



Gender and family influences on Spanish students' aspirations and values in stem fields

Milagros Sáinz & Jörg Müller

To cite this article: Milagros Sáinz & Jörg Müller (2017): Gender and family influences on Spanish students' aspirations and values in stem fields, International Journal of Science Education, DOI: [10.1080/09500693.2017.1405464](https://doi.org/10.1080/09500693.2017.1405464)

To link to this article: <https://doi.org/10.1080/09500693.2017.1405464>



Published online: 22 Nov 2017.



Submit your article to this journal [↗](#)



Article views: 8



View related articles [↗](#)



View Crossmark data [↗](#)



Gender and family influences on Spanish students' aspirations and values in stem fields

Milagros Sáinz  and Jörg Müller

Internet Interdisciplinary Institute, Universitat Oberta de Catalunya (UOC), Barcelona, Spain

ABSTRACT

Drawing on expectancy-value theory, this study examines gender and family influences on students' career aspirations and attached values. 796 secondary Spanish students (M age = 16 years old, $S.D.$ = 0.81) participated. 53% were boys. The results show that boys and students with mothers who have completed intermediate level education were more interested in science, technology, engineering and mathematics (STEM) architecture and technology. Girls and students with highly educated mothers born in Spain were more likely to aspire to STEM health and experimental studies. Furthermore, boys and students planning to pursue STEM-technology studies attached higher extrinsic values to these studies. On the contrary, girls and participants with interest in experimental and health studies attached less extrinsic values to these studies. Moreover, students with highly educated mothers and interested in STEM architecture and technology reported higher extrinsic values. Understanding the interaction of gender and family factors shaping adolescents' career aspirations in STEM fields seems to be crucial to designing significant and effective school and family grounded interventions.

ARTICLE HISTORY

Received 8 May 2017

Accepted 12 November 2017

KEYWORDS

Career choice in STEM;
gender; family influences;
values

Whereas the share of women in science, technology, engineering and mathematics (STEM)-related university degrees like medicine, pharmacy, and biological sciences was very high, in Spain, during the academic course 2010–2011 (68.61%, 70.17%, and 63.24% respectively), their presence was particularly low in the STEM university degrees of physical science (28%), electronics engineering (13%), and computer science (15%). The well-known under-representation of women in these very technical fields has its parallel in the relative absence of men in care and educational disciplines: men are under-represented in university studies related to humanities (30%), education sciences (18%), social work (19%), and tourism (17%) (Women's Institute, 2016).

This underrepresentation is already observable during secondary education and subject preferences. In this regard, the most prolific literature on career-related decisions has been conducted at the individual level during the course of secondary school years (Eccles, 2009; Eccles & Wang, 2015; Weiss, Wiese, & Freund, 2014). In Spain and despite the relevance of this subject matter, few studies tackle this subject matter focusing mainly on STEM career-related choices (Sainz, 2011).

CONTACT Milagros Sáinz  msainzi@uoc.edu  Internet Interdisciplinary Institute, Universitat Oberta de Catalunya (UOC), Av. Carl Friedrich Gauss, 5, Parc Mediterrani de la Tecnologia, Castelldefels, Barcelona 08860, Spain

© 2017 Informa UK Limited, trading as Taylor & Francis Group

This vocational segregation has important practical implications because men and women do not participate on equal terms in various shaping activities at the societal level that are currently being undertaken such as the production and design of technologies (software, machinery, and other new generation appliances) or the provision of education and care to minors and other dependent people. Furthermore, taken into consideration that women are also under represented in decision-making positions and positions of influence (see European's Institute of Gender Equality, 2012), the dearth of women in leadership positions in technological fields is especially pronounced and especially worrying, since technology permeates throughout more and more aspects of our lives. It is therefore crucial to continue investigating the personal (i.e. gender, subjective task values) and family (i.e. parental educational level) reasons that drive secondary school students to develop an interest in certain studies and discard others.

Past research under the framework of the expectancy-value theory of achievement motivation (EVT) has demonstrated that individual characteristics together with previous academic achievement shape the development of value beliefs, which in turn influence academic performance, coursework selection, and career choices (Eccles, 2009; Guo, Parker, Marsh, & Morin, 2015). Secondary school seems to be an ideal period in life to look at these influences, given that in Spain most career-related decisions are made during these years (Sainz, 2011). Congruent with this idea, a recent longitudinal study shows that students' career interest when entering high school is the strongest predictor of their career interest when leaving high school (Sadler, Sonnert, Hazari, & Tai, 2012). This points to the relative stability of students' career plans over the high school period and suggests the importance of early (pre-high school) experiences, socialisation, and characteristics are in determining young persons' career intentions. Career interest has been established in research as a predictor of future career paths, which depends to high extend on how young people are socialised (Eccles, 2009).

Gender differences in career and study choices

According to the EVT theory, the purposes and reasons for action (such as the choice of studies or occupations) account for achievement values, goals, and intrinsic and extrinsic motivation (Wigfield & Eccles, 2002). All these subjective task values are highly linked to educational or career choices (Durik, Vida, & Eccles, 2006; Wigfield & Eccles, 2002) and involve the following motivational factors that shape individuals' interest in a particular activity: attainment values (the importance people give to the choices they make), intrinsic values (the enjoyment of engaging in an activity or studies, similar to Ryan and Deci's conceptualisation of intrinsic motivation, 2000), utility value (how useful the activity or studies will be for what they would like to do in the future, similar to Ryan and Deci's conceptualisation of extrinsic motivation, 2000), and the costs of engaging in a particular field, and discarding others. In the present research, we will focus on predictors of two elements of the values that students attach to their future occupational aspirations: intrinsic and extrinsic values.

