers than girls. The effects of the variable, occupation of the mother, and of its interaction with gender are not statistically significant ($p > .05$).

3.1.3.3. Behavioral dimension of computer attitudes. ANOVA (2 × 2) renders a main effect of gender on the global behavioral dimension of computer attitudes [$F(1.490) = 4.250$, $p < .040$] (see Table 4). Boys behave more proactively with computers than girls. The effects of the variable occupation of the mother and of its interaction with gender are not statistically significant ($p > .05$).

3.1.4. Domain of Bachillerato chosen

3.1.4.1. Cognitive dimension of computer attitudes. ANOVA (2 × 3) only illustrates a significant effect of the interaction gender × for type of *Bachillerato* chosen, whose effect is only statistically significant on computer science professional's social skills [$F(2, 178) = 4.331$, $p < .015$](see Table 5).

Girls enrolled in Technology hold more positive attitudes towards computer science professional's social skills than girls in Humanities and Social Science and Nature and Health Science. On the contrary, boys enrolled in Technology and Nature and Health Science hold more positive attitudes towards computer science professional's social skills than boys enrolled in Humanities and Social Science. The magnitude of gender differences is greater among adolescents in Humanities and Social Science. A main effect of gender or field of *Bachillerato* chosen was not observed on any scale of the cognitive dimension of computer attitudes ($p > .05$). Most likely, adolescents who are enrolled in Technology, especially boys, hold more positive attitudes towards computers and computer scientists because they do not consider computer scientists as geeks nor as isolated people who use computers for the main purpose of earning money.

3.1.4.2. Affective dimension of computer attitudes. ANOVA (2 × 3) demonstrates a main effect of gender on the global behavioral dimension of computer attitudes [$F(1, 176) = 6.414$; $p < .012$] (see Table 5). Thereby, boys show more positive emotions towards computers than girls.

3.1.4.3. Behavioral dimension of computer attitudes. ANOVA (2 × 3) shows a main effect of gender on the behavioral dimension of computer attitudes [$F(1, 179) = 4.712$; $p < .031$] (see Table 5). Boys behave more actively with computers than girls.

3.1.5. Type of Bachillerato to be chosen

No statistical differences were observed in the different scales of the cognitive dimension and the affective dimension of computer attitudes, when considering the gender variable in an isolated instance nor when considered in interaction with the type of *Bachillerato* to be chosen ($p > .05$ in all cases).

3.1.5.1. Behavioral dimension of computer attitudes. ANOVA (2 × 5) shows a main effect of the modality of *Bachillerato* to be chosen on the behavioral dimension of computer attitudes [$F(4, 268) = 2.804$, $p < .024$] (see Table 6). Adolescents who plan not to continue studying or plan to choose either Technology or Nature and Health Science spend more hours using computers.

The gender × type of *Bachillerato* to be chosen interaction has a main effect on the behavioral dimension of computer attitudes [$F(4, 268) = 2.310$, $p < .05$]. Boys who report not to continue studying or who plan to pursue the Humanities and Social Science and Arts in *Bachillerato* use computers more frequently. Girls who plan to discontinue studying and who choose Technology and Nature and Health Science use computers more frequently. The magnitude of gender differences in computer use is higher among adolescents who plan to discontinue studying.

Table 5
Means and standard deviations (in brackets) of computer attitudes in boys and girls by modality of *Bachillerato* chosen.

Dimensions	Boys			Girls		
	Tech.	Human.	Natur.	Tech.	Human.	Natur.
Cognitive (total)[a]	2.26 (34)	2.33 (.57)	2.27 (.43)	2.14 (.17)	2.29 (.37)	2.53 (.45)
Social skills[a]	2.06 (.58)	2.44 (.98)	2.21 (.58)	1.92 (.23)	1.95 (.61)	2.40 (.69)
Computer vision[a]	2.19 (.35)	2.15 (.54)	2.20 (.54)	2.05 (.33)	2.35 (.46)	2.50 (.59)
Intellect aptitudes[a]	2.70 (.59)	2.48 (.70)	2.47 (.64)	2.62 (.31)	2.68 (.69)	2.76 (.55)
Affective	3.29 (.70)	3.22 (.72)	3.17 (.74)	3.08 (.80)	2.76 (.61)	2.77 (.71)
Behavioral	1.78 (.63)	1.70 (.83)	1.64 (.61)	1.75 (.76)	1.24 (.38)	1.40 (.50)

[a] The lower score, the more positive computer attitude.

