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Adolescents' gendered portrayals of occupations in the field of Information and Communication Technologies

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ABSTRACT
This study tackled secondary students’ gender-stereotyped portrayals of ICT occupations, together with the use of gender references associated with these occupations. Likewise, the existence of gender differences was also examined. 443 boys and 457 girls (mean age 15 years; S.D.= 0.65) from Catalonia (Spain) participated in the study. A content analysis of responses to one open-ended question on ICT occupations was performed that suggested that there were gender differences in students' perceptions of ICT occupations. Contrary to expectations, non-masculine references about ICT occupations were more highly reported than masculine references. However, young females were more likely to offer non-masculine references to occupations where ICT is the tool rather than the object of their work. In contrast, young males were more likely to offer masculine references to occupations involving the design and production of ICT products and services. The theoretical and practical implications of the findings were discussed.

KEYWORDS
Gender roles, stereotypes, male-dominated occupations, women in ICT

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INTRODUCTION

Information and Communication Technologies (ICT) are present in most activities that modern societies deal with. In Spain, this field is currently associated with more work opportunities than other sectors (INE, [Spanish Statistics Office] 2014). However, despite the numerous working opportunities that the production and design of ICT offers to men and women in Europe and North America, most women are not interested in working professionally in this field (Appianing & Van Eck, 2015; Barker & Asprey, 2006; Sáinz, 2011; Valenduc, 2011). This underrepresentation is especially marked in occupations with a large hard technological component (hard ICT jobs), such as computer science, and has been documented by North American and European scholars (Burger, Creamer, & Meszaros, 2011; Castaño, 2011; Cohoon & Asprey, 2006; Margolis & Fisher, 2002; Sáinz 2007; among others). Paradoxically however, women who are highly identified with the prototypical view of ICT professionals and with an interest in the field tend to play a secondary role in the design and production of ICT technologies (Barker & Asprey, 2006; Meszaros, Lee, & Laughlin, 2007). On the other hand, women are overrepresented in soft ICT occupations where ICT is the tool rather than the target of their work, such as office and other clerical jobs (Castaño, 2011; Zarrett & Malanchuk, 2005).

Several factors seem to discourage young women from entering the ICT field. These include the stereotypical masculine portrayal of ICT occupations, their lack of identification with this portrayal and the dearth of female role models in the field (Barker & Aspray, 2006; Cheryan, Drury, & Vichayapai, 2012; Cheryan, Play, Handron, & Hudson, 2013; Margolis & Fisher, 2002). Research drawing on social role theory concludes that the perception that computer science is technology-oriented rather than people-oriented may cause women to express less interest in the field than men (Diekman, Brown, Johnston, & Clark, 2010). Women perceive Science, Technology, Engineering and Mathematics (STEM) careers as less likely than those in other fields to fulfill communal goals (Diekman et al., 2010). Therefore, as most career decisions are made while at secondary school, the research presented here aims to analyze secondary school students' gendered endorsement of the occupations related to the ICT field.

Gendered Portrayals of Occupations

In the past young people's gendered stereotypical views of several occupations (i.e. doctors, accountants, police officers, nurses, teachers, etc.) have been widely investigated in North American contexts using mainly self-reported surveys (Cejka & Eagly, 1999; Levy, Sadovsky, & Troseth, 2000; Liben, Bigler, & Krogh, 2002). Several studies have however highlighted a major limitation associated with this methodological approach: the formulation of explicit questions about gendered occupational aspirations (such as, "out of the following occupations choose which ones are masculine or feminine" or "list 5 to 10 occupations that most suit you") may lead to the elicitation of gender stereotypes (Gadassi & Gati, 2009; Rudman & Glick, 2010). Incidentally, research conducted in Israel shows less gender~-biased occupational choices when young adult participants reported their occupational preferences in indirect rather than direct terms (Gadassi & Gati, 2009).

Interestingly, as stereotypes create automatic associations about gender and occupations, psychosocial research into secondary students' implicit reports has emerged in the literature (Banaji & Hardin, 1996; Lemus, Moya, Lupiánez, & Bukowski, 2014; López-Sáez, Puertas, & Sáinz, 2011; White & White, 2006). These studies support the idea that implicit reports are less likely to be influenced by social desirability than explicit ones (Fazio & Olson, 2003). Accordingly, rather than explicit methods looking at participants' gender stereotype knowledge by means of closed questions (Miller, Lurya, Zosuls, & Ruble, 2009), the present study used an open-ended question approach in order to activate secondary students' stereotypical portrayals of ICT-related occupations. This approach is consistent with psychosocial theories that distinguish between the availability and accessibility of constructs in memory (Higgins, 1996; Higgins & King, 1981). Whereas the availability of constructs (whether or not a construct is stored or present in the memory) would correspond to knowledge of stereotypes, accessibility (readiness with which it is retrieved) would correspond to stereotype activation (the main scope of the present research).

