Pathways to STEM Interest among High School Girls: Insights from the Women in Science and Technology Conference in Biobío, Chile

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Abstract

A 2024 study by the Chilean Ministry of Education revealed a 37.6% gender gap in first-year enrollment in STEM programs, with technological fields such as electrical engineering showing only 11.6% female participation. In light of this gap, it is essential to foster initiatives that promote young women's interest in science and technology, offering early experiences and female role models to challenge stereotypes and broaden career aspirations. In this context, the School of Engineering of a well-known private university in Chile organized the "Women in Science and Technology Conference in Biobío," designed to engage high school girls through workshops and talks led by women leaders in STEM fields. To explore participants' perceptions after the event, we used a validated scale grounded in expectancy-value and self-efficacy frameworks, designed to identify early STEM vocations. The scale measures four aspects of students' attitudes toward science: enjoyment, utility, self-efficacy, and interest in STEM careers. The last aspect indicates students' future orientation and the perceived effectiveness of outreach efforts. Data were collected through a single post-event survey administered to 109 participants in the 2025 conference edition. The participants were female students from 10 different high schools and aged between 16 and 18. Descriptive and correlational analyses were complemented by a stepwise path analysis, which tested whether enjoyment, perceived utility, and self-efficacy predicted professional interest in science and technology. Results highlight the mediating role of enjoyment over the perceived utility in linking self-efficacy with professional interest in science. The study demonstrates how motivation and expectancy-value factors influence girls' interest in STEM and highlights the role of targeted outreach in promoting science and technology careers. Despite its single-measure limitation, it contributes to the research on reducing gender gaps in STEM by examining how short-term interventions can influence long-term career goals.

Keywords: Women in STEM, gender gap, expectancy-value theory, self-efficacy, professional interest, path analysis.

Introduction

The persistent gender disparity in women's participation in STEM fields—science, technology, engineering, and mathematics—represents a global concern, with particular significance in Latin American nations. Several studies have demonstrated that, despite the rapid expansion of access to education in recent decades, women remain underrepresented in scientific and technological careers, particularly within engineering and applied technology disciplines. This scenario constrains women's opportunities for professional advancement. International research indicates that this underrepresentation is not attributable to differences in biological or cognitive capabilities but is instead influenced by social, cultural, and educational factors that shape interests, expectations, and self-perceptions within academic contexts [1].

Within the national context, the considerable disparity in women's involvement in science and technology disciplines constitutes an issue being addressed throughout all sectors of Chilean society. Various environmental factors, including young people's self-perception of their abilities and prevailing social stereotypes, contribute to the markedly low participation, enrollment, and retention of women in scientific and technological careers.

The Andrés Bello University recognizing this issue, endeavors to foster an interest in science and the development of scientific thinking among young women in the region through an event entitled “The Women in Science and Biobío Technology Meeting”. This event targets female students in their final years of secondary education from schools within the region. It is an educational initiative designed to motivate, inspire, and draw regional female students closer to STEM (Science, Technology, Engineering, and Mathematics) disciplines. The initiative emphasizes promoting female participation in these fields, where women have traditionally been underrepresented. The young women attend presentations by successful women engineers who share their experiences and areas of expertise. Furthermore, workshops are held across the various STEM disciplines offered by the Faculty of Engineering. In this recent edition, three presentations and seventeen workshops were held, covering disciplines such as Civil Engineering, Computer Science, Geology, Robotics, Technology, Physics, Chemistry, among others.

This initiative, which held its seventh edition in 2025, aims to deepen the understanding of its participants, going beyond the satisfaction assessment collected in previous versions. The main goal of this research is to characterize the interest in science and technology among the attendees, analyzing the role of the initiative in early detection and strengthening of science and technology vocations. This will be carried out through the adapted application of the ACESTEM questionnaire (Attitudes toward Science in STEM Education) [2], which is used to measure and analyze students' attitudes toward science within the context of STEM education (Science, Technology, Engineering, and Mathematics).

Related works

This section contextualizes the gender gap in STEM and reviews evidence on its main determinants and possible intervention pathways. It summarizes background information on female underrepresentation (focusing on Chile and Latin America), psychological, family, and sociocultural factors that influence vocational choice, and the impact of initiatives and events aimed at promoting STEM careers among women. Finally, it presents the most commonly used theoretical frameworks and methodological approaches for assessing changes in interests and aspirations in this field.