Table 6
Means and standard deviations (in brackets) of computer attitudes in boys and girls by modality of *Bachillerato* to be chosen.

Dimensions	Boys					Girls				
	Tech.	Human.	Natur.	Arts.	No study	Tech.	Human.	Natur.	Arts.	No study
Cognitive (total)[a]	2.22 (.55)	2.19 (.44)	2.39 (.61)	2.17 (.36)	2.56 (.62)	2.11 (.42)	2.25 (.32)	2.29 (.44)	2.28 (.46)	2.31 (.29)
Social skills[a]	2.07 (.81)	2.05 (.44)	2.28 (.77)	2.24 (.72)	2.58 (.59)	1.95 (.61)	2.05 (.65)	2.11 (.64)	2.25 (.73)	2.79 (.44)
Computer vision[a]	2.07 (.62)	2.18 (.48)	2.29 (.84)	1.81 (.51)	2.43 (.81)	2.06 (.51)	2.16 (.47)	2.25 (.53)	2.01 (.53)	1.57 (.75)
Intellect aptitudes[a]	2.68 (.82)	2.41 (.62)	2.72 (.67)	2.69 (.63)	2.75 (.35)	2.43 (.62)	2.71 (.60)	2.67 (.70)	2.83 (.51)	2.88 (.75)
Affective	3.19 (.68)	3.19 (.90)	3.38 (.72)	3.55 (.52)	2.63 (.48)	3.29 (.56)	2.97 (.59)	3.02 (.81)	3.22 (.72)	3.12 (.75)
Behavioral	1.56 (.63)	1.65 (.83)	1.50 (.60)	1.64 (.64)	1.75 (.65)	1.62 (.50)	1.29 (.44)	1.29 (.55)	1.39 (.52)	2.63 (.25)

[a] The lower score, the more positive computer attitude.

Table 7
Prediction of the intention to pursue technology-related occupations: moderating role played by Gender.

Dimensions	Gender	Computer attitudes	Gender × computer attitudes
Cognitive (total)[a]	$\chi^2(1) = 20.614$ Wald = 20.155***	$\chi^2(1) = 14.962$ Wald = 13.934***	$\chi^2(1) = 28.215$ Wald = 26.260***
Affective	$\chi^2(1) = 20.614$ Wald = 20.155***	$\chi^2(1) = 18.019$ Wald = 17.015*** ($b = -.572$)	$\chi^2(1) = 2.108$ Wald = 2.097
Behavioral	$\chi^2(1) = 20.614$ Wald = 20.155***	$\chi^2(1)=6.043$ Wald = 5.939** ($b = -.404$)	$\chi^2(1) = 1.058$ Wald = 1.052

[a] The lower score, the more positive computer attitude.
* $p < .05$
** $p < .01$.
*** $p < .001$.

3.2. Moderating influence of gender on the relationship between the dimensions of computer attitudes and the intention to pursue technology-related occupations

Simple logistic regressions were realized in order to contrast the moderating role of gender in the relationship between the three dimensions of computer attitudes and the intention to pursue technology-related occupations.

3.2.1. Cognitive dimension of computer attitudes

Only the global dimension of computer attitudes has been considered for this purpose. The intention of undertaking technology-related occupations depends on adolescents' beliefs about computers and computer science professionals, on gender and also on the interaction between gender and beliefs about computers and computer science professionals (see Table 7). The increase in χ^2 [$R^2 CoxSnellcognitivedimen$ = .035] after including the gender x cognitive dimension interaction is statistically significant [$R^2 CoxSnellgenderxcognitivedimen$ = .065]. Considering the influence of gender and beliefs about computers separately, boys (*OR* = 2.374) and adolescents with positive beliefs about computers (*OR* = 2.342) are more likely than girls and adolescents with negative beliefs about computers to undertake technology-related occupations.

