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Teachers' Perception of the Gender Gap in STEAM Subjects in Pre-University Stages

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Abstract: The term STEAM (Science, Technology, Engineering, Arts and Mathematics) is associated with a promising pedagogical approach to improve the development of students at different educational stages. Degrees linked to a STEAM approach encourage real-world problem solving through the application of multidisciplinary knowledge. The objective of this research is to analyze the perception of Early Childhood and Primary to Secondary Education teachers on the existence of the gender gap among pre-university students in subjects related to STEAM degrees in Spain. Given the results obtained, it is possible to affirm that according to teachers, there is a gender gap among students in the early educational stages in topics related to STEAM careers, which can mark their future gender gap in university education. Given this scenario, it is necessary to continue researching the possible factors that influence the gender gap in these degrees to understand possible gender inequalities in the educational field. Furthermore, the need to implement educational strategies that promote gender equality in Spain from the first educational stages is highlighted.

Keywords: STEAM; gender gap; teaching; decision-making; career choice

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1. Introduction

Currently, a large proportion of young people, especially women, have lost interest in science-related university degrees [1]. Over the years, several authors have identified the difficulties experienced by women in choosing STEAM (Science, Technology, Engineering, Arts and Mathematics) degrees [2–6], with data from most industrialized countries in the world [7,8] showing a lower interest of women in these types of degrees. The great loss of human capital in the labor market and the mercantilism in the university system have generated great interest in the international scientific community in recent years [9–11].

There are studies suggesting that university professors tend to perceive a higher suitability of male students for STEAM degrees [12]. This perception is influenced by gender stereotypes and unconscious biases associating males with higher abilities in these areas [13]. Taking into account the guiding role that teachers assume in the development of their students' scientific skills and competencies, it is necessary to increase both their social and emotional skills, as well as their knowledge and skills as researchers [14]. At the same time, the teacher must enhance meaningful learning, seeking to enable students to acquire knowledge and connect with science autonomously [15]. The success or failure of STEAM grade-oriented education depends, in large part, on teachers since their support and guidance to students is necessary for them to achieve success [16,17].

The difference between male and female students in STEAM degrees is remarkable [12]. This gender gap is visible from a very early age and clearly manifests itself years later when it comes time to choose a university degree [18]. Worldwide, studies have shown that

there is almost no difference between boys and girls in their aptitude and performance in STEAM-related subjects at the beginning of elementary school, but the gender gap increases over time [19]. By the time students reach eighth grade, there is a gender gap in favor of boys [20]. This finding has remained constant for 20 years [21], so it can be considered a generalized behavior. In this sense, it can be considered that it is necessary to change the mentality of girls and to convey to them that they have the ability to perform any activity they set their minds to and that they are also capable of creating a home and educating their children at the same time.

It is important to note that women enrolling in STEAM degrees enter with the same level of confidence as men; however, as the time spent in STEAM degrees progresses, their confidence level drops drastically [22]. This decline in confidence in female students in STEAM degrees is due to the wide variety of intrinsic barriers faced by female students due to their gender status, such as (Figure 1) (i) the inability to juggle paid work with domestic responsibilities [17,23]; (ii) the belief that women are less capable than men in achieving goals that require scientific skills [24]; (iii) the low self-esteem that is generated in women from childhood [25]; (iv) the high anxiety that can effect women when facing a mathematical problem [23]; (v) the existence of a negative classroom climate towards women; (vi) the lack of necessary teacher and family support [26]; (vii) socioeconomic or ethnic status [27]; (viii) possible social marginalization due to cultural aspects [28]; (ix) insecurity about their own intellectual abilities [29]; (x) the difficulty of developing a scientific career in an essentially male environment [30]; (xi) the fear of social rejection [30]; (xii) the underrepresentation of women in many jobs [31]; (xiii) the belief of an innate talent in people studying STEAM careers [32–35]; (xiv) the lack of female role models [31,36]; (xv) the belief that women will be paid less than men for the same work and the same activity [11]; and (xvi) the tendency to make women's great contributions invisible [30].

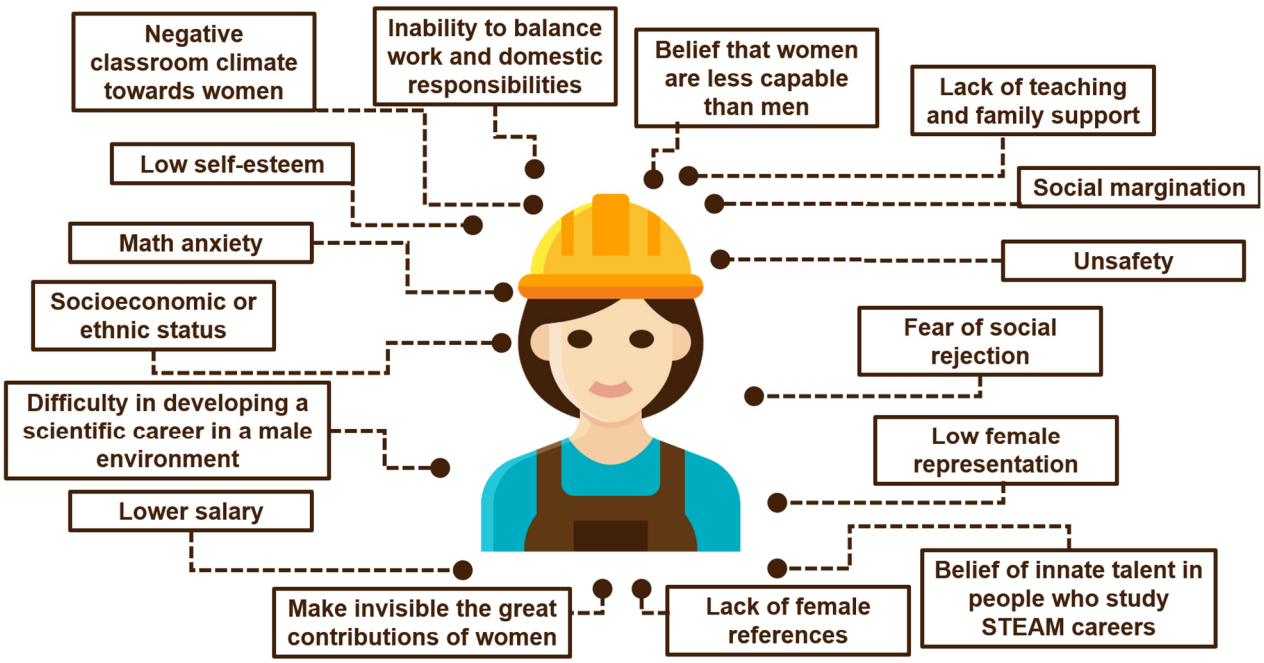

Figure 1. Factors influencing women when choosing STEAM degrees.