Gender gap in STEM

The low representation of women in STEM is a global issue, notably pronounced in Latin America [3]. Multiple studies indicate that women constitute approximately 20% of university enrollments in STEM disciplines. Data from the Ministry of Science in Chile reveal that, in 2022, only 7.5% of women graduating with undergraduate degrees did so in STEM fields. Consequently, Chile ranks as the second lowest OECD country in terms of women graduating in STEM, with the OECD average standing at 14% for the same year [4]. This discrepancy is concerning, considering women comprise half of the population yet remain underrepresented in a vital area for development. For instance, a UNESCO report emphasizes that STEM fields are critical for the advancement of the UN's 2030 Agenda [5], and that the underrepresentation of women constitutes a significant barrier to achieving this development.

Concerning academic achievement, [6] observes that although males and females exhibit comparable performance during the educational phase, women nonetheless do not typically pursue careers in STEM fields. Nevertheless, once enrolled, their academic performance surpasses that of men, and they also demonstrate a lower dropout rate. In summary, despite the lower enrollment of women, their academic outcomes are superior [7].

This prevailing gender disparity has been thoroughly investigated, as documented in [8]. The study undertaken presents a bibliometric analysis that evidences a rise in research focused on STEM disciplines from a gender perspective. Moreover, these investigations also highlight that women are statistically less inclined than men to engage in careers within STEM domains.

Factors Influencing Women's Selection of STEM Careers

Women's difficulties in accessing and remaining in a STEM career are associated with multiple gender factors (psychological, family, school, and social), which overlap and interact in complex ways [9]. Studies suggest that girls' disadvantages in STEM are the result of the interaction of a wide range of factors embedded in both socialization and learning processes [5]. In [6], it is indicated that choosing a STEM career is not related to skills but to perceptions and gender stereotypes.

Educational systems are instrumental in fostering girls' interest in STEM disciplines. [5] highlights that measures such as appointing female teachers in STEM fields positively impact girls' academic achievement.

Conversely, numerous studies examine the influence of parental educational level and area of expertise on their children's vocational choices. Specifically, [10] concluded that educational attainment does not significantly predict the selection of STEM careers, but rather the degree of parental engagement and role models. This familial influence is further elucidated in **[11],** where it is described as cultural capital manifested through informal and early activities that stimulate scientific interest. Additionally, [12] indicates that the impact varies, with parents' STEM degrees exerting greater influence on their children, particularly noting that mothers' degrees have a more pronounced effect on daughters. [13] recommend that families encourage their daughters to participate in extracurricular programs that can offer motivational support and aid in restructuring any potential biases present within the household.

Impact of initiatives and events in promoting STEM for women

Universities are instrumental in implementing measures that can mitigate this disparity [9]. In Chile, higher education institutions and even non-profit organizations have introduced various initiatives aimed at promoting gender equality, including gender equity programs, scholarships or special quotas, and mentoring, among others. An increasing number of studies suggest that the challenge extends beyond merely providing access to creating supportive actions such as these [8]. The UNESCO report [5] emphasizes that interest significantly influences girls' engagement with STEM disciplines during their school years, which in turn affects their career choices in higher education. Such engagement could be enhanced by exposing girls to experiences in these fields. It has also been suggested that women might derive more benefit from these interventions, as they are more susceptible to gender stereotypes concerning their capabilities in this area. Lastly, it is noted that self-selection bias is the primary factor influencing the choice of careers in STEM.

For example, in Israel, a program called "Mind the Gap!" was initiated, which coordinated school visits to Google, annual technology conferences, and interviews with women engineers to discuss careers in computer science and technology. It was subsequently observed that the program impacted girls' selection of computer science as a high school major [14]. In subsequent years, this program was also implemented in Brazil, demonstrating that effective practices can be adapted and applied in diverse contexts.

Although institutional affirmative action policies serve as measures to counteract the effects of historical entry barriers and to enhance women's participation in STEM programs [3], the ongoing challenge lies in quantifying the impact of these initiatives on individuals' perceptions of their own abilities, preferences, and interests within scientific and technological curricula.

Theoretical frameworks and methodologies for assessing the impact on STEM interests and aspirations

To effectively attract more women to STEM fields, it is essential to employ robust theoretical frameworks and rigorous methodologies for the assessment of programs designed to cultivate interest and aspirations in these domains. A systematic evaluation of initiatives that encourage young women to pursue STEM disciplines relies on sound theoretical foundations and meticulous analytical techniques. One prominent approach is Bandura's self-efficacy theory [15], which posits that an individual's confidence in their abilities markedly influences performance and perseverance. Within the context of STEM, programs that enhance self-efficacy through interactive activities and immersive experiences, such as workshops and camps, have demonstrated a positive impact on participants' career ambitions [16]. Furthermore, the Expectancy-Value Theory, developed by Eccles and Wigfield [17], provides insights into how expectations of success and the perceived value of an activity influence persistence and career decision-making. Activities that relate learning to practical applications and personal objectives are particularly effective in increasing interest and motivation in STEM fields [18].

