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Exploring Career Selection in Computing: A Case Study Examining the Experiences of Women Across Different Age Groups in Costa Rica

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Abstract*– Women have lower participation in STEM careers than men, Computer Science being one those. Despite many efforts, the number of women haven´t increase much throughout the years. In this qualitative research paper 24 Costa Rican women, professional and students in CS, of different age groups were interviewed. They were asked about the things they considered when selecting the career and what factors played a major role into their decision of studying it. Support from family and friends are very important. They considered that CS as a career has many stereotypes that make the access difficult for them but it isn't an impossible task, they encourage other people to try. Through their experience we highlight interesting findings and considerations about career selection, career experiences and preconceptions, their thoughts about gender gap and the efforts needed to allow space for more women and other underrepresented groups in STEM disciplines.

***Keywords*-- women, gender, computer science, career selection**

I. Introduction

In Costa Rica, women participation in areas such as Science, Technology, Engineering and Mathematics (STEM) is considerably lower than men. One of the key differences between both genders is the lack of digital skills and access to technology in school [1].

Several factors intervene in digital skills development, such as gender roles, stereotypes and how difficult it is to challenge these roles. The underestimation of women in STEM, scarce role models and the lack of orientation systems, among other things make these interventions even more complicated. [2]

Costa Rica has an equal entry of women and men into university. However, this does not ensure the choice of careers in science and technology by women [3]. The majority of degrees issued have been awarded in areas such as education, social sciences and health [1]. Many times, little family support, obstacles to move from residence, the availability of courses and other barriers make the access to these careers more difficult for women. Furthermore, all of these are also possible factors that impact not only career selection but also retention [3].

In the case of careers such as Computer Science (CS), some of the motivations that lead students, both men and women, to study it are: job possibilities, skills they already have that make them "good" at it, and motivations from both: family and teachers For women, the guidance and support they receive from those around them play a significant role in the selection process.

Some possible factors why women do not enter CS careers are: gender stereotypes, the lack of promotion of technical careers towards women and the distribution of social roles by gender. [4] Women also think more about the skills they require to be admitted and tend to be less confident than men. [5]. In Costa Rica, both genders consider that there are still strong stereotypes towards CS that directly affect female participation [6]. Friends and family opinion are very important for women when selecting a career. In this sense, many had not considered CS for the same reason, because it wasn't mentioned or suggested to them before. [7]

Employment is an issue that also impacts vocational decisions. It is estimated that in CR 76% of highly educated women participate in the market economy, demonstrating that university degrees considerably favour women's access to a job. However, it is important to highlight that areas such as education and health in which there is a greater female presence are areas whose main employer is the Government and these are precisely the sectors that have grown the least in recent years. The opposite happens in science and technology sectors, which has had sustained growth, but registers very low female participation numbers. [1]

With technical education something similar happens, as women choose office technicians, and food or textile production more, while men select areas like tourism, mechanics, design, and, networks and databases administration. This limits woman access to the market, since work positions are being generated the most in the STEM area [2] as the labour structures moving towards STEM sectors [8].

Women also have higher unemployment rates. They are concentrated in less dynamic areas of the economy [2]. Likewise, informality occurs to a greater extent in women than in men and, the wage gap also disadvantages women [9]. It should be noted that poverty is closely linked to female heads of household as well [10]. Also, determinants like care and domestic work fall mainly on women as well as other family responsibilities. This affects vocational and career selection as well [2].

Therefore, although it seems that opportunities are the same for men and women; the barriers they face are different. The issue of female participation in STEM careers and the factors that influence vocational selection are topics of current interest due to the remaining gaps and how it affects future working conditions.

Women in Engineering has increased in CR. However, it is still very far from reaching parity. Numbers are positive in careers such as industrial design and industrial production, but in other traditionally "masculine" careers with greater male participation and that involve a lot of logical mathematical thinking, such as CS, participation is much lower, with rates below 15%. A notable point is that despite this numbers, when comparing academic performance, the degree of career satisfaction and leadership, there are no significant differences between both genders [11].

It is important to note that other factors that lead to studying these careers, are: strong foundations in high school education (mainly in mathematics), good job options, self-interest in technology and the challenge that entails studying CS, among others. [12]. Although women are more effective in graduating, there are fewer of them, even more so, in IT administration careers [13].