Notably, knowledge areas related to STEAM degrees that are taught early and maintained throughout education may be less likely to have gender gaps in college life than STEAM areas that are less frequently taught in high schools [37]. Early learning of these degrees may change male stereotypes about these careers and expose women to role models [19]. In fact, it is worth noting that it is widely accepted that female role models are more effective than male role models in inspiring girls and women to enter STEAM fields [38].

In addition, some authors reported that when girls had a close relationship with a friend or family member involved in science, they had more positive and less stereotypical views about science and science-related careers [39]. Taking all these aspects into account, it is assumed that it is important that STEAM interventions are integrated into classrooms as early as Primary School [40] or even in Early Childhood.

STEAM professional education has the challenge of bringing great benefits to science. Therefore, it is important to promote diversity among professionals engaged in these scientific disciplines, as women are underrepresented in science-related professions [41]. In addition, it is crucial to implement training programs for male teachers on unconscious bias and to foster an inclusive educational environment that supports all students equally, regardless of their gender [13].

Given the existence of a gender gap in STEAM university degrees and the different reasons that influence the low interest of women in these degrees, the aim of this research is to analyze the perception that Spanish teachers at pre-university educational stages have about their own students and the existing gender gap in STEAM-related subjects.

2. Materials and Methods

This research has been carried out in five phases (Figure 2): Phase I: determination, definition, and formulation of the research objectives and variables, as well as the inclusion criteria of the target population of the study; Phase II: design of the survey used as a research instrument; Phase III: data collection from the responses to the questionnaire sent to the target population; Phase IV: analysis of the data obtained; and Phase V: obtaining and formulating conclusions.

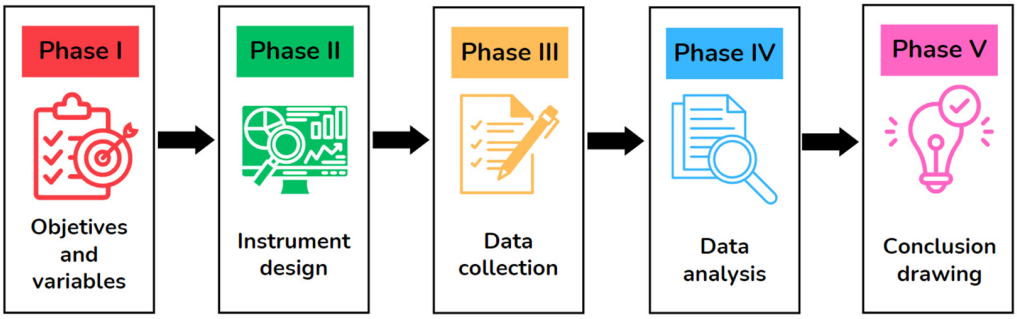

Figure 2. Research methodology phases.

2.1. Objectives and Variables

The main objective of this research is to analyze the perception of Early Childhood, Primary and Secondary Education teachers about the existence of the gender gap among pre-university students in subjects related to STEAM degrees in Spain.

To achieve this objective, the independent variables defined in Phase I (Figure 2) of the present investigation are (Figure 3) (i) IV-1: gender (female and male); (ii) IV-2: age (from 20 to 35 years, from 36 to 50 years and from 51 to 65 years); and (iii) IV-3: educational stage (Children and Primary, Secondary). On the other hand, the dependent variables considered are (Figure 3) (i) DV-1: the difference between the number of male and female students in STEAM; (ii) DV-2: academic results; and (iii) DV-3: gender discrimination.

