Influences on IT-Related Courses Choices: A Gendered Analysis Based on Social Cognitive Career Theory

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Abstract: This study investigates what influences students to choose IT-related courses, focusing on gender differences within the Social Cognitive Career Theory (SCCT) framework. Gender disparities in IT are a significant problem in most European countries despite the growing demand for qualified professionals. In 2023, only 20% of employed ICT specialists in Portugal were women. Attracting and retaining female students in IT programs remains a challenge. Both intrinsic and extrinsic factors motivate students to pursue IT courses. SCCT identifies prior experience, social support, self-efficacy, and outcome expectations as critical influences on higher education and career selection. This study surveyed how these factors affect IT course choices, considering gender differences. It involved 56 Portuguese IT-related students from two higher education institutions in 2023. Using thematic analysis, we examined twenty open-ended questions to identify the reasons behind choosing IT. The results showed that previous programming experience, exposure to IT/computer, personal interest and positive job prospects significantly influenced decisions, while support from parents, friends and teachers was less impactful. The study suggests that educators and policymakers should intensify computing activities for school students, especially girls, to foster interest and attract them to IT careers, enriching the sector with diverse perspectives and talents.

1 INTRODUCTION

Information Technology (IT) degrees are a gateway to countless career opportunities and innovations today. Fields such as Informatics Engineering, Electrotechnical and Computer Engineering, Data Science, and Design and Multimedia are essential to advancing technological frontiers and addressing global challenges. However, despite the growing demand for skilled professionals in these fields, there is still a significant gender gap (Spieler et al., 2020; Babeş-Vroman, 2021; Chen et al., 2023; Eurostat, 2024) that limits the potential for diverse perspectives and innovations.

Like most European countries, Portugal ICT workforce is predominantly male, with only 20% of employed ICT specialists were women in 2023 (Eurostat, 2024). This lack of diversity hinders a more innovative environment and makes the field less attractive to women. This percentage reflects the entry of new students into higher education in ICT at Portuguese universities, where only 18% of students were women in Portugal's 2022/2023 academic year. This begs the question: why do so few Portuguese women choose to pursue an IT degree?

Promoting diversity in IT becomes crucial to fostering an inclusive culture that values different perspectives and ideas (Spieler et al., 2020; Babeş-Vroman, 2021). A diverse workforce can drive innovation by bringing varied experiences and viewpoints to problem-solving processes. Furthermore, as technology increasingly influences all aspects of society, its creators must reflect the diversity of its users.

Considering the Social Cognitive Career Theory (Lent & Brown, 2019), several variables, including personal (emotional state, gender role attitudes), contextual (perceived social supports and barriers), and cognitive (self-efficacy beliefs, outcome expectations), interests, and goals, influence the

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decision to pursue a specific field of study. For IT majors, these decisions are further complicated by biases, stereotypes and cultural norms (Master et al., 2020; Kube et al., 2024) that often discourage underrepresented groups, particularly women (Chen et al., 2023), from entering these fields.

In this context, the current study is motivated by the need to understand better the factors that influence Portuguese students' decisions to choose IT-related courses based on the Social Cognitive Career Theory framework.

Our findings will provide a more comprehensive understanding of fostering diversity and inclusion across IT disciplines. They will help educators and policymakers better understand how to create supportive environments that encourage all students to consider careers in IT, ultimately contributing to a more inclusive, innovative, and competitive technology future.

2 BACKGROUND AND RELATED WORK

2.1 SCCT Framework

Social Cognitive Career Theory (SCCT), introduced by Lent, Brown, and Hackett in 1994, builds on Bandura's Social Cognitive Theory to explain and predict academic and career development. Initially, SCCT focused on how individuals develop educational and vocational interests, make career choices, and function in academic and work environments. Over time, it has been refined to include well-being, job satisfaction, and educational and career self-management, resulting in five comprehensive models (Brown & Lent, 2023).

Each model incorporates personal, behavioural, and environmental variables. Key personal variables include self-efficacy beliefs and outcome expectations that guide career-related efforts.

Self-efficacy beliefs are domain-specific cognitive representations of personal competencies that reflect an individual's confidence in succeeding in various activities (Bandura, 1986). These beliefs motivate behaviour by influencing choices, effort, persistence, and overall performance. They are developed through observing similar role models, experiencing success, receiving encouragement, and managing anxiety.

Outcome expectations are the perceived consequences of engaging in activities within different domains (Bandura, 1986). They are also domain-specific, motivational, and adaptive, and can be positive or negative and categorized into extrinsic, intrinsic, social, or self-evaluative outcomes and motivate engagement and persistence. A combination of self-efficacy beliefs and positive outcome expectations significantly motivate decisions, such as selecting a STEM major (Brown & Lent, 2023).

Environmental variables, such as social supports and barriers, affect career choices and help shape self-efficacy and outcome expectations (Brown & Lent, 2023).

Learning experiences, another SCCT element, involve engaging with and acquiring skills through formal or informal education, practical application, and personal exploration. These experiences influence an individual's self-efficacy and expectations of outcomes in various domains (Brown & Lent, 2023).