Achievement-related beliefs, outcomes, and goals depend on interpretative systems like causal attributions, the input of socialisers (parents, siblings, peers, or mass media), various social role beliefs, self-perceptions and self-concept apart from one's perceptions of numerous tasks, behaviours, and activities themselves (Eccles, 2009). According to the

EVT theory, gender socialisation influences adolescents' study and career choices via the values that parents transmit to their children, in terms of the different available career options (Eccles, 2014). Gender differences in career choices reflect gendered differences in the relative subjective task value of each option under consideration (Wang, Degol, & Ye, 2015). Gender is hence an important antecedent factor of the subjective task value students attach to the available academic and career options (Chow & Salmela-Aro, 2011; Durik et al., 2006).

In this regard, gender-role related experiences can also lead male and female individuals to place different values on various long-range goals and adult activities, such as the values on various educational and vocational options (Eccles, 2009). This process happens indirectly through their influence on the behaviours and attitudes of the people (parents, teachers, peers, etc.) individuals are exposed to as they grow up (Eccles, 2009). Congruently with this argumentation line, gender differences in parents' beliefs and practices contribute to explaining gender differences in STEM related course taking, occupational aspirations, and actual job choices (Eccles, 2014; Jacobs & Eccles, 2000). In fact, parents tend to associate male children with more competences in STEM-related subjects (i.e. mathematics or natural sciences), whereas they also associate girls with higher language and reading competences (Jacobs & Eccles, 2000). Furthermore, young males are more likely than young females to receive support from their parents to develop mathematics and science-related activities (Eccles, 2014). The same is true for young females in activities related to languages and reading. As a result, young females tend to express less interest in mathematics and the physical sciences and perceive them as less useful than their male counterparts, whereas they develop a higher interest in literature and reading and find these subjects more useful for what they would like to do in the future than young males (Eccles, 2009).

In addition, research conducted under the framework of the EVT theory argues that whereas young females placed a higher value on people-oriented jobs like nursing or teaching, young males placed a higher value on competitive and wealth-related occupations and jobs that allowed for work with machinery, mathematics, and computers like engineering (Eccles, Barber, & Jozefowicz, 1999). Through socialising, young females learn that they are good in interpersonal situations and care for others. In contrast, boys learn that they have a strong instrumental orientation (Weiss et al., 2014). Interestingly, compared to girls, boys might be more dependent on parental support and encouragement when deciding about the future (Schoon, 2010).

Moreover, the perception of support from both parents and peers in STEM subjects predicted students' interest in STEM courses (Leaper, Farkas, & Brown, 2012; Robnett & Leaper, 2013). In this regard, social (i.e. support of mathematics, science, or English from parents and peers) and personal factors (i.e. girls' gender-related identities and attitudes) differentially predicted girls' motivation in STEM subjects (i.e. mathematics and science) and non-STEM subjects (i.e. English), controlling for the effect of girls' age, ethnicity, and their parents' educational level (Leaper et al., 2012). In addition, perceived STEM support in the friendship group predicted students' STEM career interest (Robnett & Leaper, 2013). Interestingly, gender differences in STEM career interest were mitigated when students reported membership in a friendship group high in STEM support (Robnett & Leaper, 2013).

Family characteristics as antecedents of educational outcomes

Adolescents' own aspirations are influenced by their parents' aspirations or expectations for them (Eccles, 2009). This implies that when adolescents perceive their parents to have high educational expectations for them, they are more likely to have higher aspirations for themselves (Davis-Kean, 2005; Eccles, 2014). Parents from higher socioeconomic status report higher educational and occupational expectations for their children than parents from lower socioeconomic status (Eccles, 2009; Schoon, 2010). Parental education is an important indicator of socioeconomic status and predicts several children's educational and behavioural outcomes (Davis-Kean, 2005; Dubow, Boxer, & Huesmann, 2009; Eccles & Davis-Kean, 2005). Moreover, students with parents having higher educational attainments showed higher interest in science and mathematics-related courses (Eccles & Wang, 2015; Gorard & Beng, 2009; Senler & Sungur, 2009). Interestingly, longitudinal research reveals that higher levels of parental education led to higher levels of educational attainment in adolescence, and subsequently to higher educational attainment or more prestigious occupational status in adulthood (Bleeker & Jacobs, 2004; Dubow et al., 2009).

Furthermore, ethnic and immigrant differences in educational and occupational expectations also have an effect on students' educational outcomes (Gorard & Beng, 2009; Leaper et al., 2012). For instance, Afro-Caribbean UK students preferred degrees in social sciences, whereas Asians were interested in careers with long-term advantages (such as medicine), and students with non-ethnic background looked for more immediately attractive choices like business administration (i.e. Gorard & Beng, 2009). The literature on this topic shows that students coming from minorities and low income families tend to have lower career aspirations than students coming from minorities with high income families and students belonging to majority groups (Howard et al., 2011). Several studies highlight the role of the mother in shaping young people's educational outcomes (i.e. Duncan & Brooks-Gunn, 1997; Sadker & Sadker, 1994). Duncan and Brooks-Gunn (1997), for instance, concluded that maternal education was linked significantly to children's intellectual outcomes even after controlling for several Socioeconomic Status (SES) indicators such as family income. Similarly, UK mothers with prestigious occupations such as doctors, lawyers, or engineers were more likely to encourage their children to choose mathematics and science-related studies (Sadker & Sadker, 1994).