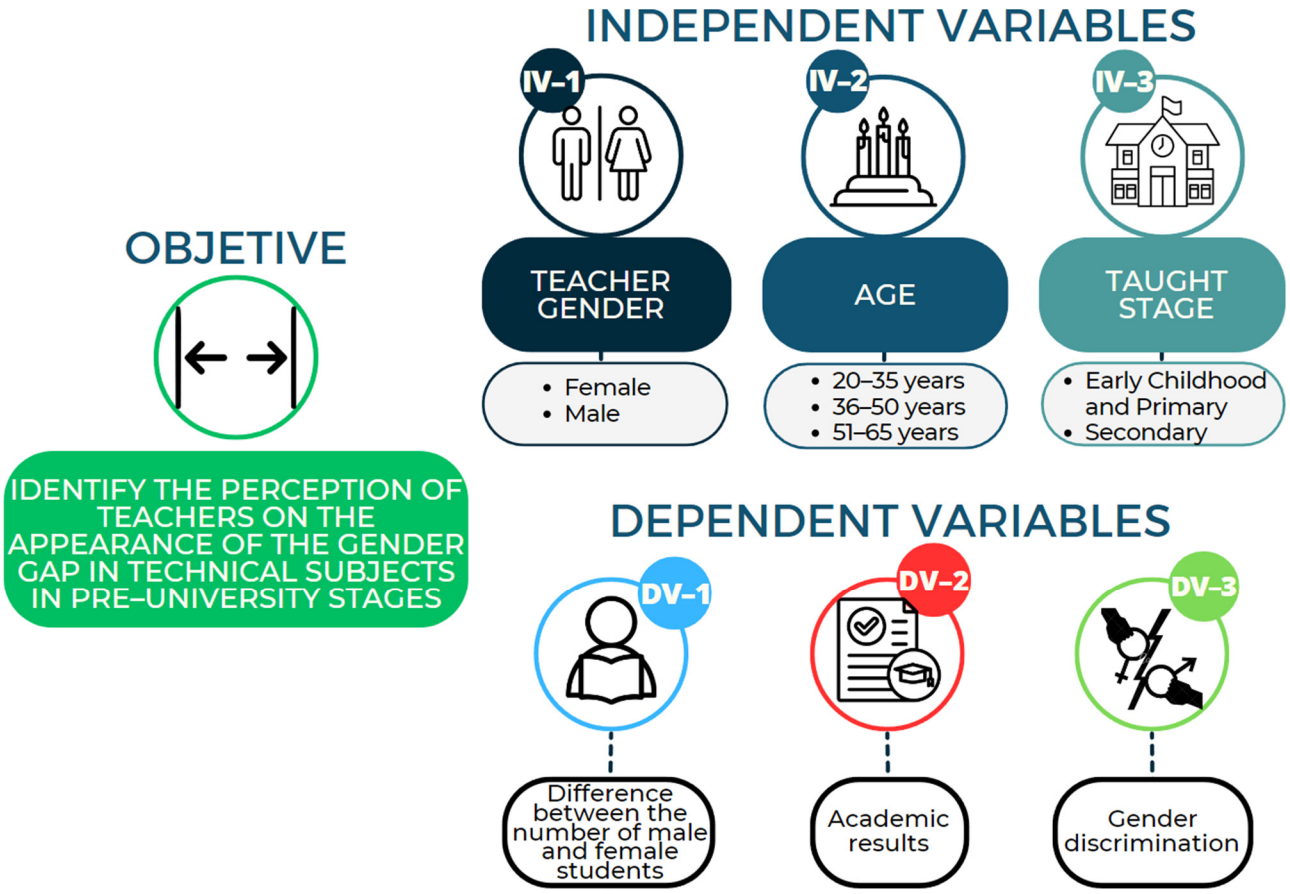

Figure 3. Research objectives and dependent and independent variables.

2.2. Instrument

The instrument designed (Phase II, Figure 2) was a questionnaire addressed to Spanish teachers of the following stages: (i) Early Childhood and Primary and (ii) Secondary. The questionnaire is made up of a block of questions (Q-1, Q-2, Q-3, Q-4, and Q-5) (Figure 3). The possible answers to the questions are Likert-type, in which teachers had to select the degree of agreement or disagreement about what was asked on a scale from 1 (least degree of influence, concern or totally disagree) to 5 (highest level influence, concern or totally agree) (Table 1).

Table 1. Questions of the teachers' survey.

Number	Question	Response Options
Q-1	There is a large difference in number of female and male students in STEAM subjects	Likert scale from 1 to 5 (1: totally disagree; 2: disagree; 3: intermediate agree; 4: agree; 5: totally agree)
Q-2	Boys are better in technical subjects (mathematics, physics, technology, computer science or drawing) than girls	
Q-3	Academic results are better for boys than for girls in general	
Q-4	There is some gender discrimination in technical subjects because more boys study them than girls	
Q-5	STEAM degree studies are for the male gender (best suited to the male profile)	

2.3. Participants

A probabilistic sampling of the population of teachers in Spain was carried out based on the different educational stages (Early Childhood and Primary, and Secondary) and with an age range between 20 and 65 years of age. The only inclusion criterion in the study was being a teacher in Spain in the Early Childhood–Primary or Secondary stages. The population of this study consisted of 170 teachers, of which 141 were from Early Childhood–Primary or Secondary. They anonymously and voluntarily offered their consent to participate in this study. Members of the target population were sent the questionnaire used as the research instrument and were asked to participate after being informed of the purposes of the research. The responses were voluntary and anonymous.

In the surveys, the participants are distributed by gender: Male, 28.4%, and Female, 71.6% (X-squared = 40,000, df = 1, p-value < 0.001). Furthermore, the age distributions were as follows: 20 to 35 years, 52.5%; 36 to 50 years, 31.9%; and 51 to 65 years, 15.6% (X-squared = 28.894, df = 2, p-value < 0.001). Therefore, there are many more women in the lower age range. The distribution by stage taught was as follows: Infant–Primary, 39.0%, and Secondary, 61.0% (X-squared = 86,000, df = 1, p-value < 0.012).

To analyze the responses (Phase IV, Figure 2), a descriptive quantitative analysis was carried out. Firstly, it has been analyzed whether the responses follow a normal distribution by testing normality graphs with tests in the software developed by IBM called SPSS version 29.

3. Results

The results obtained in this investigation are shown below (Phase V, Figure 2). Firstly, descriptive statistics (mean, standard deviation and coefficient of variation) were carried out for each of the research questions (Table 1). In the case of questions Q-2, Q-3, and Q-5, the average obtained from the participants (between 2.00 and 1.52) is below the central level of 2.27; therefore, the average indicates disagreement in those questions (Figure 4). In the case of questions Q-1 and Q-4, the average of the results indicates that there is a higher agreement between the participants. Q-5 is where the greatest dispersion occurs. Question Q-1 presents greater homogeneity (Table 2).

Table 2. Mean values were obtained in the different questions (Table 1) depending on gender (IV-1, Figure 3).

Question	Gender	Mean
Q-1	male	3.400
	female	3.300
Q-2	male	2.030
	female	1.930
Q-3	male	1.830
	female	1.670
Q-4	male	2.180
	female	3.080
Q-5	male	1.400
	female	1.570

Subsequently, the mean values of each of the research questions were obtained (Table 1) based on each of the independent variables (Figure 3). In the case of gender (IV-1) (Figure 3), the question that has the greatest significant difference between the means of men and women is Q-4. In this case, men indicate that they disagree with a mean of less than 2.2, and women indicate greater agreement with a mean of more than 3 regarding the fact that there is discrimination in technical subjects because more boys than girls study them (Table 2). On the other hand, it can be seen that both men and women give a high response to Q-1 (greater than 3.00), which implies that teachers of both genders identify that there is a great difference between the number of boys and girls in these subjects. In Q-2, Q-3, and Q-5,

men and women assigned a low average to these questions; thus, teachers of both genders disagree with the question that boys are better in technical subjects than girls, which is to say that the academic results of boys are better than girls in general and that STEAM degrees are intended for the male gender.