Additionally, recent psychosocial research has used implicit methods (alone or in combination with explicit measures) for the study of gendered stereotypical portraits and gender roles (López-Sáez et al., 2011; Banaji & Hardin, 1996; White & White, 2006). For instance, implicit and explicit measures in White and White's work coincided in identifying that engineering was stereotyped by US college students as a masculine occupation, whereas elementary school teaching was stereotyped as a feminine occupation. Similarly, accounting presented an interesting pattern. Although participants explicitly categorized accounting as gender neutral, it was also implicitly perceived to be a masculine job. As reported by White & White (2006), the socially shared portrayals of accountants as men and the perceptual association of accounting with mathematics (an area stereotypically associated with men) could explain this finding. Similarly, research in Spain using both explicit and implicit measures of attitudes towards occupational choices has shown that whereas engineering was stereotyped as a male occupation, female university students enrolled in engineering were more negatively appraised by male and female secondary students than female university students enrolled in medicine (López-Saéz, et al. 2011)

Likewise, content analysis research to examine gender stereotypical views of occupations and the people working in those occupations is also emerging in the literature (Cheryan, et al., 2013; Basow, Phelan, & Capotosto, 2006; Sáinz, Meneses, López, & Fabregues, 2016). A recent study carried out in Spain confirms that secondary students endorsed several male stereotypical portrayals of people working in the ICT field (Sáinz et al., 2016). Most references were inspired by the multidimensional nature of gender stereotypes with regard to occupations (Cejka & Eagly, 1999; Cheryan et al., 2013; Sáinz, 2007) and were therefore associated with their unattractive physical appearance, lack of social skills, or outstanding intellectual aptitudes. These views basically revolved around a set of characteristics of ICT professionals that are congruent with masculine gender roles. In addition, the distinction between professions involved in the design and development of ICT services (hard ICT jobs), and professions using ICT as a tool (soft ICT jobs) was also part of the reported stereotypes. Students (particularly boys) associated more masculine than feminine characteristics with hard ICT jobs. These findings suggested a prevalent masculine view of the professionals working in the ICT field, given the influence of masculine gender roles. Following this line of argument and given the preponderance of male gender roles in hard ICT occupations (Cheryan et al., 2013), boys and girls are expected to provide more examples of hard than soft ICT occupations (Hypothesis 1.1). Similarly, given the high presence of females in soft ICT occupations (Castaño, 2011; Sáinz et al., 2016; Zarrett & Malanchuk, 2005), it is expected that girls will be more likely than boys to write about soft ICT occupations (Hypothesis 1.2).

Grammatical Gender and Male Dominated Occupations

Research on the use of grammatical gender in the Spanish language and how it is associated with male-dominated technological occupations (such as engineering or computer science) is scarce (Sáinz et al., 2016). As in other languages with grammatical gender (e.g. Catalan, French, or Italian), the masculine form in Spanish functions as the generic form to refer to occupations or people with certain occupations. For instance, it is common to use the masculine singular '*un ingeniero*' (an engineer) or the plural form '*ingenieros*' (engineers) to refer indistinctively to male and female engineers. This use of masculine generics suggests that engineering is a highly male dominated arena, where women are underrepresented. Consequently, masculine forms often generate semantic ambiguity (Irmen & Kurovskaja, 2010), which is enhanced by the possible interpretations of the very notion of 'generic' (Gygax & Gabriel, 2011). Formally, a group of people of both sexes can, in languages with grammatical gender, mean that there is a majority of men and one or two women, that there is an equal share of both, but also that there is a majority of women and only one or two men (Gygax & Gabriel, 2011). For instance, the masculine plural form in Spanish (e.g.,' *actores*', actors), though interpretable as a generic form (i.e. actors are men and women), seems to more likely activate a specific interpretation (i.e. actors are mainly men).