In the SCCT interest and choice models (Lent et al., 1994; Lent & Brown, 2019), self-efficacy is crucial for shaping outcome expectations, as competent individuals tend to foresee favourable outcomes. Self-efficacy and outcome expectations, individually or combined, predict interests by promoting sustained engagement in activities anticipated to yield positive results, such as personal fulfilment and social recognition. These factors help individuals set goals for future endeavours, like selecting a college major or career aligned with their interests. Furthermore, environmental supports and barriers significantly affect these goals, as career-related achievements often depend on the social, material, and financial resources or obstacles present in the environment.

2.2 Related Work

Researchers have investigated several factors that could explain gender disparities in occupational engagement in STEM/IT fields. These factors include low self-efficacy, negative outcome expectations, and distal and proximal contextual influences on academic/career choices. SCCT has been instrumental in investigating interests, choices, and persistence in STEM/IT fields for underrepresented groups such as women and racial/ethnic minorities (Fouad & Santana, 2017; Lent et al., 2018).

Researchers found that self-efficacy had a slightly more potent influence on outcome expectations among men, whereas the impact of supports and barriers was more pronounced for women (Lent et al., 2011). This suggests that female computing students' outcome expectations are more affected by perceptions of environmental conditions and work-

family balance, with social support playing a crucial role in overcoming barriers in their pursuit of computing degrees.

Five environmental supports and barriers were identified (Fouad et al., 2010): parental, school, financial/environmental, social, and individual. Barriers negatively impacted self-efficacy more in men than in women, while supports were more positively linked to outcome expectations and goals in most samples (Lent et al., 2018). Parental support and learning experiences are essential for self-efficacy in mathematics and science (Fouad & Santana, 2017). This self-efficacy is also connected to outcome expectations, influencing interest and intentions to pursue STEM careers. Research suggests that increasing parental involvement in interventions can increase interest in STEM (Fouad & Santana, 2017). Initiatives to improve women's self-efficacy in STEM can focus on providing social support that helps mitigate the impact of barriers while strengthening outcome expectations, interests, and career choices (Lent et al., 2018).

Research has found that outcome expectations were more closely linked to interests in majority groups but more strongly linked to goals in minority samples (Lent et al., 2018). As an example of outcome expectations, perceived job availability influenced personal utility more than expected salary or job security (McKenzie and Bennett, 2022).

Alshahrani et al. (2018) explored why students choose to study Computer Science (CS) using SCCT constructs by interviewing 17 mixed-gender students at Scottish universities. They found that social support from family, teachers, friends, and mentors is crucial for women to pursue CS. These findings are like those of Tsakissiris and Grant-Smith (2021) but contrary to those of McKenzie and Bennett (2022), who found that social influences such as family and friends were not significant motivators in studying IT. Furthermore, the career opportunities provided by a CS degree, including job prospects and the potential to make significant social contributions, were significant motivators. Prior experiences such as problem-solving, programming, online self-study, and internships positively influenced their decision, while school education had a limited impact.

McKenzie and Bennett (2022) conducted a two-year study of undergraduate IT students' course selection and career aspirations at an Australian university. The findings revealed that students' motivation to study IT is primarily driven by an intrinsic interest and enjoyment of the field rather than external factors such as salary or job security. This focus on personal factors aligns with previous research (e.g., Tsakissiris & Grant-Smith, 2021).

Smit et al. (2024) examined how enjoyment predicts students' self-efficacy in programming. Students with lower initial enjoyment scores experienced more significant increases in enjoyment during the final tasks than those with higher initial scores. While girls' enjoyment scores increased more than boys', girls' overall enjoyment scores remained lower. Both genders saw an increase in self-efficacy beliefs over the course, with some variation in these beliefs attributable to enjoyment of the course. Atiq and Loui (2022) found that the predominant emotions during the programming task were frustration, anxiety, confusion, neutrality, and relief.

Tsakissiris and Grant-Smith (2021) conducted in-depth semi-structured interviews with 52 ICT students from four Australian higher education institutions. The findings reveal that emerging professional identity factors (such as mastery, sense of belonging and status, and esteem) and self-interest factors (such as anticipated income, perceived opportunities, and work-life balance) collectively exert significant influence, pushing students away from or pulling them towards pursuing an ICT career after graduation.

Despite extensive study of SCCT models of interest and choice, further research is required to evaluate their applicability in diverse demographic and cultural contexts. It is also necessary to explore new intersections between variables such as learning experiences, social support, self-efficacy beliefs, and outcome expectations, particularly regarding IT-related course selection and gender differences.

3 METHODS

3.1 Goals and Research Questions

This exploratory research investigates how learning experiences, social support, self-efficacy beliefs, and outcome expectations affected Portugal university students' choice of higher education courses in IT areas. To achieve this objective, the following research questions were formulated:

- RQ1: How do prior experiences shape students' decisions to choose IT-related courses, and what gender-specific differences affect this impact?
- RQ2: How does social support from family, peers, and educators influence students' choices

to pursue IT courses, and how does this impact vary by gender?