From a methodological standpoint, mixed-methods approaches are essential for evaluating the effectiveness of these initiatives. This approach combines quantitative tools, such as validated surveys like the S-STEM scale, with qualitative interviews that explore participants' perceptions and experiences [2]. Additionally, path analysis models are used to examine causal relationships among variables such as self-efficacy, motivation, and career choices, offering a deeper understanding of the impact of these interventions [18].

For example, recent studies in Chile have demonstrated that early exposure to STEM content, both within educational institutions and through extracurricular activities, enhances students' aspirations and reinforces their interest in these disciplines [19]. Nevertheless, challenges associated with gender stereotypes and systemic inequalities continue to persist [19], [20].

Empirical research has also examined how practical, intensive activities, such as engineering- and technology-focused summer camps, significantly affect students' interest and confidence in STEM. These experiences increase participants' intentions to pursue these fields and strengthen collaborative skills and their sense of relevance in STEM [21], [22]. These findings underscore the importance of designing interventions grounded in robust theories and methodologies tailored to participants' needs to effectively address the gender gap in these fields.

Methodology

The sample consisted of 109 female students who attended the "Women in Science and Technology Conference in Biobío." The participants were between 16 and 18 years old: 39.4% were 16 years old (n = 43), 33.0% were 17 years old (n = 36), and 27.5% were 18 years old (n = 30). Regarding the school level they were enrolled in for 2025, 55.0% were in level 3 (n = 60), and 45.0% were in level 4 (n = 49). In total, the students came from 10 educational institutions in the region.

This study uses an adaptation of the validated quantitative instrument, ACESTEM (Attitudes Toward Science in STEM Education) presented in [2], which proposes a 24-item scale divided into four dimensions:

1. Enjoyment of Science and Technology (Enjoy): It relates to the enjoyment or pleasure that learning, doing science and technology, or attending activities related to both, provokes.
2. Professional interest in science and technology (*ProfInt*): The willingness that each student has to pursue professional studies in the future related to science or technology.
3. Perceived difficulty of science and technology (*Diff*): In the original instrument, the authors refer to it as self-efficacy. It is related to students' beliefs and perceptions about their own abilities to understand, learn, and do science.
4. Perceived usefulness of science and technology (*Usef*): Items are included to assess the social relevance attributed by students to science and technology and those who practice it.

For the purposes of this research, some adaptations were made to the original instrument: (1) Considering that the event is related to Science and Technology, these words are used, replacing the abbreviation "STEM" used in the original instrument to avoid confusion in the responses from the sample group. (2) Twenty-three items from the instrument were used, removing one for not being relevant to the context of use, and two more items were added to each dimension, totaling eight, to specifically measure the impact of the event being evaluated. The instrument now has 31 items, which are available in the Appendix.

The instrument is applied to participants of the VII Science and Technology Meeting, in its 2025 edition, at the end of the event. Those students under the age of majority who participated in the study had the signed consent of their guardian, obtained prior to the event. This consent was not a requirement for participating in the event, only for the consideration of their responses for research purposes. At the conclusion of the activity, an online form with the instrument is distributed, which, in its description, guarantees the confidential handling of individual responses and their exclusive use for research purposes.

All analyses were conducted in the open-source statistical software JASP (version 0.19.0). We first screened the data by inspecting distributions using skewness and kurtosis indices and then computed descriptive statistics (means and standard deviations) for each study variable. Next, we estimated Pearson product–moment correlations to examine bivariate associations among enjoyment of science, professional interest in science, perceived utility of science, perceived difficulty in science, and perceived impact of the event. To explore potential group differences, we ran one-way ANOVAs to test whether these outcomes varied across maternal and paternal education levels, and effect sizes were summarized using eta squared (η^2). Finally, we tested a parallel mediation model to estimate the direct and indirect effects of perceived difficulty in science on professional interest in science through enjoyment of science and perceived utility of science. The model was estimated using the Maximum Likelihood estimator with robust standard errors, with 95% confidence intervals reported for all effects. Model explanatory power was evaluated using the coefficient of determination (R^2).

In this study, the perceived difficulty variable is understood as an inverse indicator of perceived self-efficacy, that is, the feeling of not having sufficient capabilities to succeed in the scientific field. This interpretation is consistent with the framework of Expectancy–Value Theory [17], which posits that success expectations are determinants of motivation and commitment in a discipline. A higher perception of difficulty (lower self-efficacy) translates into lower achievement expectations, which tends to reduce both enjoyment of the activity and the willingness to continue in it.