Given that ICT occupations are frequently male-dominated (Castaño, 2011; Cheryan et al., 2012), it is predicted that students will associate more masculine than non-masculine references with ICT occupations, especially with those involving the design and production of ICT services, which are seen as more congruent with masculine gender roles. (Hypothesis 2.1). In addition, given the higher presence of women in occupations where ICT is a tool (Castaño, 2011; Sáinz et al., 2016; Zarrett & Malanchuk, 2005), it is expected that girls will be more likely than boys to associate non-masculine than masculine references with these soft ICT occupations (Hypothesis 2.2).

THE PRESENT STUDY

Provided the important role that the information society plays in different facets of our life and the outstanding job opportunities associated with the ICT sector in Spain (INE [Spanish Statistics Office], 2014; López-Sáez et al., 2011), the present study pursues the following research questions and hypotheses:

1. What is the content of secondary students' portrayals of ICT occupations?
   Hypothesis 1.1. Boys and girls will tend to provide more examples of occupations involving the design and production of ICT tools and services (hard ICT occupations) than occupations where ICT is the tool (soft ICT occupations).

2. Is there any gender difference between secondary students' portrayals of ICT occupations?
   Hypothesis 1.2. Girls will be more likely than boys to write about occupations where ICT is a tool rather than the target of their work.

3. To what extent are masculine references more prevalent than non-masculine references in secondary students' gender references associated with ICT occupations?
   Hypothesis 2.1. Students will associate more masculine than non-masculine references with ICT occupations.

4. Are there any gender difference between how boys and girls use the language to refer to ICT occupations?
   Hypothesis 2.2. Girls will be more likely than boys to associate non-masculine than masculine references with ICT occupations, especially those where ICT is a tool rather than the target of their work.

Some of the observed gender differences in occupational choices may be attributed to the fact that in the early stages of career development, women tend to consider a different set of options to men, due to the possible effects of gender stereotypes on the choice of occupations (Eccles, 2007; Gadassi & Gati, 2009). Indeed, research based on theories of occupational choices (i.e. Gottfredson, 1981; Eccles, 1994) claims that individuals' occupational aspirations tend to be limited to alternatives regarded as appropriate for their gender. In fact, boys and girls choose studies and occupations congruent with existing gender roles (Eccles, 2007). Therefore, and in order to challenge the aforementioned lack of interest of women in the ICT field, it is paramount for research to examine how young people perceive the gendered views of ICT occupations. Similarly, given the prominent role that ICT plays in relevant settings of our society such as education, health, or economics (Barker & Aspray, 2006), it is crucial for women to play a more active role as designers as well as competent users of technological tools and services.

The present study aims to examine gender differences in the stereotypical occupations that secondary students associate with ICT. It looks at secondary school students' use of masculine references in their descriptions of ICT occupations. Accordingly, the existence of gender differences in the way young Spanish people refer to gender when they think about ICT occupations was examined.

METHODS

Participants

All students enrolled in the final year of junior secondary education at 10 public secondary schools located in various areas of Catalonia (an autonomous region in the North of Spain) were targeted. Thereby, 900 students attending schools in urban (58.3%) and rural (41.7%) settings in Catalonia participated in this study. Approximately 51% of the participants were female. Most of the participants belonged to middle class households (65%) and were of Spanish origin (81%). The mean age was 15 years (S.D.= 0.65). Although more than 30 schools were originally targeted, only 10 agreed to participate in the study. The response rate for all targeted participants was approximately 90%. The recruitment procedure was partly carried out with the help of secondary teachers. Prior authorization of school managerial teams and parents of students were necessary to carry out the study. In order to comply with ethical standards (APA, 2010) informed consent was also obtained from students after having explained to them the purpose of the research, its duration, and the procedure used to gather the data. Both anonymity and confidentiality of all the data to be gathered through the administered surveys were guaranteed. Informed consent from their parents and the education authorities was also obtained.

Materials

A questionnaire was administered in classrooms during the 2009-2010 academic year to all students. The research team administered the questionnaire, which consisted of the following open-ended question: "What type of occupation comes to mind when you think about ICT?" *("¿Qué tipo de profesión te viene a la cabeza cuando piensas en las TIC?"*). This question was based on Zarrett and Malanchuk's (2005) study of US high school students' attitudes to ICT professionals. The relevance of this question to the examination of young people's gendered views of male dominated occupations (such as computing) was informed by former research conducted in Spain with junior and senior secondary students (Sáinz, 2007; Sáinz et al., 2016). In comparison to Zarrett and Malanchuk's research (focused on classifying IT jobs students were more likely to choose in the near future), a content analysis of responses to this question was conducted in the present study. The response rate to the questionnaire was 83.9% (n=900). The survey was available in both Spanish and Catalan. As the instructions were provided in Spanish to most of the participant schools, most students responded in Spanish.