- RQ3: How do self-efficacy beliefs influence students' decisions to pursue IT courses, and what factors impact these beliefs, particularly regarding gender differences?
- RQ4: How do outcome expectations shape students' decisions to choose IT courses, and what gender-specific differences exist in perceptions of career opportunities in these fields?
- RQ5: How do students' perceptions of IT culture and stereotypes affect their course choices, especially for underrepresented genders?
- RQ6: What suggestions do students have for parents, schools, and universities to support and recruit more underrepresented groups into IT courses?

3.2 Recruitment and Participants

After authorization from the ethics committee and approval from the data protection office of the authors' institution, we recruited participants.

The participants invited to this study were all students at all university levels (undergraduate to doctorate) and over 18 years old enrolled in IT-related courses, including Informatics Engineering, Electrotechnics and Computer Engineering, Data Science, and Design and Multimedia from two higher education institutions in Portugal.

Participants were recruited through outreach efforts, including posters and flyers delivered directly by the researcher and emails sent by the student's department secretary or director. Participants were assured of their anonymity and informed that their participation was voluntary. Informed consent was required from all study participants. No financial incentives or other benefits were offered, relying solely on the participants' willingness to contribute to scientific research.

There were 56 participants, identified as follows: man (M) - 35, woman (W) - 19, non-binary or preferably not specifying gender (NI) – 2. All participants were Portuguese students who were actively enrolled and reported being studying or having studied the following undergraduate courses: Informatics Engineering (M-18, W-7, NI-1), Electrotechnical and Computer Engineering (M-10, W- 4, NI-1), Design and Multimedia (M-3, W-2), Data Science and Engineering (W-3) and Others (M-4, W-3) (see details in Table 1). The participant pool consisted of 33.3% female and 63.2% male students, along with 3.6% who identified as non-binary or preferred not specifying gender. This distribution reflects the study's focus on exploring gender differences in IT major choices. Participants ranged in age from 18 to 43, with the majority falling within the typical 18-23 age range for undergraduate students. The study included students from a variety of academic levels, including undergraduate (53.6%), master's (30.4%), and doctoral (16.1%) degrees.

Table 1: Participant demographics.

Course	N	Age*
Informatics Engineering	26 (M-18, W-7, NI-1)	18 to 23 (53.84 %) 24 to 28 (30.76 %)
Electrotechnical and Computer Engineering	15 (M-10, W-4, NI-1)	18 to 23 (73.33 %) 24 to 28 (13.33%)
Design and Multimedia	5 (M-3, W-2)	18 to 23 (100%)
Data Science and Engineering	3 (W-3)	18 to 23 (100%)
Others	7 (M - 4, W - 3)	18 to 23 (71.42%)
N = 56; M (men) = 62.5 %; W (women) = 33.9 %. NI (not binary or not specified) = 3.6% * Other age ranges omitted due to space constraints		

3.3 Data Collection and Instruments

Data was collected through an online survey with an extensive questionnaire that will be used for a broader study in the future. However, this article will focus on analysing a specific block of 20 open-ended questions in addition to demographic data.

The block of 20 open-ended questions was adapted from Alshahrani et al. (2018) and translated from English to the Portuguese context. Bilingual experts (Portuguese - English) reviewed and validated the questions. The questionnaire was then pilot tested with a sample of the target audience.

This block of questions explores the SCCT constructs that influenced the decision to pursue an IT course through questions about prior experiences in school and with IT before entering university, social influences and support, self-efficacy beliefs and outcome expectations, as well as questions to collect participants' perceptions and suggestions about the IT field and society's view on gender disparity in this area. This approach allowed participants to express themselves, providing rich qualitative insights into their experiences and perspectives.

The survey was conducted using the Lime Survey platform. It was available to students at all

educational levels in the departments involved, from undergraduate to doctoral, over the course of two months, from November to December 2023.

3.4 Data Analysis

This qualitative study analyses open-ended questions related to SCCT constructs and gender differences.

Demographic data were analysed using descriptive statistics to count, calculate the percentage and summary of responses.

Data from open-ended questions were analysed using a mix of deductive and inductive thematic analysis (Braun & Clarke, 2006) that guided this study. The steps for thematic analysis are explained as follows.

Familiarization with the Data: Participant responses were exported from Lime Survey to an Excel spreadsheet. The Excel spreadsheet was adjusted to include only participant demographics and the block of 20 open-ended questions. In addition, any missing data or respondents who were not part of this research's target audience were removed. After that, fifty-six documents corresponding to the responses of the 56 participants were imported into Atlas.ti. Then, the data were prepared to be read, analysed and coded.

Generating Codes and Categorization: Most of the coding emerged from the data, but its construction was influenced by previous research (Alshahrani et al., 2018; Lent & Brown, 2019). Coding was aided by Atlas.ti and attempted to capture the most meaningful terms and organize them into groups. The coding process was based on the responses to each question in the questionnaire, previously associated with a general theme, such as prior experiences, social support, selfie-efficacy, outcome expectations, perceptions and suggestions. As results, 370 codes were generated and assigned in 984 citations.