Boys who have the intention of pursuing technology-related occupations (*M* = 2.16; SD = .51) hold more positive beliefs towards computers than those who do not have the intention of pursuing technology-related occupations (*M* = 2.41; SD = .50). Girls reporting to have

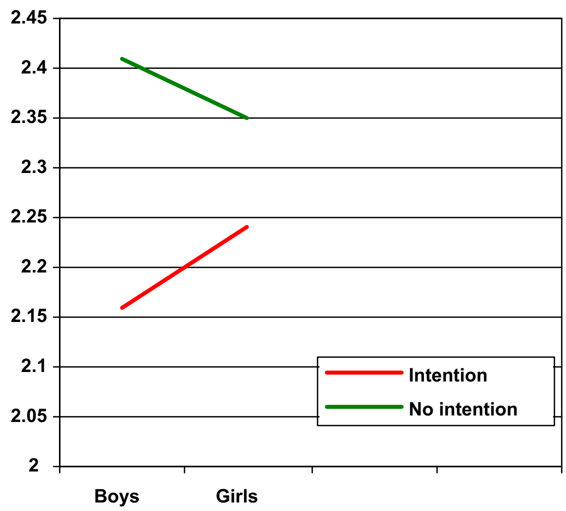

Fig. 1. Moderating role of sex between the cognitive dimension of attitudes and intention of pursuing technology-related occupations.

the intention of undertaking technology-related occupations ($M = 2.24$; SD = .37) show more positive computer attitudes than those without the intention of undertaking technology-related occupations ($M = 2.35$; SD = .45). Nonetheless, it is observed that the magnitude of differences between those adolescents with and without the intention to pursue technology-related occupations ($p < .05$) is higher among boys than among girls, where mean differences are not significant (Fig. 1). This finding confirms those achieved by Zarrett and Malanchuk (2005), where it was proved that negative stereotypes or beliefs about computers predicted the intention of pursuing IT-related occupations in girls.

3.2.2. Affective dimension of computer attitudes

Both the affective dimension of computer attitudes and gender have an influence on the intention of undertaking technology-related occupations, when considered separately (see Table 7). Nonetheless, no significant effect is achieved when gender is considered with the affective dimension of computer attitudes. Thereby, gender does not moderate the relationship between the affective dimension of computer attitudes and the intention of undertaking technology-related occupations. In conclusion, boys ($OR = 2.374$) and adolescents emotionally attached to computers ($OR = .565$) are more likely to pursue technology-related occupations.

3.2.3. Behavioral dimension of computer attitudes

The behavioral dimension of computer attitudes and gender separately predict the intention of undertaking technology-related occupations, but not when considered together (see Table 7). There is no moderating effect of gender in the relationship between the behavioral dimension of computer attitudes and the intention of pursuing technology-related occupations. In summary, boys ($OR = 2.374$) and adolescents who use computers frequently ($OR = .668$) are more likely to pursue technology-related occupations.

4. Discussion

This study is an original contribution to the analysis of gender differences in computer attitudes and the prediction of technology-related occupations within the context of Spain. Conversely to the investigations carried out using a bipolar perspective of computer attitudes (conceived in terms of positive and negative stereotypes about computers) with the model of task achievement (Zarrett & Malanchuk, 2005; Zarrett et al., 2006), a triple conceptualization of computer attitudes has been utilized to deal with the construct computer attitudes.

Most findings obtained in this study verify our predictions about women's lower computer attitudes than their male counterparts and confirm those obtained by other research (Dickhäuser, 2001; Dickhäuser & Stiensmeier-Pelster, 2002; Nelson & Cooper, 1997; Shashaani & Khalili, 2001; Volman & van Eck, 2001; Volman et al., 2005). Nevertheless, and in line with the conclusions of the meta-analytical study carried out by Whitley (1997), it cannot be assumed that even though women hold fewer positive computer attitudes than men, their attitudes towards computers are negative. That boys and girls exhibit different computer attitudes could entail that they differ in their motivations and interests in considering the utility of computers, and their ultimate use of computers (Volman et al., 2005), as well as the role computers play in their lives. As some authors suggest (Deyoung & Spence, 2004), making women get in contact with computers from early years could reduce gender differences in computer attitudes.