Procedure

A content analysis of responses to the open-ended question was conducted in order to identify secondary students' gendered stereotypes of ICT occupations (Schreier, 2012). The coding procedure consisted of three phases. In the first phase, a coding scheme was inductively developed from the students' responses. In the second phase, the resulting coding scheme was refined by means of a pilot study designed to test its reliability on the basis of a subsample of responses. In the third phase, the final coding scheme was applied to the full set of responses.

Two independent coders were trained in three different sessions. The first session took place before the development of the coding scheme and aimed to provide both coders with a common conceptual framework for the study, as well as achieving the necessary abilities to perform inductive coding. The second and third training sessions were carried out during the pilot study and their main purpose was to guarantee that the two coders were consistent in the application of the coding scheme to a random subsample of 90 responses. They used a checklist to identify the presence or absence of the characteristics associated with the responses to the survey questions. Similarly, they had to identify whether the responses to ICT occupations were respectively masculine, feminine, or neutral. During these last two sessions, doubts and disagreements were raised and examined. The coding scheme was modified accordingly.

Phase 1: Development of the coding scheme

The coding scheme was developed using an inductive coding technique, as suggested by Schreier (2012). This technique consisted of reading the complete pool of students' responses, identifying units of meaning in the data, and organizing these units into codes based on content similarity. Codes were then revised and their content systematically compared in order for commonalities, differences, and irregularities to be examined. When there were discrepancies between the coders, agreement was reached through debate or by consulting members of the research team. The categories therefore arose from the students' responses rather than from the coders' own assumptions. Specifically, the ICT occupations were grouped according to occupations involving the design and development of ICT tools and services (hard ICT, such as computer science and telecommunications engineering) and other occupations where ICT can be used as a tool rather than being the purpose of the work (soft ICT, such as in clerical, media, social science, or health-related occupations). Architecture and other engineering-related occupations different from electrical engineering such as chemical, industrial, or civil engineering were also considered soft ICT jobs (Castaño, 2011; Sáinz et al., 2016; Zarrett & Malanchuk, 2005).

Phase 2: Reliability of the coding scheme

As indicated above, a pilot study was undertaken to assess the reliability of the coding scheme before it was applied to the full set of responses. As gender references (masculine, feminine, and neutral) are ordinal in nature, Krippendorff's alpha was computed to determine inter-coder agreement (Krippendorff, 2004). Krippendorff's alpha calculates inter-coder reliability from a single framework, enabling the comparison of ordinal and nominal data (the content of the survey question in our study) with a single index (Neuendorf, 2011). The KALPHA macro in

SPSS version 20.0 was therefore used. This macro computes Krippendorff's alpha reliability estimate for subjective judgments, including nominal and ordinal data (Hayes & Krippendorff, 2007).

During the first phase of the pilot study, two coders independently coded a random subsample of 90 responses (10% of the full sample). As the coding resulted in a low alpha coefficient in some categories, they were refined through discussion with the research team, and an improved version of the coding scheme was agreed upon by consensus. In the second phase, the revised coding scheme was tested with a different subsample of 90 responses. The alpha coefficients ranged between 0.649 and 1 (see Table 1). Thanks to these alpha coefficients, the final version of the coding scheme was applied to all responses by each coder.

Table 1. Description of coding categories and reliability coefficients

Area of information	**Category**	**Description of the category**	**Alpha**
What type of occupation comes to mind when you think about ICT?			
A. Type of Content	1. Computer science	Computer science jobs (i.e. systems administration and engineering, software development, and computer repair and maintenance).	0.921
	2. Telecommunications engineering	Telecommunications engineering jobs (i.e. system design and installation of equipment for the transmission of landline and mobile phones, and broadband connection).	0.671
	3. Other engineering and architecture	Other non-specified engineering occupations and architecture jobs.	0.649
	4. Media occupations	Media jobs (i.e. journalism, TV and radio presenting, media advertising, sound and camera operating, graphic designing, photography, and illustration).	0.936
	5. Clerical occupations	Clerical jobs (i.e. administrative assistance and support, secretary, receptionist, and customer service).	1.000
	6. Social science related occupations	Social science related jobs (i.e. teaching in formal education, historian, legal aid, economics, and statistics).	1.000
	7. Science and health-related occupations	Science and health-related jobs (i.e. research or professional occupations within the health care, life sciences, physics, or chemistry fields).	1.000
B. Gender Reference	Use of a grammatical masculine gender form.		0.864

Note: Given the ordinal nature of B, Krippendorff's alpha was computed to determine inter-coder agreement.