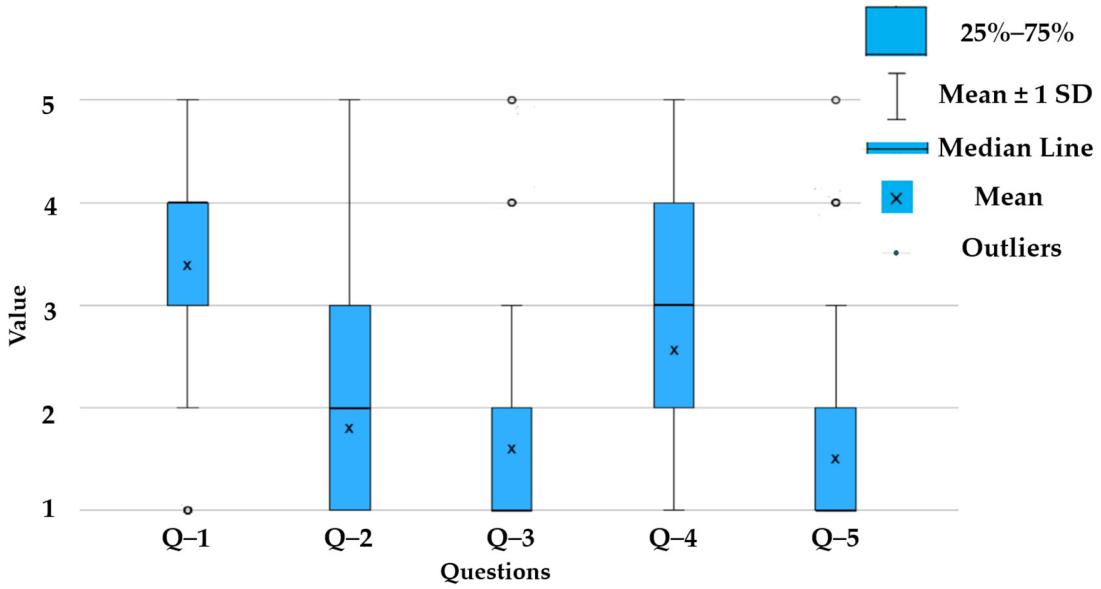

Figure 4. Box diagram of the results obtained in the different questions (Table 1).

If the data analysis is carried out based on the age variable (IV-2, Figure 3), in Q-1, the means are homogeneous in the three age groups (above 3), so the teachers agree that there is a difference between the number of female and male students in STEAM subjects. In Q-2, the means are homogeneous, lower than 2.1, so teachers disagree that boys are better than girls in STEAM subjects. In Q-3, the means are also homogeneous in all stages, less than 2, so teachers at all stages disagree that boys' results are better than girls'. In Q-4, teachers between 20 and 35 years old have given an average higher than 3, while in the rest of the age groups, the average is lower than 2.6, so the youngest teachers are the ones who most disagree with the existence of gender discrimination in technical subjects because more boys than girls study them. Finally, in Q-5, the means are low in the three age ranges; that is, the teachers do not agree that the degrees are more indicated for the male gender (Table 3).

In relation to the educational stage taught by the teacher (IV-3, Figure 3), in Q-1, the means of both stages have been higher than 3.2; therefore, the teachers of the Early Childhood–Primary and Secondary stages agree that there is a big difference between the number of boys and girls who study STEAM subjects. In Q-2, the means of both stages are lower than 2.2, so the Early Childhood–Primary and Secondary teachers disagree with the fact that boys are better in technical subjects than girls. In Q-3, the means are homogeneous, with a value of approximately 1.7; therefore, the teachers of both stages disagree that the academic results of boys are better than those of girls in general.

In Q-4, the average of the Early Childhood–Primary stage is greater than 3, while in the Secondary stage, it is less than 2.6; therefore, the teachers of the first stages show a higher agreement than those of Secondary that there is discrimination of gender in technical subjects because more boys than girls study them. Finally, in Q-5, in the educational stages of Early Childhood–Primary and Secondary, the average is less than 1.8, so the teachers of both stages disagree with the STEAM grades being dedicated to the male gender (Table 4).

Table 3. Mean, standard deviation, and coefficient of variation values were obtained in the different questions (Table 1) depending on age (IV-2, Figure 3).

Question	Age	Mean	sd	cv
Q-1	20–35	3.390	1.145	0.338
	36–50	3.270	1.355	0.414
	51–65	3.230	1.307	0.405
Q-2	20–35	1.990	0.868	0.436
	36–50	2.020	1.118	0.553
	51–65	1.730	0.827	0.478
Q-3	20–35	1.660	0.763	0.460
	36–50	1.960	1.147	0.585
	51–65	1.410	0.908	0.644
Q-4	20–35	3.150	1.190	0.378
	36–50	2.560	1.289	0.504
	51–65	2.270	1.316	0.580
Q-5	20–35	1.610	1.083	0.673
	36–50	1.580	0.892	0.565
	51–65	1.140	0.468	0.411

Table 4. Mean and standard deviation values in the different questions (Table 1) depending on the educational stage (IV-3, Figure 3).

Question	Stage	Mean	sd
Q-1	Early Childhood and Primary	3.420	1.166
	Secondary	3.270	1.278
Q-2	Early Childhood and Primary	2.180	0.925
	Secondary	1.810	0.939
Q-3	Early Childhood and Primary	1.750	0.799
	Secondary	1.700	1.018
Q-4	Early Childhood and Primary	3.250	1.040
	Secondary	2.550	1.352
Q-5	Early Childhood and Primary	1.780	1.150
	Secondary	1.360	0.781

4. Discussion

Once the results of this research were obtained, it was observed that (i) in Q-1, the most frequently given response was 4 (agree); (ii) in Q-2, the most common response given by teachers was 1 (totally disagree); (iii) in the case of Q-3, the most common response given by teachers was 1 (totally disagree); (iv) in Q-4, the most frequently given response was 4 (agree); and (iv) in Q-5, the most common response given by teachers was 1 (totally disagree) (Figure 5).

In the case of Q-1, more than 50% of teachers agree that there is a big difference between the number of boys and girls in STEAM subjects. This perception may indicate an awareness on the part of teachers of the gender disparity in these areas. In Q-2, more than 70% of teachers disagree with the statement that boys are better than girls in technical subjects, indicating that there is a consensus that there is no significant difference in technical skills based on gender. In question Q-3, more than 80% of teachers disagree with the statement that men obtain better results than women in technical subjects, which reinforces the idea that performance in these subjects is not determined by gender. In relation to question Q-4, it is not possible to reach a clear conclusion about the perception of teachers regarding gender discrimination in technical degrees due to the absence of a majority or predominant response. Finally, in Q-5, 70% of teachers expressed their total disagreement with the statement that STEAM degrees are only for men. This response indicates a positive attitude towards the inclusion of women in STEAM careers and suggests that the majority of teachers do not believe in gender stereotypes in these areas.