From Social Cognitive Career Theory [23], self-efficacy plays a central role in shaping vocational interests. Confidence in one's own ability facilitates positive performance experiences, which foster enjoyment and, at the same time, strengthen interest in pursuing a career in the field. In contrast, a perception of high difficulty acts as a barrier that limits the development of interest and reduces the appeal of projecting oneself into a scientific career.

In this sense, the proposed mediation model (perceived difficulty → perceived usefulness/enjoyment of science → professional interest in science) is theoretically supported by the idea that both the instrumental valuation of the discipline and the enjoyment of it function as proximal antecedents of vocational interest. Both dimensions are strongly influenced by self-efficacy expectations, so that students who perceive greater difficulties tend to value science less and experience less enjoyment, which in turn translates into lower professional interest in the field.

Results

Regarding the psychological variables, the descriptive statistics showed values suitable for the planned statistical analysis (Table 1). The *enjoyment* had a mean of 4.06 (SD = 1.12), with a left-skewed distribution (skewness = –1.33) and a kurtosis close to zero (0.74), indicating an approximately normal shape. The *professional interest* had a mean of 3.82 (SD = 1.05), with negative skewness (–0.51) and negative kurtosis (–0.68), reflecting a somewhat flatter distribution. *Perceived usefulness* showed a mean of 4.10 (SD = 0.97), with negative skewness (–1.6) and positive kurtosis (1.80), suggesting a concentration around the central values with heavier tails. *Perceived difficulty* recorded a mean of 2.38 (SD = 0.67), with positive skewness (0.29) and negative kurtosis (–0.54), indicating a tendency toward moderately flattened distributions. Finally, the *impact of the event* dimension had an average of 4.17 (SD = 1.20), with negative skewness (–1.72) and positive kurtosis (2.02), suggesting a concentration of responses at high values and a relatively more peaked distribution. In all cases, the skewness and kurtosis values are within acceptable ranges (±2), supporting the use of regression-based mediation models.

Table 1. Descriptive Statistics for Study Variables

Dimension	*Mean*	*Std. Dev.*	*Skewness*	*Kurtosis*
Enjoyment	4,055	1,12057	-1,327	0,74
Professional Interest	3,8211	1,0479	-0,507	-0,683
Perceived Usefulness	4,0979	0,97426	-1,6	1,8
Perceived Difficulty	2,3817	0,6725	-0,294	-0,536
Impact of the event	4,1686	1,20286	-1,717	2,021

In the comparisons between the third year (n = 60) and the fourth year (n = 49), no statistically significant differences were observed in any of the variables. The means were: *enjoyment* $M_3 = 4.03$, $SD_3 = 1.04$ and $M_4 = 4.08$, $SD_4 = 1.23$; *professional interest* $M_3 = 3.74$, $SD_3 = 0.99$ and $M_4 = 3.92$, $SD_4 = 1.11$; *perceived usefulness* showed $M_3 = 4.09$, $SD_3 = 0.84$ and $M_4 = 4.10$, $SD_4 = 1.12$; *perceived difficulty* $M_3 = 2.36$, $SD_3 = 0.67$ and $M_4 = 2.41$, $SD_4 = 0.68$; *impact of the event* $M_3 = 4.24$, $SD_3 = 1.07$ and $M_4 = 4.09$, $SD_4 = 1.36$. The Levene's test was not significant in any case ($p > .05$), so homogeneity of variances was assumed. The t-tests confirmed the absence of differences: *enjoyment* $t(107) = −0.22$, $p = .824$, $\Delta M = −0.048$, $d = −0.04$, 95% CI [-0.42, 0.34]; *professional interest* $t(107) = −0.91$, $p = .367$, $\Delta M = −0.183$, $d = −0.17$, 95% CI [-0.55, 0.20]; *perceived usefulness* showed $t(107) = −0.04$, $p = .968$, $\Delta M = −0.008$, $d = −0.01$, 95% CI [-0.39, 0.37]; *perceived difficulty* $t(107) = −0.37$, $p = .712$, $\Delta M = −0.048$, $d = −0.07$, 95% CI [-0.45, 0.31]; *impact of the event* $t(107) = 0.64$, $p = .523$, $\Delta M = 0.149$, $d = 0.12$, 95% CI [-0.26, 0.50]. Overall, the effect sizes were trivial to small, and the confidence intervals included zero, indicating that any real differences between levels, if they exist, are of small magnitude.