Previous research in Spain (where the present study was conducted) has demonstrated that the mother's educational level had a positive influence on the attainment of higher educational degrees (Salas & Martín-Cobos, 2006). Moreover and with regard to the influence of parental characteristics on students' interest in the different available academic subjects, longitudinal research demonstrates that Spanish students from higher SES families showed a high initial interest in science (Sainz, Upadyaya, & Salmela-Aro, 2017). Still, there is little empirical evidence on how family characteristics (and how they intersect or not with gender) affect young people's aspirations and associated values. More concretely, to the authors' knowledge there is a lack of research in Spain tackling the influence of the parental characteristics on the choice of studies. In addition and beyond the context of Spain, there is a dearth of research analysing the impact of family characteristics on the intrinsic or extrinsic values that male and female students attach to the different career choices. In the present study we attempt to fill these gaps by focusing on these issues from a gender perspective in the context of Spain.

Thereby, this study provides a new look at the factors associated with Spanish students' selection of STEM careers. Second, it analyses the influence that gender both alone and in interaction with family characteristics (i.e. educational level of both parents) have on the intrinsic and extrinsic values that secondary students attach to these study choices. Finally, it thereby expands our knowledge regarding the impact that gender and family characteristics both alone and in interaction with the different study choices have on students' valuing of these choices.

Purpose of the study

The purpose of the present study was to analyse gender and family influences on students' aspirations in STEM and the intrinsic and extrinsic values associated with these aspirations. Much empirical research tackling gender differences in career aspirations have been conducted in the context of STEM-related domains or careers (i.e. Guo et al., 2015; Leaper et al., 2012).

The main research questions and hypotheses are therefore:

- R.Q.1. What are the best predictors of STEM (oriented to architecture and technology and to experimental and health studies) and non-STEM studies (arts and humanities and social sciences and law)?
- H.1. We expected that gender and mothers' characteristics (attained educational level and place of origin) will play a major role in shaping students' aspirations in STEM.
- R.Q.2. What are the main and interaction effects of gender and family influences on the extrinsic and intrinsic values that boys and girls attach to their future aspirations in STEM?
- H.2. We expected main and interaction effects of gender and family characteristics shaping gender differences in the values attached to the different STEM study choices.
- R.Q.3. What are the main and interaction effects of gender, family characteristics, and type of STEM study choices on the values attached to these choices?
- H3. We expected main and interaction effects of gender and type of STEM study choices and of family characteristics and type of STEM study choices to influence on students' valuing of these choices.

Method

Participants

Students were recruited during classroom hours. The sample consisted of 796 students enrolled in the fourth course of junior secondary education (M age = 16 years, $S.D.$ = .81). The participants attended 10 public schools located in the metropolitan areas of Madrid and Barcelona. 47% of the students were girls. Approximately a total of 95% of the targeted students answered the survey. 72% of the participants were born in Spain.

Measures

A survey containing the following items was delivered in classroom (see [appendix](#)):

Family characteristics

Place of origin of both parents: Students were requested to write down both parents' country and place of birth. Most participants had fathers (64%) and mothers (66%)

born in Spain (1). From those with non-Spanish born parents (2), most came from Latin-America (mainly Peru and Ecuador), China, and Morocco.

Educational level of both parents: With a 4-point rank order scale students rated the highest educational level completed by the two parents. The options were: (1) No studies; (2) Primary school; (3) Secondary education; and (4) University studies. Most of the parents had intermediate educational attainments (2): 55% of the fathers and 57% of the mothers had completed post-compulsory secondary education. Likewise, an important number of parents had high educational attainments (1) (37% of the fathers and 39% of the mothers had completed university studies), while only 3% of the fathers and 3% of the mothers had low educational attainments (3) (provided that they either had only completed primary school or had not even finished primary school).

What type of studies are you planning to pursue in the near future?

Students were asked to choose from either vocational training, university studies or the type of studies (name them) they were willing to do in the future. This was an open-ended question categorized according to the fields of knowledge recognized by the Spanish Ministry of Education (Ministerio de Educación, Cultura y Deporte [MECD], 2016).

STEM studies comprised two categories: experimental and health sciences, and architecture and technology. Whereas the experimental and health category includes studies related to physical science, medicine, pharmacy, chemistry, mathematics, geology, and biology; the architecture and technology category comprises studies of architecture, engineering, or computer science.

For the development of the logistic regression analyses, we collapsed the categories associated with career aspirations into a dummy variable: STEM studies oriented to experimental and health (1), versus the rest (0); STEM studies oriented to architecture and technology (1), versus the rest (0).

Values attached to future aspirations

Students were asked to what extent they agreed or disagreed with a set of statements associated with the reasons to enrol in the chosen future studies. A self-elaborated instrument containing 7 items inspired by Eccles' and colleagues' scale on task values (1999) was used to measure students' values associated with the future studies. The factorial solution resulted in two factors that explained 62% of the variance ($KMO = .71$, $\chi^2(21) = 1441.01$). Factor 1 included three items measuring students' intrinsic values' associated with the future studies. The items read as follows: 'I like them much', 'they are very interesting', and 'I will be good in this field'. The Cronbach's alpha was .78, ensuring a high reliability. The Eigenvalues for factor 1 reached 1.56. This factor explained 30.29% of the variance.

Factor 2 combined four items measuring 'extrinsic values' associated with the pursuit of future studies. The items in this factor read as follows: 'I want to become someone in life', 'my parents like it', 'my teachers and advisors like them', and 'I will earn lots of money'. The Cronbach's alpha was .72, ensuring a good reliability. The Eigenvalues for factor 2 reached 2.77. This factor explained 31.61% of the variance.

Procedure

All target participants filled out the questionnaires in the spring of 2014, during normal school hours. A total of 10 secondary schools participated in the study, after previous consent obtained from parents and school authorities. Students were given the opportunity of leaving the room if they did not want to participate in the study, but none of them did so. After a brief introduction in which the researchers spoke about the purpose of the study, the students responded to the questionnaire, which took around 35–45 minutes. Participation in the study was voluntary, with no remuneration or course credits. Both the anonymity of the participants and confidentiality of the data collected were guaranteed.