The gender gap is originated even earlier in life, before college, when in high-school women select specialities in "Commerce and services", "Contact Center Executive" and "Occupational Health". In the case of "Information Technologies" the presence of women is only 36%. Other high-school specializations with lower indexes of women are: "Mechanics" and "Electronics" [14].

Distinct programs and projects have been developed by different governmental and non-governmental entities to attract and enhance the growth and permanence of women in science and technology careers. Some of them are: Tic@s [15] from Sulá Batsú Cooperative and the Plan from the Ministry of Science and Technology [16] to promote equality between men and women.

Another affirmative action to attract women to STEM careers is the "Women in Engineering" program of the University of Costa Rica (UCR), where female high-school students are introduced to engineering through "workshops" so that they can learn by doing what an engineer does with help and mentorship from regular students. One of the main findings of this experience, is that students do not envision studying engineering because the majority of them have little information about these careers [17] [18].

Other international efforts, through organizations that are working on this topic are: Ada Developers Academy, Women who code, Black Girls Code, Girls in Tech, TechLadies, TechWomen, Women in Tech, League of Women Coders, among others [19]

However, and despite the efforts being made, female participation rates in STEM careers, and particularly in CS careers, do not seem to increase much [17].

Therefore, the question arises as to whether there may be more factors that impact career selection, and permanence. Some authors have theorized that these factors include the perception of one's own abilities where men tend to overestimate their abilities, while the opposite happens for women. Other factors are the labour market and the possibility of accessing a well-paid job that provides security and satisfaction [20].

This work seeks to learn more about factors and reasons that lead women to study a CS career by interviewing current students and graduates from Computing. These interviews allowed to deepen their points of view and experiences.

II. Methodology

Interviews were carried out with a group of women, female graduates and current students of CS careers. The participation was completely voluntary. The invitation was made through a poster published on social platforms of the Laboratorio de Investigación e Innovación Tecnológica (LIIT) of Universidad Estatal a Distancia (UNED) and the Centro de Investigación en Comunicación (CICOM) of the Universidad de Costa Rica (UCR). Volunteers filled a form of interest and then the research team contacted them to set an interview.

The interviews were carried out though Teams Microsoft platform. In average, each interview took around 30-40 minutes long (with 2 hours being the longest). Collected data was processed anonymously.

22 women participated. They can be divided into three groups:

• 6 of them correspond to professional women who studied their career and obtained their degree in the late 1980s and early 1990s (Group A).
• 8 of them correspond to professional women who studied and obtained their degree after the year 2000 (Group B).
• 8 participants were current CS students (Group C).

Of the 22, 6 studied in technical or vocational high-schools where they took computing as a specialization.

Finally, only 3 of the total participants graduated from private high-schools.

A. Interview questions

Volunteers were asked the following questions:

•Was computer science/computer engineering your first career choice?
•How did you find out what this career is about?
•Did you receive motivation to study this career? (from family, friends, high school teachers...)
•What preconceptions did you have before entering the program and were they fulfilled or not? (e.g. lot of mathematics, few women, job opportunities)
• Did your high-school help with the career selection process?
• Did you have any female role models?
• If you had to characterize this career with human properties or characteristics, how would you do it?
• How would you explain this career to a person who hasn't heard of it?
• Why do you think there is such a big gender gap?

The questions listed above were open-ended, which allowed the interviewees to expand on the points they

considered relevant. Conversations were recorded, transcribed and analysed.

B- Analysis

Once the interviews were transcribed, they were grouped by question. For example, the 22 answers to question #1 were collected on a single file. The same procedure was applied to all the questions.

Then, descriptors and categories were obtained for each question, following the Grounded Theory methodology [20]. As a qualitative research, patterns were expected to emerged from the answers given by the volunteers.

With GT the data selection and analysis occur at the same time, simultaneously. One of the characteristics of this approach is that the codes obtained are grouped into categories that eventually lead to a theory based on the study's corpus of data [20].

Quantitative research has been made to explore this topic in CR, where survey options are usually predetermined. In this research, the approach was more opened so participants could express what they thought about CS, and share their experience.