The study also examined whether maternal and paternal educational attainment was associated with differences in *enjoyment, professional interest, perceived usefulness, perceived difficulty, and impact of the event* (Table 2). In both analyses, the one-way ANOVAs indicated no statistically significant effects. For mother's education (df = 2, 105), no group differences were observed for *enjoyment*, $F(2,105) = 1.268$, $p = .286$, $\eta^2 = .024$; *professional interest*, $F(2,105) = 0.676$, $p = .511$, $\eta^2 = .013$; *perceived usefulness*, $F(2,105) = 1.591$, $p = .209$, $\eta^2 = .029$; *perceived difficulty*, $F(2,105) = 0.743$, $p = .478$, $\eta^2 = .014$; or *impact of the event*, $F(2,105) = 0.327$, $p = .722$, $\eta^2 = .006$. Similarly, for father's education (df = 2, 98), none of the outcomes differed significantly across groups: *enjoyment*, $F(2,98) = 1.300$, $p = .277$, $\eta^2 = .026$; *professional interest*, $F(2,98) = 2.075$, $p = .131$, $\eta^2 = .041$; *perceived usefulness*, $F(2,98) = 0.432$, $p = .651$, $\eta^2 = .009$; *perceived difficulty*, $F(2,98) = 0.416$, $p = .661$, $\eta^2 = .008$; and *impact of the event*, $F(2,98) = 0.933$, $p = .397$, $\eta^2 = .019$. Across models, effect sizes were small ($\eta^2 \leq .041$), so post hoc comparisons were not warranted. Overall, these findings suggest that students' perceptions were comparable across levels of parental education.

Pearson correlation analyses showed statistically significant associations among all dimensions ($p < .001$). In particular, *enjoyment* was strongly and positively related to *professional interest* ($r = .844$), *perceived usefulness* ($r = .915$), and *impact of the event* ($r = .857$). In turn, *professional interest* was positively associated with *perceived usefulness* ($r = .763$) and *impact of the event* ($r = .734$). In contrast, *perceived difficulty* showed negative correlations with the other variables: with *enjoyment* ($r = –.566$), with *professional interest* ($r = –.603$), with *perceived usefulness* ($r = –.449$), and *with impact of the event* ($r = –.385$), suggesting that higher perceived difficulty is associated with lower levels of enjoyment, interest, perceived utility, and perceived impact.

Table 2. One-Way ANOVA Results by Parental Education Level

Dimension	Parent Education	F(df1, df2)	p	η^2
Enjoyment	Mother	F(2, 105) = 1.268	0.286	0.024
	Father	F(2, 98) = 1.300	0.277	0.026
Professional Interest	Mother	F(2, 105) = 0.676	0.511	0.013
	Father	F(2, 98) = 2.075	0.131	0.041
Perceived Usefulness	Mother	F(2, 105) = 1.591	0.209	0.029
	Father	F(2, 98) = 0.432	0.651	0.009
Perceived Difficulty	Mother	F(2, 105) = 0.743	0.478	0.014
	Father	F(2, 98) = 0.416	0.661	0.008
Impact of the event	Mother	F(2, 105) = 0.327	0.722	0.006
	Father	F(2, 98) = 0.933	0.397	0.019

Table 3. Pearson Correlations Among Study Variables

		Enjoyment	***Professional Interest***	***Perceived Usefulness***	***Perceived Difficulty***	***Impact of the event***
Enjoyment	Pearson's r	—				
	p-value	—				
Professional Interest	Pearson's r	0.844***	—			
	p-value	< .001	—			
Perceived Usefulness	Pearson's r	0.915***	0.763***	—		
	p-value	< .001	< .001	—		
Perceived Difficulty	Pearson's r	-0.566***	-0.603***	-0.449***	—	
	p-value	< .001	< .001	< .001	—	
Impact of the event	Pearson's r	0.857***	0.734***	0.865***	-0.385***	—
	p-value	< .001	< .001	< .001	< .001	—

* p < .05, ** p < .01, *** p < .001

The mediation model examined the effect of perceived difficulty (Diff) on professional interest in science (*ProfInt*), incorporating two parallel mediators: enjoyment (Enjoy) and perceived usefulness (Usef). Including both mediators, the direct effect of Diff on ProfInt was negative and significant, but of smaller magnitude ($\beta = -0.277$, SE = 0.091, $z = -3.043$, $p = .002$, 95% CI [−0.416, −0.126]) than the total effect, which combines the direct path plus the two indirect paths (βtotal = −0.896, SE = 0.114, $z = -7.882$, $p < .001$, 95% CI [−1.141, −0.727]). This difference indicates that a substantial proportion of the effect is transmitted indirectly. In particular, a significant indirect effect was observed via Enjoy ($\beta\_indirect = -0.606$, SE = 0.142, $z = -4.263$, $p < .001$, 95% CI [−0.906, −0.354]), consistent with a negative association between Diff and Enjoy ($\beta = -0.841$, 95% CI [−1.090, −0.647]) and a positive association between *Enjoy* and *ProfInt* ($\beta = 0.720$, 95% CI [0.429, 1.001]). In contrast, the indirect path via Usef was not significant (βindirect = −0.014, SE = 0.084, z =

−0.162, p = .871, 95% CI [−0.203, 0.159]), despite the negative relationship between Diff and Usef (β = −0.667, 95% CI [−0.935, −0.458]). Overall, the results support a partial mediation, primarily through *enjoyment*, and the model explained a high proportion of the variance in *professional interest* ($R^2 = 0.735$).