Defining and Reviewing Themes: The codes were grouped into potential themes (or subcategories) by combining all relevant data for each theme and identifying patterns and insights related to the research questions in this study. In addition to the themes previously defined by the questionnaire, new themes emerged from the analysis and were considered. As a result, twenty-two relevant themes were identified, and excerpts were associated with them.

Producing the Report: Finally, a coherent narrative was constructed considering the defined themes and subthemes and supported by selected quotes to provide a compelling account of the findings, as seen in the results section of this paper.

4 RESULTS

This section presents the results to our research questions according to four SCCT constructs: prior experience, social support, self-efficacy, and outcome expectations, along with additional categories of perceptions and suggestions.

Data are presented using example quotations from students who responded to the questions. The following codes were defined to maintain respondents' anonymity: PM#0 indicates a male participant, PF#0 indicates a female participant, and PNI#0 indicates a non-binary participant or participant who did not wish to provide their gender, followed by an identification number. It is essential to clarify that the questions were not mandatory, leaving the research participants free to answer what they wanted; therefore, not all participants answered all the questions. The students' statements presented here were freely translated from Portuguese to English.

4.1 Prior Experiences

In response to RQ1: How do prior experiences shape students' decisions to choose IT-related courses, and what gender-specific differences affect this impact, participants' responses were categorised into the following six themes: IT Classroom Environment; Types of Activities with IT Resources; Specific Programming Course Before Higher Education; Decision-Making Moment of Choosing The Course; The importance of Prior Experiences in Influencing Their Decision; and Reasons and Most Significant Influencing Factors.

Twenty-one respondents associated the IT Classroom Environment during their school years with a negative evaluation, describing an unpleasant atmosphere, unmotivating lessons and teaching of basic computer use and software applications. Ten highlighted the lack of preparation of teachers for teaching IT and the use of only basic computer resources: *"There was still a lot of immaturity regarding the use of IT in classes at school, even though I studied in an environment with a lot of exposure to it from an early age. The teachers also did not yet have the training or competence to know how to manage these dynamics, nor the appropriate tools (computers not managed by the school, etc.) to keep students focused on the activities in question." (PM#16)*. Eight participants evaluated the IT Classroom Environment positively and noted that it influenced their connection with IT: *"I learned the basic concepts of IT, used programs considered for daily use, and superficially developed a website and*

a simple robot. These activities were, in a way, important for my initial connection with IT." (PM#32) Five students took programming classes at school: *"In high school, with the subject Informatic Applications B, I developed a Media Player for video and audio files using C#. This was indeed very useful for the course I am currently studying." (PF#9).*

Only nine of the 56 participants said they had taken specific programming courses before entering higher education, and only two were women. Fourteen respondents said they decided to pursue an IT degree during high school. In contrast, others indicated it was during elementary school (6) and others (4) at the time of applying to higher education. Twenty-nine said they had or were interested in another course/field of study, while nine stated that the chosen course was their first choice.

Twenty-nine respondents commented on the importance of previous experiences in influencing the decision to choose a course and highlighted contact and experience with IT and equipment (9) as the main factors: *"I always grew up with computers, and by primary school, I had already started programming some basic games, so the decision was almost a given."(PM#16); "I did some electronics projects in high school that solidified my choice of course."(PF#6); "The experience that most influenced me to choose informatics engineering was having the informatics applications subject in the 12th grade, as I learned to program in Python, make simple animations with Pivot Animator, and edit vector images, among other things, but these were the activities I enjoyed the most."(PNI#2)* However, seven students (M=4, W=3) responded that previous experiences did not influence their decision to pursue an IT course. "*I didn't have any experience that influenced me. It was purely by process of elimination."(PF#11); "It wasn't because of the past, but because of the work opportunities in this area." (PM#22); They did not influence me at all. I wasn't influenced by experiences, only by people and facts."(PF#12)*

Participants responded that personal interest (17) and good job prospects (14) were the most significant factors influencing their choice of higher education courses: *"Personal interest, curiosity, a liking for the sciences and exact areas, a liking for technology and everything associated with it." (PF#9); "The biggest influence on my choice of this degree was the fact that it is a growing field, with above-average salaries and many job opportunities." (PM#29); "Passion. The combination of art with technology (design and multimedia)." (PM#4); "The job opportunities and their remuneration are good, and I had a great interest in learning more about this area." (PM#13)*

4.2 Social Support

In response to RQ2: How does social support from family, peers, and educators influence students' choices to pursue IT courses, and how does this impact vary by gender, participants' responses were categorised into the following three themes: Influence of Parents, Influence of Close People or Friends, and Influence of Teacher.