Results

Missing data

We screened the data to examine missing cases. Percentages missing ranged from 0% to 10.3% on individual variables. No missing values were reported for ‘gender’ or ‘choice of post-compulsory secondary studies’. A total of 156 cases (19.6%) had missing data on the reported variables. Looking at missing cases in combinations of variables and cases, most missing entries pertain to a single variable per case (19.87% of all missing cases). Combinations of two missing values per case account for 11.52% with other combinations having lower values.

Preliminary analysis

The descriptive and binary correlations are reported in Table 1. The bivariate correlations revealed that gender was negatively and significantly correlated with the occupation of the mother, and the studies of architecture and technology, but positively correlated with experimental and health sciences. The birthplace of the mother was positively and significantly correlated with the birthplace of the father and extrinsic values, but negatively associated with experimental and health sciences. The birthplace of the father was negatively correlated with the mother’s education, but positively and significantly correlated with extrinsic values. The mother’s education correlated positively and significantly with the father’s education, and experimental and health sciences. The father’s education

Table 1. Correlations, means, and variances.

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Gender									
2. Birthplace mother	−0.04								
3. Birthplace father	−0.03	0.72***							
4. Education mother	−0.02	−0.21***	−0.20***						
5. Education father	0.00	−0.07	−0.08	0.54***					
6. Intrinsic values	0.01	−0.04	0.01	0.07	0.04				
7. Extrinsic values	−0.07	0.09*	0.09*	−0.05	−0.01	0.30***			
8. Arch. & Tech.	−0.37***	0.01	0.01	0.01	0.02	0.01	0.09*		
9. Exp. & Heal Sci.	0.13***	−0.09*	−0.05	0.08*	0.10*	0.00	0.06	−0.31***	
<i>M</i>	–	–	–	4.15	4.15	6.10	4.95	0.24	0.22
<i>SD</i>	–	–	–	0.84	0.83	0.93	1.24	0.43	0.42

Note. *** $p < .001$; ** $p < .01$; * $p < .05$.

showed the same pattern of correlations as the education of the mother. The extrinsic and intrinsic values correlated positively. Finally, the studies of architecture and technology correlated negatively and significantly with experimental and health studies.

Gender and family influences on the values attached to students' aspirations in STEM

No significant gender differences *per se* regarding extrinsic or intrinsic values were observed. However, several ANOVA analyses were run to examine the main and interaction effects of gender and family influences on the values associated with students' aspirations. The 2 (gender) \times 2 (birthplace of mother) ANOVA suggests that participants whose mother was born outside Spain ($M = 5.13$) reported higher extrinsic values than those with a Spanish mother ($M = 4.83$), $F(1,739) = 8.580$, $p < .01$, $\eta^2 = .02$. Likewise, and in line with expectations, girls ($M = 4.70$) of mothers born in Spain reported lower extrinsic values than girls with mothers born outside Spain ($M = 5.15$). Similarly, boys whose mothers were born in Spain ($M = 4.99$) reported lower extrinsic values than boys with non-Spanish mothers ($M = 5.09$). The highest difference between boys and girls in terms of extrinsic values could be observed among participants with Spanish mothers, $F(1,739) = 3.945$, $p < .05$, $\eta^2 = .02$.

Equally, the 2 (gender) \times 2 (birthplace of the father) ANOVA showed that girls ($M = 4.85$) associated lower extrinsic values with their future aspirations than boys ($M = 5.05$), $F(1,739) = 4.897$, $p < .05$, $\eta^2 = .02$. Also, students whose fathers were born outside Spain ($M = 5.12$) associated their aspirations with higher extrinsic values than those with fathers born in Spain ($M = 4.87$), $F(1,739) = 6.782$, $p < .01$, $\eta^2 = .02$.

The 2 (gender) \times 3 (educational level of the mother) ANOVA confirmed that participants whose mothers had completed secondary education ($M = 5.04$) associated higher extrinsic values with their future expectations than those whose mothers had finished university studies ($M = 4.85$) or only completed primary school ($M = 4.46$), $F(2,732) = 3.806$, $p < .05$, $\eta^2 = .02$. In addition, girls with highly educated mothers conveyed lower extrinsic values to their aspirations ($M = 4.63$) than girls whose mother had a low ($M = 5.10$) or intermediate educational level ($M = 5.02$). The exactly inverse relation holds true for boys, whose extrinsic values were higher when the educational level of their mothers was intermediate ($M = 5.07$) rather than low ($M = 4.31$) or high ($M = 5.06$), $F(2,732) = 3.280$, $p < .05$, $\eta^2 = .02$. Post hoc Tukey test revealed significant differences between boys and girls whose mothers had high educational attainments (dif. = $-.43$, $p < .04$); between boys with intermediate educated mothers and girls with highly educated mothers (dif. = $.44$, $p < .02$); and between girls with intermediate and highly educated mothers (dif. = $.40$, $p < .05$).

With regards to intrinsic values, the 2 (gender) \times 3 (educational level of the mother) ANOVA illustrated that girls with low educated mothers attached lower intrinsic values to the future studies ($M = 5.00$) than those with mothers having attained intermediate ($M = 6.11$) and high ($M = 6.18$) educational level, $F(2,765) = 3.019$, $p < .05$, $\eta^2 = .02$. However, boys with intermediate educated mothers ($M = 6.03$) reported lower intrinsic values than whose mothers had low ($M = 6.11$) and high ($M = 6.13$) educational level. The Post-hoc Tukey test informed of significant differences between girls with low and highly educated mothers (dif. = -1.18 , $p = .58$).