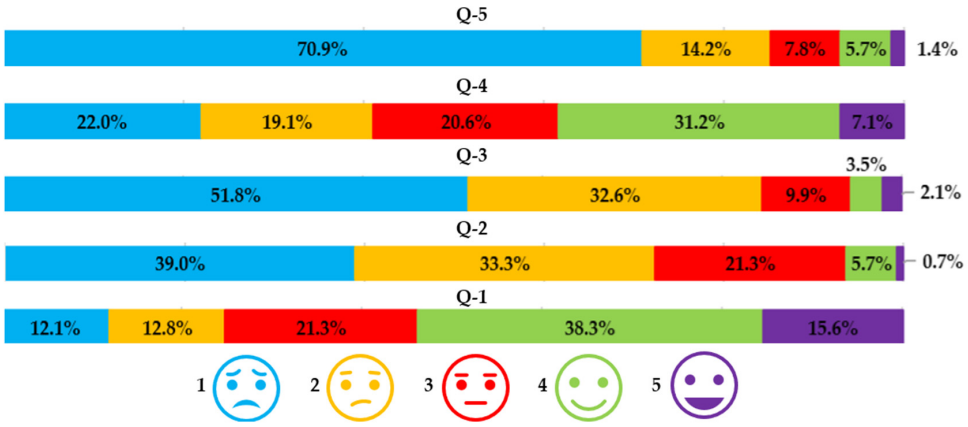

Figure 5. Percentage results obtained in questions Q-1–Q-5 (Table 1).

Regarding question Q-1, it has been identified that the majority of men and women believe that there is a great difference in the number of boys and girls who study STEAM subjects (Table 2). Therefore, the results of Q-1 have been analyzed with respect to the gender variable (IV-1) (Figure 6). The results obtained indicate that more than 50% of men and women agree that there is a great difference between male and female students in STEAM subjects. This finding is relevant because it demonstrates that opinion on gender disparity in these areas is not divided by gender but rather that both men and women recognize this gap. The fact that more than 50% of both men and women agree with the existence of a large difference between male and female students in STEAM subjects suggests that this perception is widespread and shared by both sexes. This common awareness of the gender disparity in STEAM subjects is an important starting point for addressing the issue and working toward greater gender equity in these areas. This result can also be used as a solid foundation to implement educational strategies and programs that encourage the equal participation of men and women in STEAM subjects.

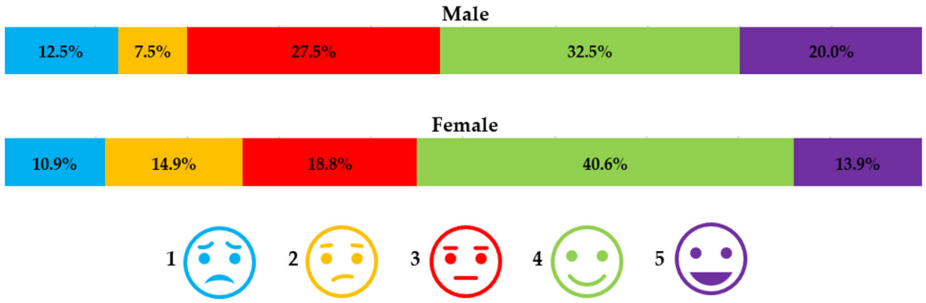

Figure 6. Percentage results obtained in question Q-1 (Table 1) depending on gender (IV-1, Figure 3).

In Q-1, the results have also been analyzed based on the age variable (IV-2) (Figure 3). The data indicate that, regardless of age range, more than 50% of teachers agree that there is a large difference between the number of male and female students in STEAM subjects. This consistency in perception across different age groups is a significant finding that highlights the persistence of the problem of gender disparity in these areas over time (Figure 7).

Finally, question Q-1 has been analyzed regarding the educational stage taught (IV-3, Figure 3), and it is also observed that in both Early Childhood–Primary and Secondary, more than 51% of teachers believe that there is a great difference between male and female students in STEAM subjects (Figure 8). It is surprising that only approximately 50% of teachers respond positively to Q-1 since this indicates the high percentage of teachers who are not aware of the problem of the gender gap in STEAM degrees. This implies that surely a large percentage of Spanish teachers are not doing anything to solve or change this situation.

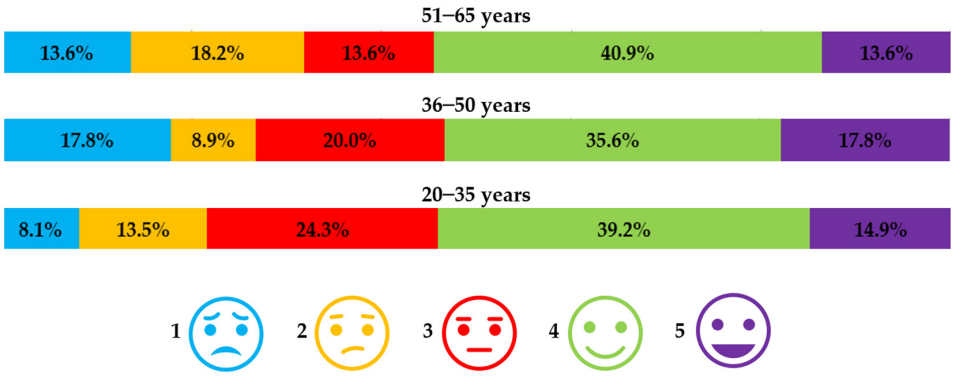

Figure 7. Percentage results obtained in question Q-1 (Table 1) depending on age (IV-2, Figure 3).