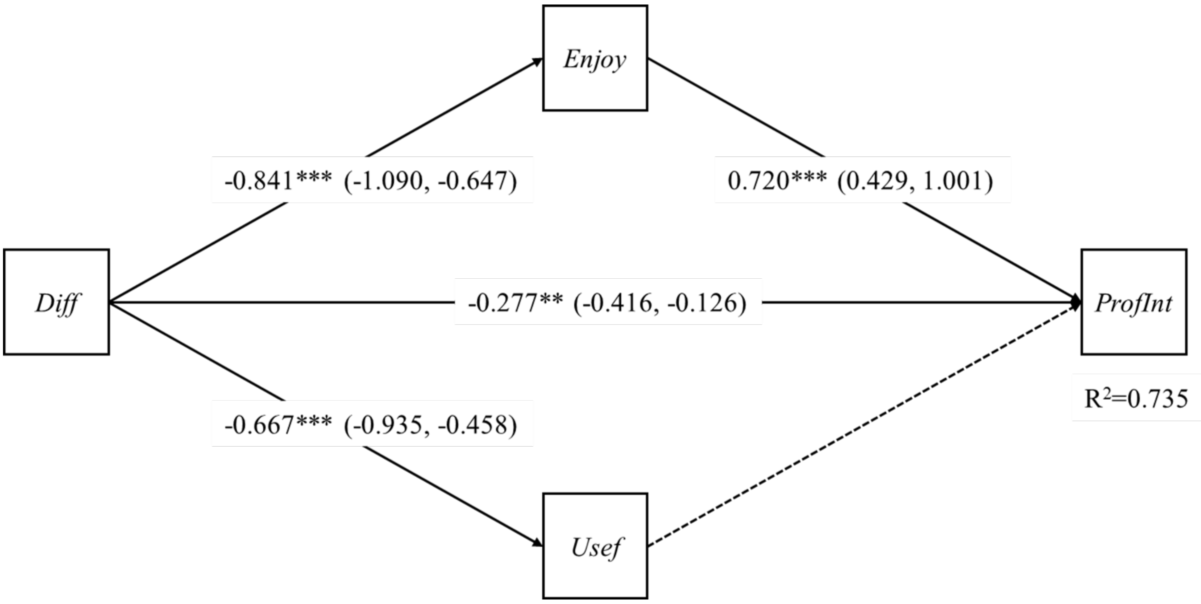

Figure 1. Parallel Mediation Model Predicting *Professional Interest* in Science (ProfInt) from *Perceived Difficulty* (Diff) via *Enjoyment* (Enjoy) and *Perceived Usefulness* (Usef) (**p <0.01; *** p < 0.00)

Table 4. Direct, Indirect, and Total Effects in the Parallel Mediation Model

	Efecto	*Estimate*	*Std. Error*	*z-value*	*p*	*95% Confidence Interval*	
						Lower	*Upper*
Diff → ProfInt	Directo	-0.277	0.091	-3.043	0.002	-0.416	-0.126
Diff → Enjoy → ProfInt	Indirecto	-0.606	0.142	-4.263	< .001	-0.906	-0.354
Diff → Usef → ProfInt	Indirecto	-0.014	0.084	-0.162	0.871	-0.203	0.159
Diff → ProfInt	Total	-0.896	0.114	-7.882	< .001	-1.141	-0.727

Together, these findings outline a consistent pattern: the students surveyed attending the event report high levels of enjoyment, perceived usefulness, and event impact, while perceived difficulty is the lowest component and, at the same time, the one most consistently linked to the other dimensions. The observed associations suggest that positive perceptions of science (enjoyment and usefulness) are closely linked to professional interest, and that perceived difficulty can erode that interest, especially when it reduces enjoyment. At the same time, the lack of differences based on parental education suggests that these patterns are relatively homogeneous within the sample. In the next section, we discuss how to interpret these relationships in light of the literature on motivation and interest in STEM, what implications they have for designing specific experiences like this event, and what limitations of the study should be considered when extrapolating the results.