Gender and type of studies influences on the values attached to students' aspirations in STEM

Several ANOVA analyses were conducted to see the main and interaction effect of gender and type of studies on the extrinsic and intrinsic values associated with the different study choices. The 2 (gender) \times 2 (STEM architecture and technology related studies versus the rest) ANOVA indicated that congruently with expectations students who pictured themselves in architecture and technical careers reported more extrinsic values ($M = 5.13$) than students with non-technical aspirations ($M = 4.89$), $F(1,742) = 5.282$, $p < .05$, $\eta^2 = .007$.

Family characteristics and type of studies influences on the values attached to students' aspirations in STEM

Finally, several ANOVA analyses were conducted to examine the main and interaction effects of family characteristics and type of studies on the values attached to the different aspirations. Similarly, the 2 (STEM architecture and technology studies versus the rest) \times 3 (educational level of the mother) ANOVA revealed that students willing to pursue STEM architecture and technology-related studies ($M = 5.13$) reported higher extrinsic values than those planning not to choose these studies ($M = 4.89$), $F(2,732) = 5.180$, $p < .05$, $\eta^2 = .03$. Furthermore and aligned with hypothesis 4, students whose mothers had intermediate educational attainments ($M = 5.04$) informed higher extrinsic values than those with low ($M = 4.44$) and high ($M = 4.86$) educated mothers $F(2,732) = 3.880$, $p < .05$, $\eta^2 = .03$. Moreover, students inclined to go into STEM-architecture and technology related studies and whose mothers had low educational attainments ($M = 4.1$) reported lower extrinsic values than those with high ($M = 5.3$) and intermediate ($M = 5.1$) educated mothers, $F(2,732) = 4.125$, $p < .05$, $\eta^2 = .03$. For students who did *not* plan to choose STEM architecture and technology-related studies, those with highly educated mothers ($M = 4.7$) reported lower extrinsic values than those with intermediate ($M = 5.00$) and low ($M = 4.9$) educational attainments. The post-hoc Tukey comparison resulted in significant differences among the group of students willing to pursue STEM studies oriented to architecture and technology and those with highly educated mothers willing not to pursue these studies (dif. = .57, $p = .001$); between students willing to pursue architecture and technological studies with high and intermediate educated mothers (dif. = .30, $p = .06$); and those participants willing to choose studies related to architecture and technology with high and low educated mothers (dif. = -1.19 , $p = .05$).

In addition, the 2 (STEM architecture and technology studies versus the rest) \times 3 (educational level of the father) ANOVA informed that students inclined to pursue STEM-architecture and technology-related studies reported higher extrinsic values ($M = 5.12$) than students willing not to choose these studies ($M = 4.90$), $F(2,700) = 3.173$, $p < .05$, $\eta^2 = .02$. Likewise, students willing to go into STEM architecture and technological studies with low educated fathers attached a lower extrinsic value ($M = 4.61$) to these studies than those with intermediate ($M = 5.00$) and highly educated fathers ($M = 5.36$), $F(2,700) = 3.173$, $p < .05$, $\eta^2 = .02$. Similarly, students willing to pursue non-technical careers with highly educated fathers reported lower extrinsic values ($M = 4.80$) than those with intermediate ($M = 4.96$) and low ($M = 4.92$) educational attainments, $F(2,700) = 3.173$, $p < .05$, $\eta^2 = .02$. Post-hoc Tukey analyses confirmed significant

differences among students willing to pursue STEM studies oriented to architecture and technology with highly educated fathers and students willing to pursue studies different from STEM-studies related to architecture and technology with highly educated fathers (dif. = -0.56 , $p = .02$).

Discussion

This study extends our understanding of how Spanish secondary students shape their interest in the different available academic and occupational choices in STEM. More specifically, the results of the present study aimed at examining a group of Spanish secondary students' future gendered aspirations. In addition, the intrinsic and extrinsic values attached to these aspirations were also examined. For these purposes, some family influences (i.e. parental educational attainments and country of origin) were also taken into consideration.

In line with expectations and research carried out in other western contexts using EVT theory (Eccles, 2014; Eccles & Wang, 2015; Leaper et al., 2012), the present research replicates the current trend of young people's gendered aspirations. That is, girls continue developing a great interest in STEM studies related to biology, health and chemistry, while they also continue to discard the possibility of enrolling in STEM technological fields (Eccles, 2014; Leaper et al., 2012; Wang et al., 2015). Furthermore, and beyond these gender differences, many characteristics associated with the participants' mother play a crucial role in shaping young people's academic and occupational aspirations (Duncan & Brooks-Gunn, 1997; Sadker & Sadker, 1994; Salas & Martín-Cobos, 2006). The current economic situation in Spain may explain some of the findings associated with the present research.

Gender and family influences on students' future aspirations in STEM

In general terms, many students wanted to pursue STEM studies (either experimental and health studies or technological studies). Moreover, students with Spanish mothers had lower aspirations in arts and humanities than those with non-Spanish mothers, but higher aspirations in social sciences and law. Interestingly, girls and students, whose mothers were born in Spain, were planning to choose university studies and were more likely to pursue experimental and health sciences studies. These findings are aligned with existing literature (Howard et al., 2011). In Spain, the studies related to health sciences (where women are highly represented) are more academically prestigious than other studies (López-Sáez, Puertas, & Sainz, 2011). In comparison to previous research in Spain highlighting the influence of the mother's educational level on the attainment of higher university degrees (Salas & Martín-Cobos, 2006), the results of the present research suggest the important role of the mother's educational level in shaping the quality of their children's aspirations and the value they attach to these aspirations.