At the same time, the lack of gender differences in the cognitive dimension of computer attitudes has been proved when the influence of gender is considered an isolated instance, but not when considered together with other moderating variables. In general, our findings prove that the fact that girls hold more positive attitudes about computer science professional's social skills could denote, on the one hand, the communal orientation with which girls associate all occupations, in general, and the antisocial image society holds with regard to computer scientists. Computers and technology seem to be perceived as incompatible with social skills, which are supposed to be important requirements for women to achieve proper professional and personal development, while intervention programs with parents, educators and other influential individuals are necessary to promote girls' attraction toward computers and technologies and to change the image of technology-related occupations as male-dominated areas. This way, girls would perceive computers and technology as a way of developing social skills, de-bunking typical stereotypes about technology and computers, such as the consideration of computer scientists as freaks, geeks or socially isolated (Margolis & Fisher, 2003; Sáinz, 2006; Zarrett & Malanchuk, 2005). On the contrary, that boys hold more positive attitudes about computer science professional's intellectual aptitudes than their female counterparts could indicate that this aspect is a challenging and attractive justification for boys, because it is more prototypical of the instrumental-agentic trait traditionally associated with men (Eagly & Steffen, 1984).

In accordance to our findings, not all moderating variables have a main effect on some dimensions of computer attitudes when taken separately from the gender variable. Nevertheless, when considered simultaneously with the gender variable, most of them increase or decrease the influence that the gender variable has on the dimensions of computer attitudes. In this sense, the use of the occupation variable of the mother as a moderating variable in the study of gender differences in computer attitudes makes visible the contribution of women in the workforce. The place of origin variable also plays a moderating role in the relationship between gender and computer attitudes. As social relationships play an important role in rural environments, girls from rural areas may encounter more social pressure to behave congruently with feminine roles and therefore to hold more positive attitudes towards computer science professional's social skills. On the other hand, adolescents from lower social class use computers less frequently than adolescents from upper and intermediate social class. These findings are in line with the ones observed by OECD (2005), where it noted that socioeconomic background was found to be a stronger predictor of whether or not a student had access to a computer at home, than gender.

At the same time, boys whose mothers are employed hold more positive beliefs about computers and computer science professionals and use computers more frequently than boys whose mothers are unemployed. Mothers without occupation out of home can limit their children's use of computers in a higher extend than those mothers who have an occupation out of home, discouraging their male children to use computers in an immoderate way.

Congruent with these findings, future research should include different types of contextual variables in the study of gender differences in attitudes towards computers and computers science, in order to have a wider understanding of the conditions and situations where these differences take place (Deaux & Major, 1987). In this regard, the hypothesis about the lack of gender differences in computer attitudes in non co-educational schools could also be contrasted by future research (Cooper & Weaver, 2003).

According to our findings, the three dimensions of computer attitudes predict the intention to pursue technology-related occupations. Nevertheless, gender only plays a moderating role between the cognitive dimension of attitudes towards computers and the intention to pursue technology-related occupations. Therefore, the difference between holding positive and negative computer attitudes and having the intention of pursuing technology-related occupations is higher among boys than among girls.

As adolescents may hold misconceptions of what a career in the fields of technology and computing involves, educational settings should put more effort into trying to reduce the stereotypes held about technology and IT-related occupations. It could also be interesting to carry out a similar study analyzing parents' and teachers' computer attitudes and the way they transmit stereotypes to their children and students, respectively.

Younger women do not have positive models of reference of female engineers or computer scientists succeeding in non-traditional studies or careers. Furthermore, feminine mentors who support other women's professional paths are scarce in these non-traditional areas.

The inability to pursue technical and scientific-related careers places women in marginal and less economically-rewarding positions (American Association of University Women (AAUW), 1999). That is why it is especially important to carry out studies that contribute to shed light on the low representation of women in technology-related studies and occupations. Some authors (Sonnert, Fox, & Adkins, 2007) even recognize that "the dearth of women in science and engineering could be perceived as a public policy problem, both in terms of underutilizing talent and human resources and of perpetuating gender inequities".

Finally, it is necessary to state that given the sample was not randomly selected, the results of this research can only be applied to the selected group.

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