Phase 3: Application of the coding scheme

The final coding scheme was applied to all of the students' responses. It took the form of a checklist consisting of two topical areas: (a) the type of content and (b) the gender references observed in the text.

Students' responses were categorized using eight dichotomous categories. In each response, the presence of the feature represented by each category was coded as 1 and its absence was coded as 0. For instance, responses such as '*informáticos*' (computer scientists), '*telecos*' (electrical or telecommunications engineers), '*arquitectos*' (architects), '*engineers*' (ingenieros), '*periodistas*' (journalists), '*gente que trabaja en una oficina*' (people working in an office), '*servicios sociales'* (social workers), or '*enfermera*' (a female nurse) were respectively coded under the categories 'computer science', 'electrical engineers', 'media occupations', 'clerical occupations', and 'social science' and 'science and health-related occupations'.

For the gender references, grammatical gender was used to code the students' responses as masculine, feminine, or neutral. Examples of masculine, feminine, and neutral gender roles that related to ICT occupations were respectively: '*un informático*' (a computer scientist - masculine); '*secretaria*' (secretary - feminine); and '*periodista*' (journalist - neutral). Plural gender forms, such as '*ingenieros informáticos*' (computer engineers), '*programadores*' (programmers), or '*periodistas*' (journalists) were considered gender neutral and represented 40.45% (161 out of 398) of this category. The use of masculine generics like '*ingenieros informáticos*' (computer engineers) does not necessarily indicate that the person has explicitly referred to males. Accordingly, its use was also considered 'gender neutral or non-masculine'. Similarly, indefinite expressions such as '*gente que sale en televisión*' (people who are on television) were also considered 'non-masculine'. However, grammatically masculine and singular expressions like '*informático*' (male computer scientist) or 'i*ngeniero*' (male engineer) were categorized as masculine and represented 52.7% of the responses (210 out of 368). Feminine singular occupational roles were also considered under the 'non-masculine' category, as was the case for '*secretaria*' (female secretary) or '*reportera*' (female reporter) and represented 2.5% of the responses (10 out of 368). As cell frequencies below 1 were expected and more than 20% of the table cells had cell frequencies below 5, the chi-square test could not be calculated (Cochran, 1954). Accordingly, the expressions considered feminine were grouped under the 'non-masculine' category together with the neutral ones.

RESULTS

How do Young People Express their Portrayals of ICT Occupations? Are there any Gender Differences in the Expression of these Meanings?

With regards to the first ideas that came to participants' minds when thinking about ICT occupations, while 66.2% of the 755 participants associated ICT with computer scientists, only 9% referred to telecommunications engineering (see cross tabulated frequencies in Table 2).

Table 2. Gender differences regarding the type of occupation associated with ICT

	Total	Males	Females	$X^2(1)$
Computer science				
Yes	500 (66.2%)	249 (68.8%)	251 (63.9%)	2.037
No	255 (33.8%)	113 (31.2%)	142 (36.1%)	
Total N	755	362	393	
Telecommunications engineering				
Yes	68 (9.0%)	46 (12.7%)	22 (5.6%)	11.621***
No	687 (91.0%)	316 (87.3%)	371 (94.4%)	
Total N	755	362	393	
Engineering and architecture				
Yes	106 (14.0%)	54 (14.9%)	52 (13.2%)	.444
No	649 (86.0%)	308 (85.1%)	341 (86.8%)	
Total N	755	362	393	
Media Occupations				
Yes	165 (21.9%)	78 (21.5%)	87 (22.1%)	.038
No	590 (78.1%)	284 (78.5%)	306 (77.9%)	
Total N	755	362	393	
Clerical occupations				
Yes	101 (13.4%)	25 (6.9%)	76 (19.3%)	25.134***
No	654 (86.6%)	337 (93.1%)	317 (80.7%)	
Total N	755	362	393	
Social science related occupations				
Yes	21 (2.8%)	7 (1.9%)	14 (3.6%)	1.848
No	734 (97.2%)	355 (98.1%)	379 (96.4%)	
Total N	755	362	393	
Science and health-related professions				
Yes	25 (3.3%)	11 (3.0%)	14 (3.6%)	.161
No	730 (96.7%)	351 (97.0%)	379 (96.4%)	
Total N	755	362	393	

*** $p < .001$ ** $p <.01$ *$p <.05$. Note: Chi-square values for the comparison between males and females for all categorical row variables. The degrees of freedom are specified between brackets.