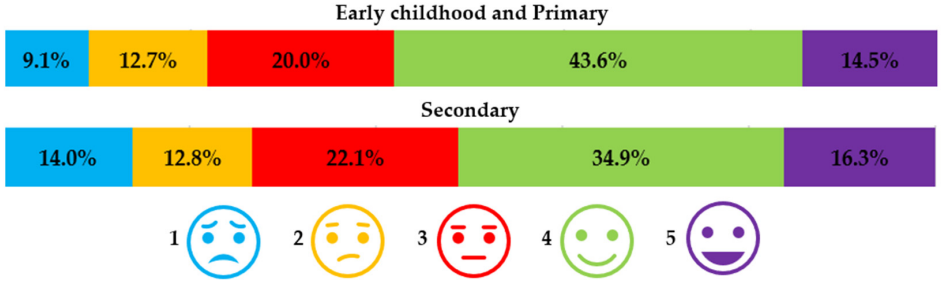

Figure 8. Percentage results obtained in question Q-1 (Table 1) depending on the educational stage taught (IV-3, Figure 3).

To obtain more significant results in Q-4, the results obtained have been analyzed based on the gender variable (Figure 3). In this way, significant differences are found in the distribution of Likert-type responses (1–5) depending on the gender variable. The data reveal significant differences in the responses of men and women, suggesting disparities in gender attitudes and beliefs in the context of STEAM careers. Firstly, it is worrying to note that more than 45% of female teachers agree with the statement that STEAM degrees are for men. This perception may appear due to the existence of gender stereotypes rooted in the educational field, which could discourage women from actively participating in STEAM disciplines. On the other hand, the fact that only 20% of men agree with the statement (Q-4) indicates that the majority of men do not perceive STEAM degrees as exclusive to their gender. However, it is crucial to address the attitudes and beliefs of those who do agree with Q4's statement, as even a relatively low percentage of men who share this perception can contribute to maintaining gender bias in STEAM careers (Figure 9).

In Q-4, the results have also been analyzed based on the age variable (IV-2) (Figure 3). It should be noted that in the age group 20 to 35, teachers show higher agreement than when they increase in age. That is, younger teachers agree more that there is discrimination in technical subjects because more boys than girls study them than older teachers (Figure 10). Therefore, it seems that if young teachers are the most aware of the problem, perhaps in the near future, there may be changes in this regard.

Question Q-4 has also been analyzed in terms of educational stage. The results obtained show that the average of the evaluations given by teachers in Q-4 is higher in the Preschool–Primary stage than in Secondary. Therefore, teachers in the early stages show a high agreement that there is gender discrimination in technical subjects because more boys than girls study them, while in the Secondary stage, the agreement is low. This result is important because secondary school teachers are not as aware of this discrimination in technical subjects, while in Early Childhood–Primary, they are (Figure 11).

Finally, question Q-5 has been analyzed with respect to the stage taught because significant differences were found in the distribution of the answers. As seen in Figure 12, both the teachers of the Early Childhood–Primary and Secondary educational stages

disagree with the statement that STEAM degrees are more suitable for the male gender. However, it should be noted that this difference is more critical in the Secondary educational stage because these teachers show greater disagreement with this statement.

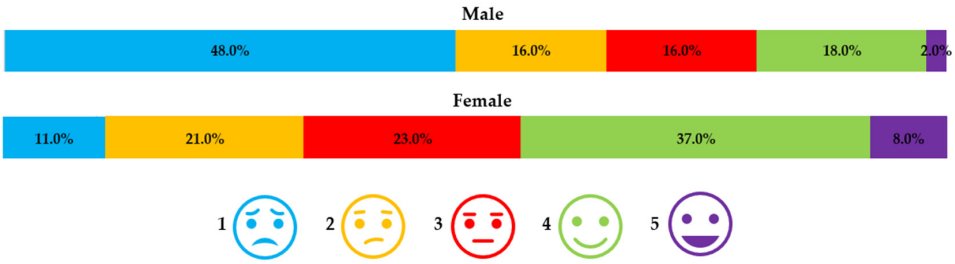

Figure 9. Percentage results obtained in question Q-4 (Table 1) depending on gender (IV-1, Figure 3).

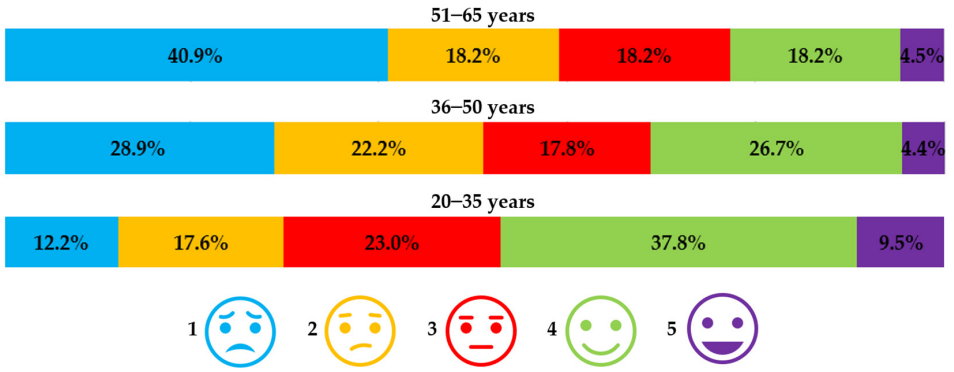

Figure 10. Percentage results obtained in question Q-4 (Table 1) depending on age (IV-2, Figure 3).

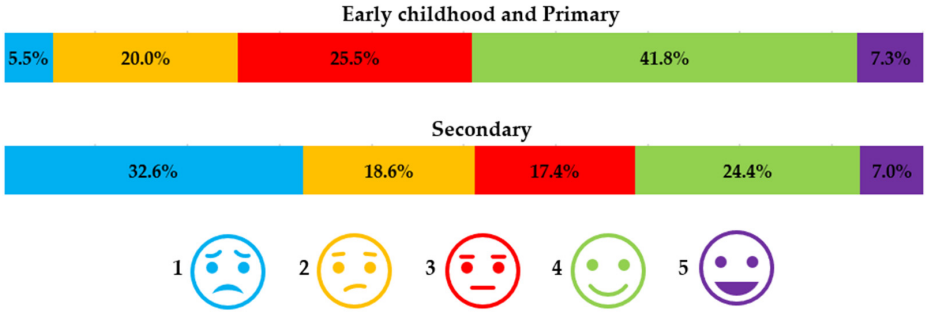

Figure 11. Percentage results obtained in question Q-4 (Table 1) depending on the educational stage taught (IV-3, Figure 3).