Discussion

The results of the parallel mediation model show that enjoyment of science (*Enjoy*) is the main mediator in the relationship between the perception of difficulty (*Diff*) and professional interest in science (*ProfInt*). In particular, a partial mediation is observed: *Diff* maintains a direct negative effect on ProfInt, but a substantial proportion of the total effect is transmitted indirectly through *Enjoy*. This pattern suggests that when science is perceived as more difficult, enjoyment tends to decrease, and this reduction in enjoyment is associated with a lower interest in pursuing a professional career in the field.

This interpretation aligns with the role of ability beliefs in sociocognitive frameworks. Conceptually, Diff can be understood as an indicator of low self-efficacy or a perception of limited capacity to handle scientific tasks. As [15] notes, these beliefs reflect subjective judgments about one's ability and do not necessarily correspond to actual performance. Additionally, the instrument's dimension [2] focuses on personal perceptions of ability. In this context, the results suggest that not only academic demand but also the student's interpretation of their ability to meet it is linked to a less positive emotional experience during learning, and that this emotional experience is closely related to professional interest.

In contrast, perceived usefulness (*Usef*) does not emerge as a mediating mechanism of the *Diff* → *ProfInt* link in this model. Although *Diff* is negatively associated with *Usef*, the indirect path through usefulness is not significant. This does not necessarily imply that usefulness is irrelevant in vocational terms, but rather that, under the conditions and measures considered here, *Usef* does not explain the transmission of *Diff*'s effect to *ProfInt*. A plausible interpretation is that usefulness may function as an instrumental belief that justifies the discipline, but it does not alone sustain professional interest when the affective component (enjoyment) is diminished by a perception of low ability. In other words, recognizing that 'science is useful' might be necessary, but not sufficient if the learning experience is not rewarding.

These findings align with Social Cognitive Career Theory, where self-efficacy is a key determinant of interests and career choices, and low self-efficacy can act as a barrier to exploring, persisting, and developing aspirations in STEM pathways [23]. From an applied perspective, the results suggest that university interventions aimed at strengthening perceived self-efficacy could be especially relevant in protecting or increasing enjoyment of science. Pedagogically, this points to learning experiences with calibrated and progressive difficulty, feedback focused on progress and strategies, early achievement opportunities, peer modeling, and an environment that reduces the threat associated with making mistakes. If these actions succeed in improving perceived capacity, it is expected that enjoyment will be sustained and, through this, a greater professional interest in the scientific field will be fostered.

The descriptive statistics show a profile consistent with a self-selected sample of female students who voluntarily attend the 'Women in Science and Technology Meeting." In particular, the high levels of enjoyment (*Enjoy*), perceived usefulness (*Usef*), and event impact (*Imp*) suggest that the experience was evaluated very favorably and that, for many participants, science and technology are already perceived as valuable and motivating on an immediate level. At the same time, perceived difficulty (*Diff*) presents a low average and less dispersion, which may reflect a protected and supportive participation context, consistent with the purpose of this type of initiative to reduce perceived barriers and reinforce positive experiences. In this context, it is expected that professional interest (*ProfInt*), although relatively high, would be at a more moderate level than *Enjoy* or *Usef*, suggesting that the transition from a positive, specific experience to a sustained vocational projection is not automatic.

Together, these patterns reinforce the relevance of analyzing affective and socio-cognitive mechanisms that explain how brief but meaningful formative experiences can contribute to the development and consolidation of professional interest (*ProfInt*) in STEM among women. Additionally, since enjoyment (Enjoy) emerges as the main mediator of the link between perceived difficulty (Diff) and professional interest (ProfInt), these results support the importance of maintaining and expanding extracurricular activities like this gathering, as they promote positive experiences with science. This interpretation is consistent with evidence that values the participation of girls and young women in STEM activities outside the formal curriculum as a way to strengthen their interest in the field and support future pathways [11], [13].

The similarity in education levels of parents and its limited impact on evaluated dimensions aligns with evidence that parental influence on STEM interests depends more on everyday involvement than formal credentials. Active support like guidance and encouragement appears more decisive than educational attainment [10]. The lack of differences based on education might indicate that supportive climate and quality of involvement are more telling than academic degree. Literature suggests that parents' field of specialization could introduce variability by providing specific cultural capital and role models, affecting access to scientific careers [12]. This variable was not examined here, representing an opportunity for future research involving direct measures of involvement and support to understand family influences on STEM interest and perception.

The results provide relevant guidance for the design and maintenance of STEM promotion initiatives, but should be interpreted in light of several limitations. First, the study is based on a single measurement corresponding to the 2025 version of the event, with a voluntarily participating sample, so the conclusions cannot be generalized to other cohorts or isolated effects attributable to the event. It should also be considered that although the students participate voluntarily in the event, there could be a bias of prior interest in science and technology, which should be studied. Second, the cross-sectional design without pre- and post-event measurements prevents estimating changes associated with the experience and limits inference about the directionality between variables; consequently, the mediation model should be understood as an association compatible with theoretical mechanisms, rather than as causal evidence.