This result confirms Hypothesis 1.1. Similarly, 21.9% of the 755 respondents referred to media-related occupations (for instance, journalism, web design, and advertising) while 14% of the remaining responses referred respectively to architecture and engineering other than electrical engineering, and 13.4% to clerical occupations. A further 3.3% and 2.8% of the responses were correspondingly related to social science, science, and health-related occupations. Concerning gender differences, more young females than young males associated ICT with clerical occupations $X^2(1,755)=25.134$, $p<.001$. These findings are in line with Hypothesis 1.2. In contrast, more young males than females associated ICT with telecommunications engineering $X^2(1,755)=11.621$, $p<.001$.

Are Masculine References more Prevalent than Non-masculine References in Secondary Students' Gender References Associated with ICT Occupations? Is there Any Gender Difference?

For participants' global perception of ICT-related occupations, 55.2% of 755 participants considered these occupations to be non-masculine while a further 44.8% of the participants regarded them in masculine terms. Contrary to our expectations (Hypothesis 2.1), most of the references to ICT occupations were formulated in non-masculine terms. However, chi-square test illustrated that whereas for young females most of the occupations were not exclusively masculine, for young males these occupations were mostly masculine $X^2(1,755)=10.331$, $p<.001$ (Table 3).

Table 3. Gender differences with regard to gender references associated with ICT occupations taken as whole

		Total (n=755)	**Males (n=337)**	**Females (n=359)**	**$X^2(1)$**
Gender references	Masculine	338 (44.8%)	184 (50.8%)	154 (39.2%)	10.331***
	Non - masculine	417 (55.2%)	178 (49.2%)	239 (60.8%)	

*** p < .001 ** p < .01 *p <.05. Note: Chi-square values for the comparison between males and females for all categorical row variables. The degrees of freedom are specified between brackets.

Chi-square analyses performed by taking each ICT occupation independently (see Table 4) tell us that computer science was the occupation most frequently described in masculine terms, $X^2(1,755)=36.723$, $p<.001$ (Hypothesis 2.1). 106 responses that were associated with architecture and engineering were also assigned more masculine than non-masculine references, $X^2(1,755)=5.917$, $p<.05$. Similarly, in comparison with computing and engineering or architecture-related occupations, several non-masculine references were observed with regard to the media and clerical occupations. However and in line with Hypothesis 2.2 (see Tables 5 and 6 for the within gender comparison), young females associated more non-masculine references with computing than their male counterparts, X^2girls $(1,393)=17.854$, $p<.001$. On the one hand, these findings do not support our predictions that participants would provide more masculine than non-masculine references to ICT occupations (Hypothesis 2.1). On the other hand, these findings confirm our expectations that boys would be more likely than girls to express masculine rather than non-masculine references to ICT occupations (Hypothesis 2.2).

Table 4. Gender references associated with ICT occupations for the global sample

Gender references	Computer Science		Tel. Engineering		Engineering Architecture		Media Occupations		Clerical Occupations		Social Sciences		Science and Health	
	No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Masculine	75	263	312	26	279	59	265	73	300	38	329	9	334	4
	29.4%	52.6%	45.4%	38.2%	43.0%	55.7%	44.9%	44.2%	45.9%	37.6%	44.8%	42.9%	45.8%	16.0%
Non-Masculine	180	237	375	42	370	47	325	92	354	63	405	12	396	21
	70.6%	47.4%	54.6%	61.8%	57.0%	44.3%	55.1%	55.8%	54.1%	62.4%	55.2%	57.1%	54.2%	84.0%
Total (n =755)	255	500	687	68	649	106	590	165	654	101	734	21	730	25
$X^2(1)$	36.723***		1.290		5.917*		.024		2.407		.032		---	

*** p < .001 ** p <.01 *p <.05. Note: Chi-square values for the comparison between masculine and non-masculine for all categorical col variables. The degrees of freedom are specified between brackets. --- Chi square cannot be computed, as some are values lower than 5.