After analyzing the results obtained in this research, it is necessary to link the different research variables (Figure 3) with the research questions (Table 1) to obtain the most relevant conclusions. The variable DV-1 (number of students) is related to question Q-1 (there is a large difference in the number between female and male students in these subjects). The variable DV-2 (academic results) is related to questions Q-2 (boys are better in technical subjects) and Q-3 (academic results are better for boys than for girls in general). The third variable, DV-3 (gender discrimination), is related to questions Q-4 (there is some gender discrimination in technical subjects because more boys study them than girls) and Q-5 (STEAM degree studies are for the male gender) (Figure 13).

In view of the results obtained in this research, it is observed that the majority of teachers believe that there is a great difference between the number of male students and that of female students in STEAM subjects (Q-1, DV-1) (Figure 13). This high perception by teachers of the great difference between the number of male and female students in STEAM subjects is confirmed by both male and female teachers (Figure 6) of all ages (Figure 7) and who carry out their teaching activities in the different educational stages

of Early Childhood–Primary and Secondary (Figure 8). In fact, female teachers are the ones who most opt for this response (Figure 6) due to the general belief that exists that the female gender is less capable of studying these degrees [22,23]. The need to implement educational strategies that promote gender equity and support the academic performance of all female students is of great urgency at this time [16,17,24]. Furthermore, it is necessary to increase the skills of education professionals in this type of subject [14] so that the teacher is a guide in the development of scientific skills and competencies and strengthens the meaningful learning of students [15]. Therefore, these significant differences between the number of female and male students highlight the importance of encouraging girls' participation and interest in STEAM fields from an early age, as well as challenging gender stereotypes associated with these careers [24]. These degrees make students aware of their great importance in preparing the workforce of the future [13]; therefore, it is necessary to increase the awareness of teachers and the social environment of students [17] so that there is no longer a loss of human capital by female students in these STEAM careers [25,26].

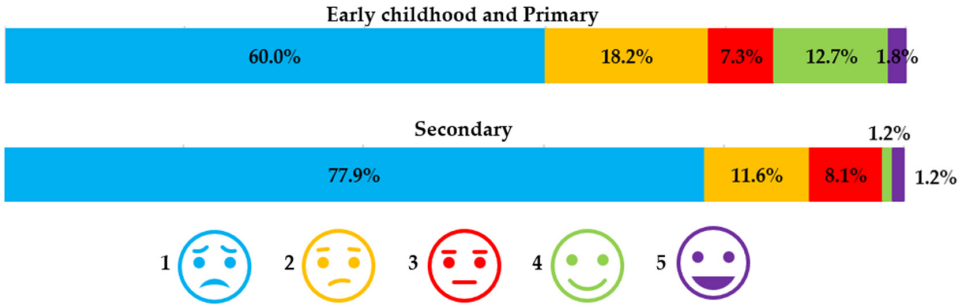

Figure 12. Percentage results obtained in question Q-5 (Table 1) depending on the stage taught (IV-3, Figure 3).

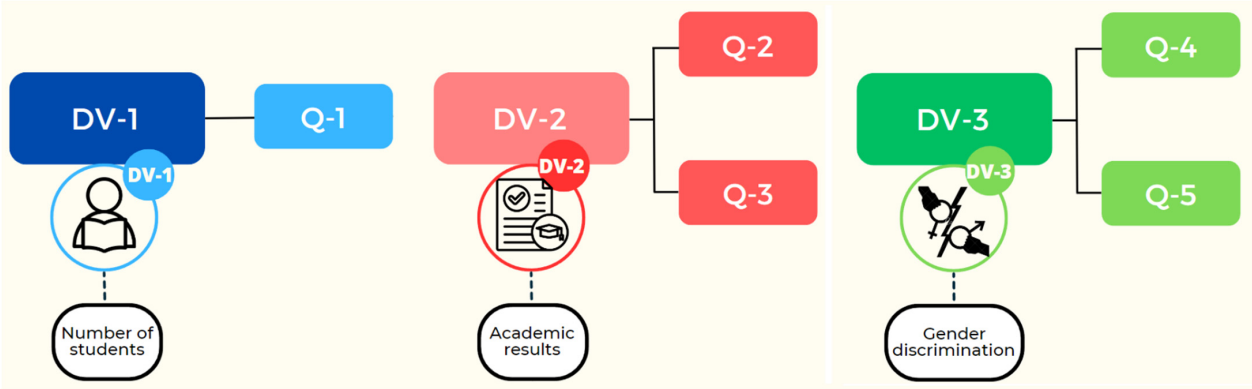

Figure 13. Relational scheme of the research between the dependent variables and the research questions (Table 1).

Also, it has been observed that most teachers agree that there is gender discrimination in these subjects because more boys than girls study them (Q-4, DV-3) (Figure 13). This discrimination is directly linked to the barriers that female students experience when choosing these careers in the future [18]. This fact is reflected in the low participation of female students in these careers in the future [25]. For this reason, it is important to highlight the importance that students' knowledge of STEAM subjects is formed in the early stages of school. Furthermore, the choice of university degree is one of the most important decisions in a student's life [28]; therefore, the knowledge about STEAM subjects that female students must have from their early school stages must be high so that they can take into account consider STEAM qualifications in the future.

It should be noted that secondary school teachers do not agree as much as Preschool–Primary teachers that there is discrimination in technical subjects because more boys study

them than girls. Furthermore, secondary school teachers indicate to a greater proportion that they do not agree with the notion that STEAM careers are for the male gender. Given this scenario, the reinforcement of this educational level on the gender difference becomes important because it is the most critical stage where students already choose the studies they want to pursue soon, and this gender difference is already notable. Female role models and the influence of the immediate environment are also important when choosing a degree [41]. Consequently, knowing these qualifications both in the early educational stages and in secondary school can change the masculine stereotypes of these careers [30]. If girls have close role models dedicated to science, their views will be more positive and less stereotyped in the future [30]. Therefore, this difference between male and female students indicates that more research and awareness of the gender gap in STEAM degrees is needed to address this gender issue in education, as discussed in previous research [26].

To mitigate the barriers faced by women in STEAM degrees, future research should focus on identifying specific barriers at different educational levels, especially in Early Childhood education, where early gender perceptions are formed. It is crucial to develop interventions such as mentoring programs and workshops that challenge gender stereotypes and promote equality. In addition, there is a need for further analysis of how teacher training and professional experiences influence gender perceptions of competencies, as well as the teaching methods used. This study would provide new insights to foster a more inclusive and equitable learning environment in STEAM.