Eight participants (M=4, W=3, NI=1) mentioned the influence of others on their course choice. Of these, 4 mentioned the influence of family: *"In part, I was influenced by my father's experience, who is an electrical engineer, and from an early age, he talked to me about his field and his course." (PM#13); "the experience of family members as computer engineers also helped" (PNI#2); "Seeing my mother working in the field." (PM#10);* "*My father, who earned a degree in Electrotechnical and Computer Engineering, which is more or less in the field, also influenced my choice, reinforcing my professor's opinion." (PF#12).* Three mentioned the influence of close people or friends: *"obviously, I took the second path and later entered Informatics Engineering, largely due to the influence of those close to me and the job prospects." (PM#17); "Encouragement from a friend/colleague." (PM#30).* Only one mentioned the influence of a teacher: *"My teacher, whom I hold in high regard and esteem, not only recommended this course to me but also spoke very highly of it." (PF#12) However, one cited the discouragement from teachers: "I was always encouraged to go into the health field and not technology, mainly by my teachers."(PF#2)*

4.3 Self-Efficacy

In response to RQ3: How do self-efficacy beliefs influence students' decisions to pursue IT courses, and what factors impact these beliefs, particularly regarding gender differences, participants' responses were categorized into the following four themes: Confidence in the Ability to Study the IT Course; Beliefs about the IT field; Programming Skills; and Feelings about Being an IT Student.

Twenty-eight of those respondents said they were very confident: *"Very confident because I really enjoy everything I learn and work on in this area." (PM#6); "Very much. I don't see much reason why I couldn't do it if I wanted to." (PF#6)* Others said they were confident (6) or relatively confident (3):

"Confident when it comes to programming and problem-solving, not so confident when it comes to more theoretical things." (PM#34); "Confident enough to continue achieving my personal and professional goals." (PF#9). Another said he wasn't very confident. Although some women and men rated themselves highly, only three women rated themselves with the lowest degree of confidence: *"Very little, honestly." (PF#12); "Not at all confidence." (PF#10). "Trust 0." (PF#11)*

Regarding student's beliefs about the IT field, responses were sub-categorized into the following themes. The importance of IT: *"The importance of studying in this area and its relevance to the future of technology has become increasingly clear." (PM#13); "I think it's an important area that has a significant impact on various parts of society." (PF#3);* Interesting area: *"It's interesting, there's still much to discover/create." (PM#20);* Area that requires dedication: *"It's demanding but not difficult if we are consistent." (PF#16) "Nothing is impossible, it just requires dedication and time." (PF#19)*

Participants were asked about their programming skills, whether they enjoyed programming and whether this could influence their choice to enter the IT field. Twenty-one responded that they have good skills and enjoy programming. However, a lack of skills does not prevent them from choosing a course, although it helps. *"I feel that my skills are good. I had several classmates with zero experience in programming, and with help and study, they easily reached the level I had acquired before entering higher education." (PM#26); "Programming was something I had never 'done.' I entered the first year with no experience, but with effort, I succeeded, and it is one of the things I like the most." (PF#14); "I think I have good logical reasoning and that I will be a good programmer." (PF#18)* Two respondents mentioned that they had basic skills: *"Very basic skills, I have a lot of interest and enjoyment, but it's complicated since there's a lot of material and it's taught very quickly." (PM#30); "I know the basics, but I'm ready to learn MORE." (PM#36).* Meanwhile, three boys claimed to have advanced skill: *"My programming skills are advanced." (PM#7); "At this point, I am already competent at programming." (PM#27); "I am a quite capable programmer." (PM#16)* Two responded that they don't like it and are not good at it: *"I'm not good, I don't like studying Programming, but I hope it's just the initial impact and that it will get better over time." (PF#12); "It's not the most pleasant, but it's one of the most important." (PM#22)*

Participants were asked how they felt about studying a course related to IT. The subthemes identified were as follows. Happy (3): *"I feel somewhat happy to be doing something I like." (PM#8); "I feel proud and happy to be challenged." (PM#13)* Good (7): *"Currently, studying Informatics Engineering makes me feel very good, as I'm always discovering new applications of various concepts, and it doesn't seem like this will change anytime soon." (PM#17);* Fulfilled (4): *"Fulfilled by achieving my goals in courses and in life." (PM#10); "I feel fulfilled with what I am learning, unlike all the education before higher education." (PF#9)* Frustrated (2), Tired (2), but Satisfied: *"I couldn't be studying anything better; each day I may get tired, but it's worth it." (PF#17); "Frustrating, rewarding, tiring, inspiring." (PF#7); "Sometimes there are some frustrations since there are errors that are not perceptible. On the other hand, there is enormous satisfaction when things go well. In terms of self-esteem, I feel good about myself and motivated to be studying to become a future informatic engineer." (PM#35)* Confident about the future (4): *"Confident that this path will open many doors for me." (PF#15); "I feel that I am studying an area that will help me improve the world and people's lives in the future." (PNI#2); "I feel somewhat relieved regarding employability in this area." (PF#19);* Normal (2) or nothing special (2): *"I feel normal, neither more nor less happy; it's a good area with very interesting moments and others that are more boring." (PM#5); "Neutral. It doesn't make me feel anything special." (PM#25)*

4.4 Outcome Expectations

In response to RQ4: How do outcome expectations shape students' decisions to choose IT courses, and what gender-specific differences exist in perceptions of career opportunities in these fields, participants' responses were categorised into the following three themes: Outcome Expectations (Employment and Salaries, Contributing to society, and Personal and Professional Success); Influence of Outcome Expectations on the Choice of Higher Education Course; and Attractive IT Careers for Women.