Table 5. Gender marks associated with ICT occupations for male participants

Gender references	Computer Science		Tel. Engineering		Engineering Architecture		Media Occupations		Clerical Occupations		Social Sciences		Science and Health	
	No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Masculine	39	145	164	20	154	30	144	40	173	11	180	4	181	3
	34.5 %	58.2%	51.9%	43.5%	50.0 %	55.6%	50.7%	51.3%	51.3%	44.0%	50.7%	57.1 %	51.6%	27.3%
Non-Masculine	74	104	152	26	154	24	140	38	164	14	175	3	170	8
	65.5 %	41.8%	48.1%	56.5%	50.0 %	44.4%	49.3%	48.7%	48.7%	56.0%	49.3%	42.9 %	48.4%	72.7%
Total (n =362)	113	249	316	46	308	54	284	78	337	25	355	7	351	11
$X^2(1)$	17.497***		1.139		.567		.008		.501		---		---	

*** p < .001 ** p <.01 *p <.05. Note: Chi-square values for the comparison between masculine and non-masculine for all categorical variables. The degrees of freedom are specified between brackets. --- Chi square cannot be computed, as some are values lower than 5.

Table 6. Gender references associated with ICT occupations for female participants

Gender references	Computer Science		Tel. Engineering		Engineering Architecture		Media Occupations		Clerical Occupations		Social Sciences		Science and Health	
	No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Masculine	36	118	148	6	125	29	121	33	127	27	149	5	153	1
	25.4 %	47.0 %	39.9%	27.3%	36.7 %	55.8%	39.5%	37.9%	40.1%	35.5%	39.3%	35.7 %	40.4%	7.1%
Non-Masculine	106	133	223	16	216	23	185	54	190	49	230	9	226	13
	74.6 %	53.0 %	60.1%	72.7%	63.3 %	44.2%	60.5%	62.1%	59.9%	64.5%	60.7%	64.3 %	59.6%	92.9%
Total (n =393)	142	251	371	22	341	52	306	87	317	76	379	14	379	14
$X^2(1)$	17.854***		1.388		6.916**		.074		.529		.073		---	

*** p < .001 ** p <.01 *p <.05. Note: Chi-square values for the comparison between masculine and non-masculine for all categorical variables. The degrees of freedom are specified between brackets. --- Chi square cannot be computed, as some are values lower than 5.

DISCUSSION

This research tackled prototypical views of ICT occupations, as well as differences in young people's gendered portrayals of ICT occupations. A content analysis of students' unplanned responses regarding ICT occupations was used to delve into their perception of ICT occupations from a gender perspective. In our opinion, this is one of the assets of the present research. A better knowledge of the content of adolescents' stereotypical portrayals could provide information about how they could be challenged in the crucial period at secondary school when young people make decisions about their future careers. This is particularly important because many young people base their career decisions on inaccurate information about professions and occupations (Eccles, 1994).

In line with our expectations, most of the participants referred to computer science as a prototypical ICT occupation. Similarly, there is a prevalence of associations between ICT occupations and hard technological developments. On the contrary, the participants frequently indicated several occupations that use ICT as a tool in certain job activities. This was the case with clerical and media-related occupations (like journalism) as well as science and health-related occupations, where women are strongly represented. This result supports Abbiss' (2008) multidimensional conceptualization of IT workplaces, which suggests a broader scope for what constitutes computing-related occupations. According to Abbiss (2008) these workplaces entail "an overlap between telecommunication functions and knowledge about hardware and software that requires computing-related workplaces to overlap with a wide range of technical (hard) and communication (soft) skills" (p. 161).

Likewise, although some of the students made reference to technical occupations (such as architecture and some engineering-related occupations) fewer participants than expected (more males than females) mentioned telecommunications engineering. This finding is particularly striking, given that in Spain the number of women taking university degrees in telecommunications engineering is higher than it is for computer science (Instituto de la Mujer [Women's Institute], 2014). This result might also be associated with the dearth of role models for people in telecommunications engineering in Spain. As opposed to computer scientists (who are present in many TV series and other mass media targeting young people), the Spanish mass media may not sufficiently report on what telecommunications engineers do. This aspect requires further investigation.

Gendered References about ICT Occupations

Regarding the gender marking references associated with ICT occupations, participants' grammatical and semantic use of the Spanish language confirms the dearth of feminine references related to ICT occupations (Gygax & Gabriel, 2011; Irmen & Kurovskaja, 2010; Levy et al., 2000; Sáinz et al., 2016). Moreover and in line with predictions, occupations such as computing, engineering, or architecture were to a great extent ascribed masculine rather than non-masculine references.