A summary of the present investigation can be seen in Figure 14. In question Q1, women in the 51 to 65 years old stage and the Early Childhood–Primary Education stage agree more with the results. In the case of question Q4, there is a big difference between the level of agreement of women and that of men since women show higher agreement. In the case of age, it is teachers between 20 and 35 years old who agree the most, while in the other stages, it is seen that the level of agreement is lower. Finally, in the case of the stage taught by the teacher, there is also a big difference because it is in Secondary when a higher level of agreement is shown than in the early stages.

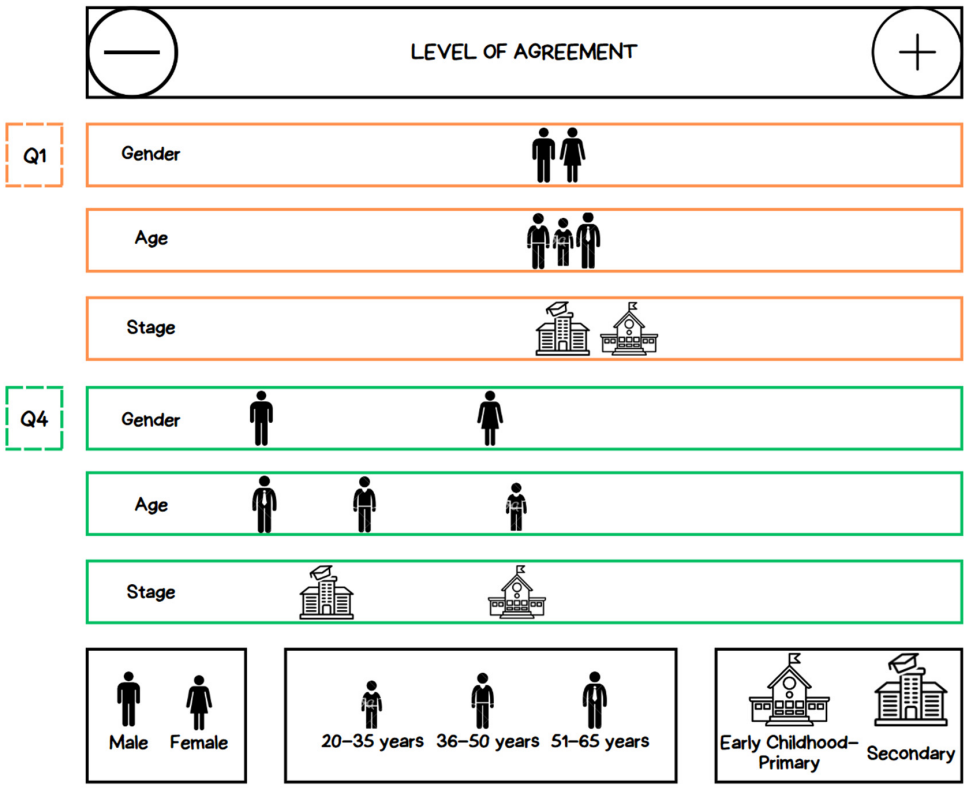

Figure 14. Discussion of the final results of this research.

5. Conclusions

STEAM degrees are linked to the comprehensive development of students and the acquisition of skills that ensure their professional employability. To achieve these objectives, the teacher has a leading role and, to this end, it is important that he or she has received adequate training that helps him or her to be a guide in the development of scientific skills and competencies, bringing science closer to students and promoting significant learning.

The results obtained in this research suggest that there is a low participation of women in STEAM careers. Consequently, it would be necessary to address the difficulties and barriers that women face when making the decision to choose these degrees. Gender differences can also arise and be reinforced through the educational system, which is why it is important to promote gender equity in the STEAM field. Furthermore, the development of scientific–technological skills among students is crucial for the progress of society and the economy. Therefore, increasing the awareness of teachers, as well as families and young people, about STEAM careers, is important to promote future student participation in these fields.

Consequently, the role of teachers is essential to abolishing this gender gap, which has its origins in the education received during the first stages of school. According to the results of this study, the perception that male and female teachers have is that there is a great difference between the number of boys and girls in technical subjects. Furthermore, they also agree with that statement at all ages surveyed. It should be noted that teachers in the early stages of school, such as Preschool–Primary, are more aware of this difference than in Secondary. Therefore, it is essential to increase awareness at this educational level about the gender disparity in STEAM subjects since this difference is a tangible reality. This moment is crucial, as it marks a decisive stage in which students choose whether they will continue their studies in the field of STEAM degrees.

The statement that there is gender discrimination in technical subjects because more boys than girls study them is also perceived differently among teachers depending on age. The results show that younger teachers show higher agreement with this statement. This statement may suggest that new generations are looking more critically at this difference than older teachers.

Continuing with this statement, there are different results regarding the belief that there is gender discrimination in technical subjects because more boys than girls study them, depending on the educational stage in which the teachers surveyed teach. Thus, it seems that in Spain, teachers of the initial educational stages (Early Childhood–Primary) believe that this discrimination exists in classrooms. This is an important result that should be considered, given that, in secondary schools, they are not as aware of this discrimination, and it is a critical stage in the students' choice of degree. Furthermore, secondary school teachers are the ones who show the greatest disagreement that STEAM degrees are indicated for the male gender. Therefore, seeing the results obtained here, it is evident that there is a need to reinforce the training of Spanish secondary school teachers because they are not aware of the real gap that exists in the classrooms.

Finally, these conclusions highlight the need to promote equal opportunities and the empowerment of girls in scientific-technological areas, as well as to generate awareness and action to eliminate any form of gender discrimination in the educational field.

6. Future Investigations

To better understand and mitigate the barriers women face in choosing STEAM careers, future research should focus on identifying more specific barriers at different educational levels. Understanding these barriers in depth can inform the development of targeted interventions and support mechanisms. Furthermore, given the important influence of early education on career choice, research should explore effective strategies to promote gender equality at these stages. Finally, future research should delve into the underlying reasons for these differences in perception. Comparative studies could analyze how teacher education programs, professional development opportunities, and personal experiences shape these

views. In addition, examining how teachers' perceptions influence their teaching methods and interactions with students could provide insights into effective ways to foster a more equitable and STEAM-oriented learning environment.

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