Similarly, boys and students willing to pursue non-university studies were interested in technological fields. This is congruent with the indication that many Spanish students wanting to access STEM technology studies can do so either via vocational training (the less prestigious pathway) or university (Women's Institute, 2016). Although men are still nowadays more likely than women to attend and graduate from vocational training

studies, men are still much more likely than women to receive degrees in fields related to engineering and the physical sciences, which are likely to lead to some of the highest paying and prestigious jobs (Leaper et al., 2012; López-Sáez et al., 2011). These findings also suggest that traditional gender socialisation may hinder boys' and girls' aspirations different from traditional ones (Leaper et al., 2012).

Gender and family influences on the values associated with future aspirations in STEM

Gender (when taken separately) does not explain much of the pattern of differences in terms of extrinsic or intrinsic values attached to the different study options, but the intersection of gender and family characteristics shows noticeable findings in that regard. These findings are in line with research conducted in other international contexts (Chow & Salmela-Aro, 2011; Davis-Kean, 2005; Eccles & Davis-Kean, 2005; Eccles et al., 1999). As the reported results indicate, it is primarily the birthplace of the parents and the educational level of the mother that influences the degree to which students attach higher or lower extrinsic values to their future study choices. Thus, students whose parents were born outside of Spain had higher extrinsic values than those students whose parents were born in Spain. Since non-Spanish born parents basically come from Latin-America (Peru and Ecuador), China, and Morocco, this finding suggests a similar interpretation as put forward by Sjøberg and Schreiner (2005), who argue for the relationship between the UN Index of Human Development of a given country and young people's attitudes to science and technology.

Although our finding regarding the higher extrinsic values attached to the future aspirations is valid across all students and subject areas, and not just science and technology, one can still argue that for parents (and their children) coming from countries with lower living standards, the future occupation is still a possibility of making a positive contribution to society and changing the reality in which one is living, including one's own social mobility. In more developed countries, the future profession is seen less in terms of extrinsic values and more in terms of intrinsic attainments, i.e. options that are primarily meaningful and fulfilling to oneself as opposed to affecting one's – taken for granted – social position. As Sjøberg and Schreiner (2005) further argued, the disenchantment with science and technology is much more pronounced for girls than for boys, a finding that has its parallels in the much lower extrinsic values for girls in the present study. Compared to boys, girls whose parents were born in Spain attach the lowest extrinsic values to their studies.

Apart from the birthplace of parents, interesting gender interaction effects on extrinsic values could also be observed, in relation to the educational level of the mother. For mothers with a low educational level, marked differences exist regarding the relatively high extrinsic values of girls versus the relatively low extrinsic values of boys. This suggests that girls' higher extrinsic motivation results from the desire to overcome the rather limited educational situation of their mothers, probably further bound to very stereotypical gender roles of care and housework. Since boys do not perceive their destiny along the same (gender) role models of their mothers, their extrinsic motivation can be much lower. Independent of the educational level of their mothers, they apparently enjoy a certain freedom to focus more on their intrinsic motivation, irrelevant of the broader family circumstances.

Surprisingly, it is only the educational level of the mother, and not the father's, that displays this main effect on extrinsic motivation. Taken together with the other main effects of the mother's birthplace, these results suggest the changing function of the mother regarding the motivational values of girls versus boys. The high extrinsic values of girls with mothers born outside of Spain and with low educational levels suggest that the extrinsic values attached to their future occupation basically may stem from a desire to overcome one's gendered destiny of care and household work. Since the boys of these mothers perceive their futures as distinct from their mothers' current gendered roles and responsibilities, they are also less pressed to struggle against these rather limiting options for their future life. For highly educated mothers born in Spain, this necessity is much more relaxed for girls; in fact both boys and girls can now dedicate all their attention to their intrinsic values and preferences.

Despite this main effect that the educational level of the mother has on the intrinsic values of boys and girls, overall, the effects on the extrinsic values were much more pronounced. One probable cause of the predominance of extrinsic values has to do with the national context of Spain and its economic crisis. Given the overall high percentage of unemployment among young people, which reaches up to 50% in Spain (INE [Spanish Statistics Office], 2016), and the concomitant difficult living conditions, young people's overall occupational choices might be much more driven by instrumental considerations than by intrinsic ones. It seems at least plausible that young adolescents orient their academic and occupational aspirations around the few but realistic options available instead of being simply guided by their own self-interest, which might be more satisfying but having little to no hold on the meagre labour market. This argument is partially supported by the findings of research conducted in the U.S. where leisure and extrinsic values have been increasing among a large sample of high school seniors over the past decades, while social and intrinsic values were decreasing (Twenge, Campbell, & Hoffman, 2010). Although Twenge et al. (2010) did not find any gender difference, the economic crisis may highlight the existence of gender differences: how, for example, do we explain that girls of highly educated mothers in Spain exhibit lower extrinsic values than boys? Given that their intrinsic motivation is almost as high as that of boys, it seems that girls from the strongest family backgrounds are less bound to be successful in the labour market and enjoy the 'freedom' to pursue intrinsic rather than instrumental values, when thinking about their future occupations. They do not 'violate' gendered role expectations when they fail to enter the labour market; whereas, obtaining a 'real' job is much more 'obligatory' for boys as future fathers and main support for their families. Here, instrumental considerations abound much stronger for boys than for girls, especially in a context of economic crisis.

On the other hand, technological studies present a complex pattern of gender and family influences (Jacobs & Eccles, 2000). In fact, these studies have a highly instrumental component and are frequently associated with high competitive and wealth-related jobs (Eccles et al., 1999; López-Sáez et al., 2011). This finding could be partly aligned with the increasing importance of identity concerns for one's future study choices where expressive and creative values predominate, rather than instrumental ones (Holmegaard, Madsen, & Ulriksen, 2012).