Participants referred to Employment and Salaries (23) as the most impactful expected outcome they hope to achieve by pursuing an IT course: *"Obtaining a higher-paying job, more opportunities for growth, and personal development." (PM#28); "A good job, new challenges, and new opportunities. I hope to become a competent professional and fulfilled with what I do in my day-to-day life." (PF#9);* The second

theme was Personal and professional success (7): *"Personal and professional success and a good living condition for me and my family." (PM#6); "Success on all levels." (PM#36).* Contributing to society (4): *"A contribution to society." (PF#7); "I hope to be able to do things to help people and have a stable job that gives me security. I also hope to meet more people like me who see this area as a way to create incredible things and help others." (PNI#2).*

Twenty-nine participants agreed when asked whether the outcome expectations they mentioned could influence students to study IT. *"Yes, it seems to me that the pleasure in acquiring and disseminating knowledge in the area is what contributed to getting here." (PM#17); "Yes, it's always important to consider expectations regarding job availability in the field." (PF#9); "Yes, I think if someone has expectations of good results, they will want to study in this area." (PNI#2); "Of course, good expectations lead to the creation of dreams." (PM#15).* Two said it depended on the student: *"It depends a lot on the student's goals. For many people, academia is not the right path and a career in programming can be daunting." (PF#3); "It depends on the student's willingness and interest in the area." (PM#35).*

Students were asked what they knew about careers with a degree in IT and whether they were attractive careers for women. Twenty-two said the careers were equally attractive to both sexes: *"They are equally attractive for women as for men. I don't notice, for example, a salary difference. Companies, when hiring, don't ask for a 'man' or a 'woman.' They ask for someone qualified."(PM#2); "They allow for a motivating and dignified career with access to good living conditions. I think so, both for men and women. Because the field itself doesn't make that gender separation at any point."(PM#6); "I know they are promising, and I think they are attractive to anyone who knows them."(PM#13); "It's possible that they are attractive, yes. There are many IT jobs that are done remotely, I imagine that is very useful for a mother, for example."(PM#15); "Yes, but it is still an area controlled by men."(PF#1); "Yes, there are quotas to fill."(PF#2); "I don't see a difference in attractiveness between sexes; they are generally attractive careers."(PF#15); "I know it's a well-paid area and that, because there is a quota of women that companies have to fill, it's easier for a girl to be hired."(PF#18)* Three responded regarding the environment: "As a woman, *I think it's a 'double-edged sword' situation. By that, I mean the salary can be attractive, but the toxicity associated with these environments can be demotivating."(PF#19); "No, due to possible social environments, negative for women, but if they have enough interest, I don't think it's enough to deter the decision."(PM#21) "No. It's still a very male-dominated world. Many men who work in the area are and usually have power."(PF#6)* Six participants said they had no idea about this topic.

4.5 Perceptions

In response to RQ5: How do students' perceptions of IT culture and stereotypes affect their course choices, especially for underrepresented genders, participants' answers were captured regarding the following four themes: The Importance of IT at School and Early Exposure; How IT students are Seen by Society; Reasons Why IT Courses don't Attract Women; Differences between Being a Boy and Being a Girl in Receiving Support from Family or Society to Study IT.

Participants emphasized the importance of IT education in schools, particularly the need for Digital Literacy (26). They highlighted the benefits of early exposure to IT (8) and advocated for including Computer in the curriculum (7): *"Yes. In my opinion, with the great evolution in the field of computing, I think it's important to learn a bit about programming, robotics, and artificial intelligence to be prepared to interpret the future problems of the world and to understand what is happening around us and behind the devices we use."(PM#35).* Conversely, three respondents (M=2, W=1) suggested that IT should be taught only to those who show interest.

Regarding the society view of IT students, participants positively point out that IT students are seen as intelligent (4), well-regarded (2), capable (2): *"In my circle of acquaintances, they are seen as students dedicated to learning a bit of everything they can." (PM#10); "Technology students are considered very intelligent because they use knowledge of mathematics and science to solve problems."(PF#33)* Negatively, IT students are often stereotyped as nerds (11), in addition to other negative characteristics: *"Nerds, antisocial, and strange people. I understand because after spending so much time on a project, I also feel strange and antisocial (not a nerd)."(PM#3); "I don't agree because I think there's still a strong notion that it's a field more suitable for males, and there's also that typical stereotype associated with programmers—basically a (male) person without social skills, who is a 'nerd,' has poor hygiene/appearance, and does nothing but program."(PF#19)*

Respondents attribute gender disparity in IT field to several factors. The male-dominated environment (4) in IT courses can make women feel isolated or

unwelcome: *I think what doesn't attract women to this course is the number of men; they might feel like they don't belong or don't feel safe, I'm not sure."(PM#34)* Perpetuated stereotypes suggest that women are better suited for social interaction-oriented fields, while IT is seen as a logical domain more suited to men: *"Yes, because for women, it's not as attractive; women are emotional beings, men are rational/logical, and IT is mostly logical."(PM#36)* Programs like Design and Multimedia show balanced gender representation, but engineering-focused IT courses remain male-dominated.