It is importance to noticed that participants come from different careers in the computer spectrum such as: Computer Science, Computer Engineering and System Engineering. In this paper the words computing and CS are used as synonyms to talk about those three careers as the distinction between the three was not necessary for this paper.

The results are presented in the following "Results" section where a small subset of answers was included to exemplify the interaction.

III. Results

Some of the quotes and statements made by the participants are included in the result section. The age group have been included in parenthesis following the following specification:

- Women who studied their career and obtained their degree in the late 1980s and early 1990s (Group A).
- Women who studied after the year 2000 (Group B).
- Current CS students (Group C).

To safeguard the identity and confidentiality of the participants, their identity will be anonymized using pseudonyms or initials that do not correspond to their real names.

A. Computer Science as a first career option

The first question participants were asked was whether Computer Science was their first career choice, or whether, on the contrary, they had not considered it before. The results could be summarized into two large groups: "Yes" and "No".

However, as part of the selection process, the decision was not so easy for a group of those interviewed. Even a group of those who were sure they would study something related to CS also considered other possibilities.

Another subgroup completely wanted something else but eventually, they decided on computing. Others came for as they mentioned, "random" selection.

Of the interviewees who did consider CS among the first options, also considered other options such as: Social Sciences careers (e. g. anthropology, sociology, psychology, administration), Medicine and Mathematics Teaching.

"Yes, Computer Engineering was my first and second choice. Well, when I was in school, it was like one of the first options, but I also wanted something like anthropology or something research related, in the end I went for computing" –Carol (B)

"Yes, since I was little my parents bought me a computer toy. So, I said: I want to do that! I want to be on a computer, to be programming!" –Fer (C)

"Yes, I was among those which computing was the first option, but I also wanted to study math teaching. I really like math" –Kim (B)

Of the group of interviewees who said "No", they mentioned that among the careers they wanted to study instead of CS were: Medicine, Architecture, Journalism, Administration, Mathematics, Psychology, Physics, Astronomy, Accounting, Administration and Electronic Engineering. However, most of them remark that they "thought it through" and finally decided on CS

"My first option was architecture but I went to the architecture school and I didn't like it. I said: No! this is not what I want to do with my life! but it turns out that nothing caught my attention. I was very clear that linguistics was not an option (...). I really liked mathematics, so the guidance counsellor and my math teacher recommended this career to me". –Vane (A)

"My first option was medicine but my father was a doctor and he told me that it was not a career for women, that I had to look up for another one (...). I looked up for architecture because I have always really liked art, design spaces, colours and he told me that this career was for very intelligent people. So, I looked up for something else (...). So, my dad eventually asked me, what is computer science? I told him: -Look, daddy, it's like a secretary but with a computer and a very complicated typewriter. - Well, yes, that's for you then". –Julia (A)

"Actually, I liked many things, I thought about Journalism and I thought about Business Administration and Electronic Engineering careers also caught my attention at some point, but there comes a time when one says, oh no!!, I'm going to go crazy, I mean, I can't continue with two careers, that's when I said: let's continue with IT and in fact I'll never finished administration! –Sofi (A)

"In my case, computing was like the last option, but it was very difficult for me to choose a career, I mean, I was like everywhere... I said, let's study physics! astronomy! economics! accounting! I said a

lot of things and I really didn't know what I wanted so I chose computing as a matter of course."–Evelyn (C)

"My mom wanted me to study as a secretarial or accounting technician, but I didn't want to, I wanted computing"–Lau (A)

"I was between computing or medicine and in the end, what made me want to choose computing and not medicine was that I always had the idea that in medicine I would not have enough time to become a mother and I was very clear that I wanted to be a mother. So, it was one of the factors that influenced my decision, perhaps because I had an uncle who was a doctor and I saw that he was constantly on duty and was almost never at home." –Emi (B)

"I had the option to apply to a technical school and enter a CS specialty. When I entered, I definitely fell in love with it" –Annie (C)

Selecting a career is difficult and many options came to mind among the three groups. When group A, who graduated in the 80's and 90's, choose a STEM career their parents weren't receptive about it, mostly because of the novelty computers carried out back then and also because they wanted their daughters to study most traditional careers, for example to be a Secretary (as mention in the interviews). Back then, it wasn't expected for women to go to college or incursion in "men" careers.