In addition, students with highly educated mothers and fathers willing to choose STEM technology-oriented careers attached higher extrinsic values (hence more

instrumentality) to these aspirations. These results may also suggest that parents of children enrolled in STEM technology studies have a more influential role in their children's aspirations (especially when the parents have high educational attainments) than parents of children willing to pursue studies different from technology. This supports research showing that parents seem to have a higher influence on their son's decisions (Schoon, 2010), provided that males are more likely to choose STEM studies related to technology than females.

Significance of the present research and limitations

All these findings suggest more interventions targeting the entire educational community of secondary school, but especially parents and families are needed in order to overcome the lack of representation of boys and girls in non-traditional careers. Likewise, the outstanding contributions of women to society and to the advancement of different fields (especially the field of technology and computer science) must be made more visible to both young people and adults. In this regard, mass media could help raising awareness among young people and other different stakeholders. The findings suggest that more intervention strategies must be implemented in school contexts in order to change students' limited views of the different academic and occupational choices (Eccles, 2014). These interventions should include the participation of career counsellors, school teachers and tutors, families (especially with immigrant origins and low educational attainments) and students, who could work together in order to change them. For instance, highlighting the intrinsic and utility values of non-STEM technological occupations may open traditional career opportunities for young people, especially for boys. Parents should be trained in order not to limit their children's educational aspirations (especially their daughters').

Likewise, more actions should be designed by career counsellors to address young people's hierarchy of academic and occupational preferences as a result of the interaction between gender and family characteristics. These interventions should therefore take into consideration the important role that intrinsic gains and motives (not only the extrinsic ones) associated with the different studies choices play in students' career development.

The combined effect of gender and family influences on students' future aspirations and on the values associated with these aspirations is one of the assets of the present study. But, the present study also has several limitations that can be associated with the lack of longitudinal perspective of the reported data. Given the cross-sectional nature of the present study, future studies should examine the long-term effects of their parents' educational and occupational levels on children's educational and occupational aspirations (Dubow et al., 2009). In addition, the composition of extrinsic values (with aspects related to how students justify their aspirations in terms of instrumental goals or in terms of perception of external influences) could be another weakness associated with the present research.

Finally and despite these limitations, the present research provides insightful findings on how parental background shape Spanish young people's gendered career-related decisions.

Acknowledgements

This paper is part of a broader research financed by the Ministry of Economy and Competitiveness (Plan Nacional I+D+I, FEM2011-24117). The authors would like to thank the respondents and Beatriz López for their collaboration in the collection of data.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Secretaría de Estado de Investigación, Desarrollo e Innovación [grant number FEM2011-2014117].

ORCID

Milagros Sáinz  <http://orcid.org/0000-0003-4803-1597>

References

- Bleeker, M. M., & Jacobs, J. E. (2004). Achievement in math and science: Do mothers' beliefs matter 12 years later? *Journal of Educational Psychology*, 96(1), 97–109. doi:10.1037/0022-0663.96.1.97
- Chow, A., & Salmela-Aro, K. (2011). Task values across subject domains: A gender comparison using a person-centered approach. *International Journal of Behavioral Development*, 35, 202–209.
- Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology*, 19, 294–304.
- Dubow, E. F., Boxer, P., & Huesmann, R. L. (2009). Long-term Effects of Parents' Education on Children's Educational and Occupational Success: Mediation by Family Interactions, Child Aggression, and Teenage Aspirations. *Merrill Palmer Quarterly*, 55(3), 224–249. doi:10.1353/mpq.0.0030
- Duncan, G. J., & Brooks-Gunn, J. (1997). *Consequences of growing up poor*. New York: Russell Sage Foundation.
- Durik, A. M., Vida, M., & Eccles, J. S. (2006). Task and ability beliefs as predictors of high school literacy choices: A developmental analysis. *Journal of Educational Psychology*, 101, 902–918.
- Eccles, J. S. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist*, 44, 78–89.
- Eccles, J. S. (2014). Gendered socialization of STEM interests in the family. *International Journal of Gender, Science, and Technology*, 7, 116–132.
- Eccles, J. S., Barber, B., & Jozefowicz, D. (1999). Linking gender to educational, occupational and recreational choices: Applying the Eccles et al. Model of achievement-related choices. In W. B. Swann, J. H. Langlois, & L. A. Gilbert (Eds.), *Sexism and stereotypes in modern society* (pp. 153–191). Washington: American Psychological Association.
- Eccles, J. S., & Davis-Kean, P. E. (2005). Influences of parents' education on their children's educational attainments: The role of parent and child perceptions. *London Review of Education*, 3, 191–204.
- Eccles, J. S., & Wang, M. (2015). What motivates females and males to pursue careers in mathematics and science? *International Journal of Behavioral Development*, 40(2), 100–106. doi: 10/1177/0165025415616201