Twenty-three participants believe that there is no gender difference in receiving support from parents or society to study IT: *"Nowadays, despite the male presence being dominant, there is, in my view, no difference between these two genders in terms of family and/or societal support."(PM#32); "I think that more and more families don't care about that, mainly because it's an area considered important with practically guaranteed employment."(PF#5)* Conversely, seventeen said there is a difference: *"Yes, the IT field is dominated by boys, so it's more likely for girls to be discouraged from entering these courses."(PM#9)*

4.6 Suggestions

In response to RQ6: What suggestions do students have for parents, schools, and universities to support and recruit more underrepresented groups into IT courses, participants' answers were captured regarding the following three themes: Encouragement and Support from Parents, Support from Schools and Teachers to Help Students Decide on IT, and Support from Higher Education Institutions to Attract More Women to IT-related courses.

Participants suggested ways parents could encourage their children to pursue IT courses, with most agreeing on the value of encouragement, though six believed parents should focus on supporting their children's decisions instead. Suggestions included presenting the IT field (15) by demonstrating its possibilities and facilitating access to technology, providing early experiences (14) through extracurricular activities and exposure to technology, and discussing prospects (8) by emphasizing IT's career opportunities and importance.

Respondents agreed that schools and teachers should support students in making decisions about IT and offered suggestions on how to do this: *"Information sessions about various areas. At my school, they brought in higher education IT professors who presented interesting projects developed."(PF#9); "Show the applicability of IT areas. Conduct activities in collaboration with universities. Create boot camps, workshops, and lectures to allow exploration and contact with these areas."(PF#19); "Show the applicability of integrating certain problems into algorithms, etc., and show how it can be fun."(PM#9); "Showing what is possible to do with the knowledge obtained, even just the basics. Like basic robotics and problems that can be solved with programming."(PM#21)*

Students suggested actions to how higher education institutions could attract more women to IT-related courses, such as aligning IT with interests of young women, conducting awareness campaigns, and integrating artistic elements with IT to foster early interest: *"Show and relate it to what a girl aged 14-18 likes." (PM#5); "Engage more closely with young women and explain the reality of working in this great field and the opportunities it can offer them for a good living condition in the future."(PM#6); "Awareness campaigns in high schools."(PF#18)*

However, three female participants argued that efforts should target both genders, promoting IT generally without focusing exclusively on women, to avoid seeming condescending. Five male participants felt that institutions should remain neutral, suggesting that the choice to pursue IT should be a personal one and not influenced by gender-focused initiatives. They believed that social change rather than institutional action would have a more significant impact.

5 DISCUSSION

This section discusses and relates the findings to previous works and their implications. The SCCT constructs section will highlight key findings considering the general themes: Prior Experiences, Social Support, Self-efficacy, and Outcome Expectations. The Perceptions & Suggestions section summarises the participants' prominent opinions on the IT area.

5.1 SCCT Constructs

Analysing the responses on Prior Experiences, the results indicate that most subjects needed better experiences with IT classes in school, describing a less engaging environment focused only on basic use of computers and office software. The non-mandatory IT curriculum led to a lack of emphasis on the subject, with unprepared teachers further decreasing student

interest. Therefore, for most participants in this study, previous experiences in school were not the relevant factor in their decision to take the course. This is like the findings of Alshahrani et al. (2018), where four individuals pursued a degree in computer science even though they had not studied CS in school.

Only nine students were exposed to specific programming activities before entering higher education. However, those who were exposed to these activities said they influenced their decision to choose an IT course. Similarly, Alshahrani et al. (2018) demonstrated that some students decided to pursue an IT-related course after having had experiences with robotics or programming.

The students elected personal interest, job prospects and contact and experience with IT and equipment as the most significant factors influencing their choice of higher education courses. These findings are in part in line with McKenzie and Bennett's (2022) conclusions that students' motivation to study IT is driven primarily by intrinsic interest rather than external factors such as job prospects; however, in our study, job prospects (14) were cited almost equally as highly as personal interest (17).

Regarding Social Support, the results showed that only eight participants of this study cited the influence of parents, friends, close people, or teachers in determining higher education course choices. No significant differences were observed among sexes. This corroborates the work of McKenzie and Bennett (2022), who revealed that social influences from family and friends did not significantly influence the choice of study. In contrast, our results differ from the previous studies (Alshahrani et al., 2018; Tsakissiris & Grant-Smith, 2021) that found that support from parents and family members was critical.

One student specifically cited discouragement from teachers who encouraged her to pursue healthcare rather than technology. This corroborates the work of Varma (2010), who found that teachers rarely encouraged female students to pursue a computer science course, unlike their male counterparts, who received implications of encouragement.