However, it is noticed that the Group A was surer about CS, even though their options were more limited and they had more barriers than the other two groups.

For Group B and C more options were available but they had more problems to decide what to study because they had more options. Some of them in these groups selected CS as "random" or "safe choice".

It is important to consider that neither mentioned "care careers", only medicine was mention once. They didn't mention nursing or education as possibilities. The "other options" are more related to sciences, other engineering programs, and social research as well as administration jobs.

B. Finding out about the career

Participants were asked how they found out about CS as a career. Here the answers could be categorized in:

•Because they have a family member or knew people who had studied CS. They got the information from them.

•Courses or workshops that they took while they were in high-school.

•Recommendation from teachers, vocational representatives or aptitude tests.

The majority of answers belong to the first category: close people, whether family or friends, are the ones who had the most influence. They explained the career for them. Here are some of the responses:

"When I was little my uncle worked in computers, he let me play the little games he had in there, "Micromundos", "Encarta" and all that! So, I loved it! because I was an only child I had nothing to do, this was my entertainment." –Carol (B)

"I actually found out from two people, a cousin and a neighbour who told my mother: - My son is going to study Computer Science because that is going to be the career of the future!" –Sofi (A)

"My cousin who studied the same CS at the time told me a lot about the courses, teachers and everything. All the information I got was basically because of him" –Gaby (C)

"One of my dad's aunts. Her son studied system engineering and I liked computers. I was about to choose a specialty and she told me: why don't you study system engineering, and that was it". –Annie (C)

"I spoke with my father. He got me to talk to a computing engineer who worked with him. I remember that my dad sat me down to talk with him and told me a little bit about what his work because I had one thing clear and that is that when it comes to disassembling a machine, screwing, hammering, that's not my thing. I was a little bit worried about the career and when he explained about the software, I dared to take that step because I really didn't want something that had to do with the hardware part" –Emi (B)

It should be noted that several of the participants highlighted vocational fairs, although they say many of them were "boring and didn't caught their attention", they served to inform them about the career options available:

"When I was in school they took us to fairs, the classic University fair. I remember the merch but not so much about the info they were giving" –Carmen (B)

School's support through counsellors, psychologists or vocational activities was more highlighted by the women who studied their careers in the 80s and 90s (Group A):

"I really liked mathematics and at school I did well in math. So, the counsellor and the school math teacher recommended this career to me personally" –Vane (A)

Also, they highlighted vocational activities like inviting experts from different professions to speak about what they did, opening a space for questions and to learn more about the different options by "listening experiences and explanations about from the professionals themselves".

On the contrary, active students or recent graduates (Groups B and C) consider that the support they received in high school was almost non-existent. They said that the support was limited to taking them to fairs or explaining how to register to university admission exams. Careers options and what they consisted of wasn't talked much.

A subgroup of interviewees searched more information on their own because they felt that they needed to complete the

information they already had. Several of them stated that they did the search by University and then career. Considering University status first. For example:

"I was desperate because I didn't know what career to choose and my dad was the one who told me to investigate computing. His friend's son was studying it. So, that's how I realized it existed. I started to research the career and I really liked what I saw" –Evelyn (C)

It is important to notice that some of the participants were able to experience what "programming" was like through their experiences at a technical school or courses they took, and from that experienced, it came the motivation and drive to study computing at the university:

"I earned a course, I don't even know why I earned it. I went and I liked it. At that time, I remember that I programmed in DOS, I formatted my diskette and saw how it was formatted, I created folders, deleted folders, I mean doing that through the device was what I loved. I was mastering the device and doing things with the computer" –Lau (A)

"I took software classes in high-school and in parallel in my last year we were taking special courses to reinforce topics of web development, object-oriented programming and other related things, hence I immediately entered the technology field at university by choosing computing" –Annie (C)"

In other cases, the school played an indirect role through classmates' influence:

There were several tech specialties in my high school. I saw that some of my classmates had to program and it always caught my attention, the truth is, that's why I decided to study computer systems". –Kim (B)

Aptitude tests were another tool used by the participants to guide their choice. Some of them took this type of test and they claimed that it fulfilled their purpose being that the result was what they expected.