Given that the event is held annually, a primary future line of work is to implement longitudinal measurements and, ideally, pre–post designs with follow-up to assess the stability of effects and any additional mechanisms that contribute to consolidating professional interest. Along these lines, it is especially relevant to develop a participant traceability system that links attendance at the event with subsequent decisions about career choice, application, and enrollment, as well as with indicators of academic progress and retention in STEM programs [8]. This follow-up would allow us to evaluate the extent to which enjoyment and favorable beliefs translate into observable, sustained behaviors, and to identify the factors that facilitate or inhibit that transition. Finally, it would be valuable to expand the variable framework to capture other plausible mediators and moderators (for example, prior exposure to STEM activities, family support, the role of mentors, sense of belonging, and specific self-efficacy by area) and to incorporate behavioral and administrative measures that clarify how to transform isolated positive experiences into effective STEM trajectories.

Conclusions

The 'Women in Science and Technology Meeting' is establishing itself as a relevant space to identify and early strengthen the interest in science among high school students. Since enjoyment appears as a key mechanism associated with professional interest, the sustained implementation of this type of initiative—and its extension to younger ages—could help broaden the vocational horizons of the participants and, potentially, reduce the still-persistent gender gaps in STEM fields.

In parallel, the results reinforce the importance of addressing perceptions of difficulty, understood as subjective judgments about one's own abilities. Just because a discipline is demanding does not mean a lack of aptitude to develop in it; therefore, strategies aimed at strengthening self-efficacy and 'objectifying' difficulty through achievement experiences, feedback, and support could sustain enjoyment and, consequently, foster a greater willingness to pursue a career in STEM. In this regard, the literature has highlighted the importance of early interventions that increase cultural capital, provide role models, and challenge stereotypes—elements that this type of gathering can concretely integrate.

Finally, it is necessary to deepen the study through a longitudinal follow-up of the participants, as has been suggested in previous works. The available evidence is limited to a post-event measurement of a version of the Encounter and does not include behavioral indicators such as application, actual enrollment, or academic progress in STEM pathways. Incorporating traceability would allow for an assessment of the extent to which interest and favorable beliefs translate into sustained educational decisions, as well as estimate the degree of alignment between perceived difficulty and objective performance in related subjects.

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Appendix A. Survey Items and Measurement Dimensions adapted from [2]

Dimensión	Ítem
Perceived Difficulty	I am not going to understand Science and Technology, no matter how hard I try.
Perceived Difficulty	Science and Technology are easy for me.
Perceived Difficulty	I can understand Science and Technology without any problems.
Perceived Difficulty	Subjects related to Science and Technology are the most difficult of all.
Perceived Difficulty	The assessments for subjects related to Science and Technology are the hardest to pass, even if I study.
Enjoyment	I really like Science and Technology.
Enjoyment	I enjoy learning Science and Technology.
Enjoyment	I like doing Science and Technology activities in the classroom.
Enjoyment	I like attending Science and Technology-related activities in my free time.
Enjoyment	I think subjects related to Science and Technology are the most interesting.
Enjoyment	I don't like Science and Technology.
Enjoyment	After the event, I feel more interested in learning Science and Technology.

Enjoyment	The activities at the event sparked my curiosity about Science and Technology.
Impact of the event	The event motivated me to consider a career related to Science and Technology.
Impact of the event	After the event, I feel more interested in studying topics related to Science and Technology.
Impact of the event	After the event, I feel I can better face the challenges of Science and Technology subjects.
Impact of the event	The event helped me see Science and Technology as less difficult than I thought before.
Impact of the event	The event made me realize how relevant Science and Technology is in my daily life.
Impact of the event	Thanks to the event, I better understand how Science and Technology knowledge can be useful for solving everyday problems.
Professional Interest	I will continue studying Science and Technology in the future.
Professional Interest	I will not choose a career related to Science and Technology in the future.
Professional Interest	My college studies will be related to Science and Technology.
Professional Interest	I would not like to have a job related to Science and Technology in the future.
Professional Interest	I would like to pursue a career related to Science and Technology.
Professional Interest	I would like to have a job related to Science and Technology in the future.
Perceived Usefulness	Knowledge of Science and Technology helps me understand the world around us.
Perceived Usefulness	We live in a better world thanks to Science and Technology.
Perceived Usefulness	Scientists are highly respected.
Perceived Usefulness	People should understand Science and Technology because it affects their own lives.
Perceived Usefulness	People don't need to understand Science because it doesn't affect their lives.
Perceived Usefulness	Knowledge of Science and Technology helps me make better decisions about my own life.