Regarding Self-efficacy beliefs, most students (male and female) demonstrated confidence in their ability to complete the higher course; however, only female students scored the lowest level of confidence. Likewise, most (male and female) students stated they had good skills and enjoyed programming, highlighting their logical reasoning and problem-solving abilities. However, only male students indicated having advanced programming skills, again demonstrating a greater degree of self-confidence among men. These findings corroborate previous studies (e.g. Kallia & Sentence, 2018) that indicate women rated themselves with less confidence than men.

Most students expressed positive feelings about being an IT student, such as being happy, well-rounded, fulfilled, and confident about the future. They were also satisfied with their choice of higher education course. Meanwhile, others said they felt nothing special, ordinary, or sometimes frustrated and tired.

Regarding Outcome Expectations, most students gave answers related to employment and salaries, contribution to society, and personal and professional success, which can be achieved by pursuing a course in IT. They mentioned that these expectations of outcomes may influence students to study IT, although some said that it depends on the student's interests or goals.

Most respondents know about IT careers and think they are equally attractive to both sexes. There was no response discrepancy between respondents of different sexes on this point. However, some pointed out that it depends on the environment, which can be toxic and harmful for women. Men also raised this point. Only one female participant disagreed that IT careers are attractive to women, justifying that men still dominate this area.

5.2 Perceptions & Suggestions

Respondents emphasized the importance of IT education in schools, advocating for Digital Literacy, Information Security, and the teaching of Logic, Programming, and Robotics. Early exposure to IT is crucial to demonstrate its integrative utility across all fields and expand future career possibilities, potentially directing students towards IT. However, some believe that IT should be reserved for interested individuals only. Respondents noted society's perception of IT students, highlighting positive traits such as intelligence and dedication alongside negative stereotypes such as being antisocial or having a superiority complex. They discussed the causes of the gender gap, citing a hostile and masculine environment, cultural stereotypes, limited exposure to technology for girls, and stereotypes about women's roles. Opinions on support for the IT study were divided, with half seeing no gender difference in the family or social support. In contrast, others noted that girls are often discouraged from IT and directed towards fields such as healthcare.

The subjects suggested several ways to enhance and promote the IT field, with a focus on encouragement and support from parents, schools, teachers, and higher education institutions. Parents can encourage their children by introducing them to IT, providing them with experiences, and discussing prospects. Many respondents advocated for schools and teachers to support students' IT decisions by demonstrating the applicability of IT and incorporating IT into pre-university curricula. In addition, there was support for higher education institutions to attract more women to IT courses by promoting initiatives for young women, raising awareness, creating role models, and implementing actions that target both genders.

5.3 Implications and Future Research

Despite the significant contributions of this study, it is crucial to acknowledge its limitations. Using instruments such as questionnaires may introduce bias, as they reflect students' perceptions rather than their actual behaviours. Furthermore, variability in participants' interpretation of questions may further contribute to data bias. The integrity of self-reported information cannot be guaranteed, as some responses were superficial, thus restricting the full understanding of complex phenomena.

Furthermore, the study's limited sample size prevents representation of the broader target population, thus restricting the generalizability of the results. To increase the robustness and diversity of responses, subsequent research should involve a larger cohort of Portuguese students, including those from various higher education institutions in Portugal. Employing alternative data collection methods, such as focus groups and interviews with participants from specific disciplines, may obtain more nuanced and direct insights from research participants.

In future research, we plan to expand the scope of this study to include a broader audience, encompassing students from various regions of Portugal. We plan to incorporate closed-ended questions to capture better the factors that influence students' decisions to pursue IT.

6 CONCLUSION

This study drew constructs from the Social Cognitive Career Theory, including prior experience, self-efficacy, outcome expectations, and social support, to identify factors influencing IT-related course selections, focusing on gender analysis.

The findings indicate that prior programming experience, IT/computer exposure, personal interest, and positive job prospects significantly impact course selection. In contrast, parents, friends, and teachers' support appears less influential. School education was perceived as having a limited role in shaping participants' decisions to pursue IT careers, with computer classes often deemed too essential and uninspiring.

Participants noted that the stereotypical image of IT students as "nerds" persists within societal views, but they regard this characterization as outdated instead of seeing themselves as intelligent and capable. The gender disparity in the IT field was attributed to factors such as a male-dominated atmosphere, which can lead to feelings of isolation or lack of belonging for women. Nevertheless, students reported no perceived gender differences in the parental or societal support received for pursuing IT studies.

Participants proposed several strategies to enhance and promote IT to school-aged audiences. These include increasing encouragement and support from parents, schools, teachers, and higher education institutions. Parents can foster interest by introducing their children to IT, providing practical experiences, and discussing potential career paths. Many advocated for schools and teachers to bolster students' IT inclinations by illustrating its practical applications and integrating IT into pre-university curricula. Furthermore, there was a call for higher education institutions to attract more women to IT courses by promoting initiatives for young women, raising awareness, creating role models, and implementing gender-inclusive actions.

Finally, this study suggests that educators and policymakers should enhance computing activities for students, especially girls, to foster interest and draw them into IT careers. This would thereby enrich the sector with diverse perspectives and talents.

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