As part of the career selection process, advice and recommendations, whether from families, friends and teachers, have a lot of impact. Usually when computer students are asked why they chose the career, they mostly mentioned that there is a lot of work opportunities or they know someone who studies it/studied it and likes what they do. [21]

C- Family and friends support

Women were asked if they received motivation to pursuit a CS degree and to persist with their studies once they entered. The majority of them mention that they did received motivation and that it came mainly from family and close friends. It is important to note that motivation was often accompanied by optimism towards the career, because even with parents or friends who did not know about it, their perception about computing was: "the career of the future" or "A career with many job opportunities."

Participants said that once in the program they got motivation from CS teachers as well, not to drop out. This statement was more common among active or recently graduated students (Students from 2000 on-wards - Groups B and C).

In Group A, three cases stand out where there was no support and rather they remember "they had everything against them" or that it was "an act of rebellion on their part". Some factors for which they did not have support were: the economy, the career was little known and, they were expected to study something more traditional for their gender. Also, in these three cases parents did not envision them continuing with university education. Many of them have to leave their houses to study in another province which wasn't common at the time, too.

"I had everything against me, but I had to study, my mother didn't want to. In fact, she didn't want to leave me, So I told her: - if you don't sign my papers I'm going to fall behind one year, but next year when I turn 18 I'll leave, I'll study" –Ari (A).

"In my case I grew up in a very humble family. So, when I finished school, my mother told me: - We've come this far and if you want to continue studying, I'll support you and everything, but economically it's no longer possible" –Lau (A)

"The school counsellor called me and asked me what I wanted to do with my life. I told him that something related to mathematics. I liked topography (there are angles and measurements). He told me that it was a very manly career, that I was not going to get into a farm and he didn't suggest that for me. He limited myself to these things because of my gender" –Patri (A)

Regarding the support inside the university by teacher or colleagues, the majority mentioned that they were motivated to persist. However, in some isolated cases teachers discouraged them with comments or "teasing" like:

"I remember that once a teacher came and he started to counting us, there were 14 women in that group. Groups were very big, like 40 and so, he said: - "Only 15 are going to pass this course, and no women are going to pass"-. At the end, 12 women pass, we all went to his office and said: - What did you say?" –Ari (A)

D- Career preconceptions

Women were asked about what preconceptions they had before entering CS and whether these preconceptions affected their decision choose career:

•Difficult career with a lot of mathematics
•Career with few women
•Good job opportunities

Most of the interviewees mentioned that they had heard at least one of these preconceptions, mainly about mathematics, but it wasn't important for them and didn't limit them.

A large group said that they considered themselves to be good at math and that they really liked the subject at high school, although at university, the math they encountered "was very different":

"I liked math in high-school but the University level was something I wasn't prepared for, it hit me very hard, but I get used to it"–Carol (C)

"Anyone good at mathematics can study this, if not, they won't make it" –Patri (A)

"I don't know if it was the curriculum, but it seems to me that I wanted more mathematics" –Emi (B)

"I went to the Vocational Fair and asked if university math was similar to high-school's math. They told me: - 'Yes, it is', and they lied to me! During my first course I broke and I didn't understand anything, about halfway through the semester I began to understand the dynamics and it was a big shock for me" –Carmen (B)

"Mathematics is difficult, like all in life, there are easy things, there are difficult things, but I say you just have to put in the effort and give your best –Fer (C)"

The majority of women interviewed emphasize that since it is a more logical kind of math, it is very different from what is seen in high-school. It is "a more applied math" (as they described) and they really liked that, although they had an initial "shock" and they need to adjust.

Comparing mathematics courses versus programming courses, a significant group of interviewees said that programming was more challenging in a "positive way", because they had to learn to think things differently and they still apply this way of thinking today to solve other problems, not necessarily computational ones.

However, they say that you cannot lie and tell other people the career is easy. Indeed, it has a learning curve, there are difficult courses and the career itself requires a lot of effort and perseverance. They recommend people "to try it first", to see if they really like it and if it meets their expectations.