These findings also suggest that hard technological occupations involving the design of ICT products and services (like computer science) might elicit more masculine references, given the lack of women working in these occupations (Sáinz et al, 2016). Interestingly, most of the non-masculine references were related to clerical-related occupations (such as secretarial work), where women tend to be highly represented (INE [Spanish Statistics Institute] 2014). This also confirms the unequal distribution of men and women in the ICT sector. Whereas hard technological ICT jobs are associated with leadership positions and are male-dominated (Zarrett & Malanchuk, 2005), soft ICT jobs (like secretarial work or customer care work in call centers) are frequently associated with precarious work conditions (in terms of salary, duration of the labor contract, or promotion opportunities) and low hierarchical positions (Castaño, 2011).

Similarly, while in the group of young males only media and clerical-related occupations were ascribed non-masculine references; in the group of young females most of the ICT-related professions and occupations were associated with non-masculine references, except for telecommunications engineering or other technical professions. This finding suggests that participants are aware that soft IT jobs are female-dominated, and also that hard IT jobs are male dominated (Castaño, 2011; Sáinz et al., 2016; Zarrett & Malanchuk, 2005). The higher presence of female role models in non-hard IT jobs may have led participants to be more likely to refer to both men and women with occupations in ICT (Cheryan, et al., 2012).

Practical Implications

The practical implications associated with these findings revolve around the need to challenge the persistence of gender roles regarding professions and occupations in modern societies. Many women with a potential interest in the field may be at risk of being underestimated and of underestimating their own capabilities when thinking of investing their talent in a hard ICT job. As research carried out in the US suggests (Cejka & Eagly, 1999; Cheryan et al., 2012; Cheryan et al., 2013), the influence of stereotypical portrayals of the type of occupations congruent with prevalent gender roles is a deterring factor that helps to explain women's lack of interest in working professionally in the hard ICT sector.

Interventions aimed at changing young people's stereotypical views of ICT occupations are required. For instance, some research suggests that stereotypical views of an occupation like ICT can be modified by offering young people a different image of the target group, which may encourage them to embrace that image and assimilate to the group by considering a future in the same (Cheryan et al., 2012; Gardner, Gabriel, & Hochschild, 2002; López-Sáez et al. 2011). Similarly, other studies report the possibility of the mass media manipulating the current image associated with, for instance, computer science (Cheryan et al, 2013). In Cheryan et al’s., (2013) study, computer scientists were perceived by undergraduate students as lacking social skills and being focused on the screen, traits incompatible with female gender roles. The manipulation strategy consisted of providing the participants with newspaper articles describing people working in the field who did not fit the stereotypical image of computer scientists.

Finally given the key role played by ICT in current society and the provision of more job opportunities for young people than other sectors in Spain (INE [National Statistics Office], 2014), intervention measures should be performed to encourage the participation of women in the design and production of ICT. In addition, some measures should be implemented to challenge young women's lack of identification with hard ICT technological occupations (Cheryan et al., 2013). Equally, it would be interesting to further analyze boys' lack of identification with some soft ICT occupations, such as clerical jobs.

Future Directions

Future research could incorporate a longitudinal perspective in the analysis of young people's stereotypical beliefs about ICT and how they develop over time as they enter higher education. It would also be interesting to compare secondary students' beliefs about traditionally feminine careers (such as nursing or primary education) with those about masculine careers (such as engineering and other related technical fields). "Similarly, some of the findings of the present study could be also identified in non-male occupational fields such as medicine". In addition, the use of implicit measures could also complement secondary students' spontaneous portrayals of these non-male occupations.

As some research suggests (Gadassi & Gati, 2009), schools and families should encourage secondary students to think about their career preferences in terms of aspects (activities they enjoy or goals they are seeking) rather than in terms of occupational titles (i.e. engineer or computer scientist). This would be an adequate strategy to control for the influence of stereotypical beliefs about occupational gateways on adolescents' decisions.

The present study has several limitations. Firstly, while content analysis offers a useful starting point for the identification of gender-stereotyped portrayals of ICT occupations, it does not provide a detailed account of the underlying motives for the observed patterns. Therefore, other qualitative methods (e.g. discursive or narrative approaches) could be used in tandem with content analysis in order to explore the relationship between gender stereotypes and secondary students' behaviors and identities (Luyt, 2011). Secondly, participants in the present study may not be fully representative of the population of secondary students in Spain. Accordingly, further studies with more diverse samples (in terms of social class and ethnic origin) could be conducted to test whether different responses could be obtained and also to improve the generalizability of the findings. All in all, future research should incorporate different methodological approaches (implicit and explicit measures, in combination with content analysis) in order to gain better insight into the content of young people's portrayals of technology and the occupations associated with this technology.

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