- European Institute of Gender Equality. (2012). *Gender equality index*. Retrieved from <http://eige.europa.eu/gender-statistics/gender-equalityindex/2012/domain/power/2>
- Gorard, S., & Beng, H. S. (2009). The impact of socioeconomic status on participation and attainment in science. *Studies in Science Education*, 45(1), 93–129. doi:10.1080/03057260802681821
- Guo, J., Parker, P. D., Marsh, H. W., & Morin, A. J. S. (2015). Achievement, motivation, and educational choices: A longitudinal study of expectancy and value using a multiplicative perspective. *Developmental Psychology*, 51, 1163–1176.
- Holmegaard, H. T., Madsen, L. M., & Ulriksen, L. (2012). To choose or not to choose science: Constructions of desirable identities among young people considering a STEM higher education programme. *International Journal of Science Education*, 36(2), 186–215.
- Howard, K. A. S., Carlstrom, A. H., Katz, A. D., Chew, A. Y., Ray, G. C., Laine, L., & Caulum, D. (2011). Career aspirations of youth: Untangling race/ethnicity, SES, and gender. *Journal of Vocational Behavior*, 79, 98–109.
- INE, Spanish Statistics Office. (2016). *Economic activity, employment and unemployment*. Retrieved from http://www.ine.es/dyngs/INEbase/en/categoria.htm?c=Estadistica_P&cid=1254735976595
- Instituto de la Mujer (Women's Institute). (2016). *Data*. Retrieved from <http://www.inmujer.gob.es/estadisticas/consulta.do?area=3>
- Jacobs, J. E., & Eccles, J. S. (2000). Parents, task values, and real life achievement related choices. In C. Sansone & J. M. Harackiewicz (Eds.), *Intrinsic and extrinsic motivation. The search for optimal motivation and performance* (pp. 405–439). San Diego: Academic Press.
- Leeper, C., Farkas, T., & Brown, C. S. (2012). Adolescent girls' experiences and gender-related beliefs in relation to their motivation in math/science and English. *Journal of Youth and Adolescence*, 41, 268–282. doi:10.1007/s10964-011-9693-z
- López-Sáez, M., Puertas, S., & Sainz, M. (2011). Why don't girls choose technological studies? Adolescents' stereotypes and attitudes towards studies related to Medicine or Engineering. *Spanish Journal of Psychology*, 14, 74–87.
- Ministerio de Educación, Cultura y Deporte (MECD). (2016). Ramas de Conocimiento [Fields of Knowledge]. Retrieved from <http://www.educacion.gob.es/boloniaensecundaria/04-1-ramas.htm>
- Robnett, R. D., & Leaper, C. (2013). Friendship groups, personal motivation, and gender in relation to high school students' STEM career interest. *Journal of Research on Adolescence*, 23, 652–664.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25, 54–67.
- Sadker, M., & Sadker, D. (1994). *Fairness at fairness*. New York: Springer.
- Sadler, P. M., Sonnert, G., Hazari, Z., & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science Education*, 96, 411–427.
- Sainz, M. (2011). Factors which influence girls' orientations to ICT subjects in schools. Evidence from Spain. *International Journal of Gender, Science and Technology*, 3, 387–406.
- Sainz, M., Upadaya, K., & Salmela-Aro, K. (2017). The co-development of science, math, and Language interest among Spanish and Finnish secondary school students: The influence of socio-economic background, performance and educational transitions. *International Journal of Behavioral Development*, Under revision.
- Salas, M., & Martín-Cobos, M. (2006). La demanda de educación superior: un análisis microeconómico con datos de corte transversal. [The demand of higher education: A microeconomic analyses with transversal data]. *Revista de Educación*, 339, 637–660.
- Schoon, I. (2010). Planning for the future: Changing education expectations in three British cohorts. *Social Historical Research*, 35, 99–119.
- Senler, B., & Sungur, S. (2009). Parental influences on students' self-concept, task value beliefs, and achievement in science. *The Spanish Journal of Psychology*, 12, 106–117.
- Sjøberg, S., & Schreiner, C. (2005). How do learners in different cultures relate to science and technology? Results and perspectives from the project ROSE. *Asia-Pacific Forum on Science Learning and Teaching*, 6(2), 1–17.
- Twenge, J. M., Campbell, S. M., & Hoffman, B. J. (2010). Generational differences in work values: Leisure and extrinsic values increasing, social and intrinsic values decreasing. *Journal of Management*, 36, 1117–1142.

Wang, M. T., Degol, J., & Ye, F. (2015). Math achievement is important, but task values are critical too: Examining the intellectual and motivational factors leading to gender disparities in STEM careers. *Frontiers in Psychology*, 6, 1–9.

Weiss, D., Wiese, B. S., & Freund, A. M. (2014). What should I do with my life? Motivational, personal, and contextual factors in mastering the transition of graduating from high school. In I. Schoon, & J. S. Eccles (Eds.), *Gender differences in aspirations and attainment. A life course perspective* (pp. 125–145). London, UK: Cambridge University Press.

Wigfield, A., & Eccles, J. S. (2002). The development of competence beliefs and values from childhood through adolescence. In A. Wigfield & J. S. Eccles (Eds.), *Development of achievement motivation* (pp. 92–120). San Diego, CA: Academic Press.

Appendix

1. Are you a boy or a girl?

1. Boy 2. Girl

2. **Out of the following educational levels**, which have your father and mother attained? (Please, choose only one option for your father and your mother).

	Attained educational level	Father	Mother
1	No studies		
2	Primary Education		
3	Secondary Education (High School or Vocational Training)		
4	University studies		

3. **What is your father’s and mother’s occupation?** (Please describe very briefly the type of job that your father and mother do).

Father: _____

Mother: _____

4. **Where were your parents born?** (Please, specify your mother’s and father’s place of birth)

Place of birth	Father	Mother
Spain		
A country different from Spain, (please write it down)		

5. **What type of studies are you planning to pursue in the near future?**

1. **Studies related to university (please name them)** _____

2. **Studies related to vocational training (please name them)** _____

6. **Why would you like to pursue these studies?** (please, for each of the following options choose in a scale that ranges between 1 (totally disagree) a 7 (totally agree) that best reflect your disagreement or agreement with the following statements.

	1	2	3	4	5	6	7
	Totally disagree						Totally agree
I like them much							
I will be good in this field							
My parents like them							
My teachers and advisors like them							
I want to become someone in life							
I will earn money							
They are very interesting							