"They talked about mathematics being very strong, but for me the shock was when I entered the programming courses. The change to logical thinking, I even had dreams about when I started programming." –Julia (A)

"The first thing they said to you is that it has a lot of mathematics and that it is difficult, but really what marks you is programming, learning how to program, that is what changes your chip and it changes it for life –Vane(A)"

"It's difficult, and it's necessary to pay close attention to classes and make an effort to learn topics outside classes" –Liz (B)

Other preconception they had was about the small female population in CS. However, this aspect was not very important for them when choosing career. They did not even question why there were so few of them? or Women did not choose this career option?

"Yes, they told me that. When I went to the vocational fair, I remember that a girl was giving a talk. She told us that – 'women can be good too', and I stayed with that" –Carol (B)

"I really didn't know about it. I remember when I arrived at my first course and there was only one woman, I was like: what?!" –Kim (B)

"I was afraid about what people told me that there are only men and things like that, and in fact it was true, there were very few women when I entered, which was in the 2019"–Evelyn (C)

They were asked what the approximate proportion of women per group they had, on average the ratio was 4:20. However, in some cases there were "*many women in the group*" (8) or very few (2) or "*it was just me*."

Many of the women heard the career has a good job market. Except Group A since the job outlook was not so clear back then.

Good demand and good remuneration are two important factors when selecting a career in computing or IT [22] Participants didn't talk a lot about the job market or employment. That wasn't the focus or main reason why they study a CS career. However, they say this aspect was important because their parents and friends were hopeful and happy about their future.

They talk more about how they liked math, technology and resolve problems and these were the main factors that motivated them to choose CS.

E- What about High-School?

Here, the majority responded that high school influenced their career selection little or very little, except for some interviewees who stated that they did receive contributions from the orientation or psychology departments with vocational fairs, aptitude tests or teachers who talked about CS as a career option. They think that many of the tools and resources the high-school gave them are not personalized which is a problem.

"The school assigned us a psychologist from the beginning. She helped us register on universities websites and during the whole admission process" –Kary (C)

"They helped by motivating us, they brought people to talk to us about everyday life, I think that marked me" –Julia (A)

"School teachers helped me not only to select my major, but even as a major student, my math school teacher explained some topics for me in her free time" –Lau(A)

"They take us to vocational fairs and they gave us a vocational test to see which career suited us more, but I think it was very generic and not very personalized –Carmen (B)"

Professionals who graduated from computing say they had vocational guidance in high school, but at the same time, they highlight the impact of receiving courses during that stage to learn more about the career. [21].

Participants agreed that this is very important because many of them had a bad experienced. They indicated that computing classes offered in high-school did not help; most of them say that "it was boring", "little was done and learned during that time" and in general, they portray it as "not a very useful course":

"It was a course, very office related. It was very general. "I didn't program at school and I think I resent them for it. There were boring classes, just copy and paste, so that wasn't for me"" –Carmen(B)

"There is a nice tool called Scratch. I think I would have appreciated something like that as a child" – Carol (B)

They were asked what their favourite subjects at school were. The majority stood out among their preferred subjects: Sciences (Mathematics and Physics were the more mentioned) and Languages, (English, French).

Even though they do like reading and getting informed. They did not like subjects that required a lot of memorization.

It should be noted that in terms of favourite subjects, they said the teacher's role is very important. The preference for some courses depends mostly on the teacher's personality and their attitude towards their students and topics.

Many of the participants had little or no fear for Mathematics and Physics at school. They liked these subjects or at least they didn't fear them. Most of them liked practical exercises and experimenting. On the other hand, the memorization and classes such as Social Studies did not attract their attention as much.

F- No Role Models

The majority answered that they did not have any role model (feminine or masculine) who served as inspiration for them in the CS area.

Those who mentioned role models, were not computer scientists, but family members. Outside the circle of close people, the names of Marie Curie, Sandra Kaufman (Costa Rican Scientist) and Margaret Hamilton were mentioned. One interviewee mentioned Franklin Chang (Costa Rican Scientist). However, these characters were mentioned, after an initial "No" or a long pause for thought. They all agree that this point needs to be developed because there are no known women in computing who can play as a role model, much less Costa Ricans.

"I would love to say yes, but I don't, I think it's something I lacked and I think that's why I always doubted whether I had chosen the right career path". –Emi (B)

They were asked if once they had entered the career, female teachers became that role model to follow. The majority responded 'yes'. This helped them to see them not only in their role as teachers, but also fulfilling other paths in life.

"There were always so many men everywhere. So, seeing a woman did generate an impact for me. I did feel a lot of inspiration from seeing a woman there, giving me classes". –Kary(B)

"When I realized that there were women who had their lives, who were mothers and you see them balancing their academic life with their personal life, you realised that it is really possible." –Carmen(B)

On the other hand, in some cases, university female professors were not a role model to follow, and rather generated uncertainty for them.

"I had a teacher who was very good but she was very tough. She had worked abroad, but she was very tough and I said: -Damn, do we have to be this hard? I mean, her masculinization disturbed me" –Julia (A)

"They were teachers who were dedicated to teaching, they weren't dedicated to software development. So, I always lacked someone that I could see and say: - I want to be there, where she is" –Emi (B)

In general, a feeling of lack of identification with the trajectories of other women were perceived. In the case of women in computing, it is difficult to meet women in higher positions or with more education and identify with them "to follow in their footsteps."

G- Career Characterization

Participants were asked which human characteristics or properties would they assign to CS. That is, if the CS were a person, how would it be like? What would it say? How would it act? Most of the answers are shown in Figure 1.

In general, they mentioned that it would be an analytical person, who applies a lot of logic and reasoning to solve problems, it's a person that perseveres and is organized, and self-taught.

It should be noted that several of the interviewees had problems thinking about career attributes. Some of them mentioned that they were going to mention the "typical ones" although they were not convinced they identified with these characteristics themselves. Among these "typical characteristics", the following were mention: "computer

engineers do not talk much", "they work alone", "they are nerdy, and soft skills are not good".

The majority of women interviewed mention that beyond the logical-mathematical part, this career also requires creativity, innovation, interaction and learning from others. They even highlight that in many cases it is necessary to reinforce these important soft skills to work not only with users, but with people from other careers and solve the problems adequately.

"What characteristics would it have? It would be an interesting person, with the desire to know new things, a person who likes to learn, it would be a serious person, responsible, dynamic, very dynamic, never a boring person!"–Ari (A)

"With capacity for logical analysis, more rational than emotional, zero emotional, things are or are not, period"–Vane (A)

Many of the interviewees said that "soft skills aren't the best in CS". However, they think that these skills should be reinforced due to the interaction with users and interdisciplinary work with other careers. They think that this definitely must be worked on because as many of them answer, they really enjoy the social part of computing (e.g talking deciphering and understanding user problems).

They also enjoy how as a career, it serves the purpose of solving different kind of problems by meeting different scenes and realities.

Women said that they think the career is always shown as a closed environment, therefore the person who study the career is also a very closed one with bad or null social life and very work oriented. They think that this idea is one of the problems why people think that only certain kind are suited to study this, which is not true.

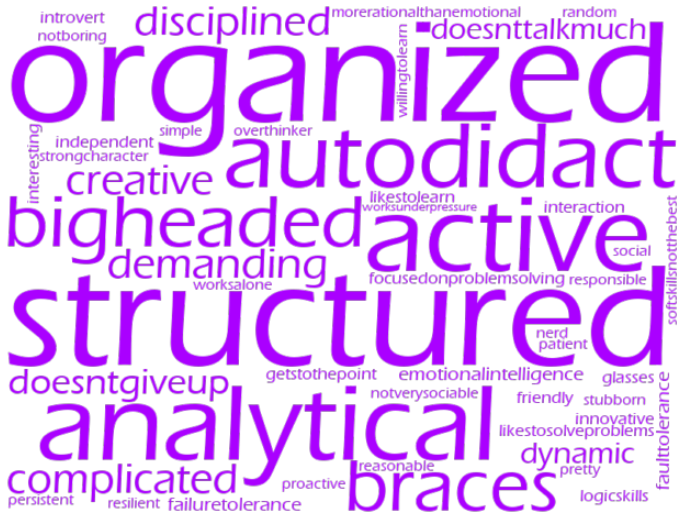

Fig. 1 Characteristics women think and relate with computing

H- Explaining the career to somebody else

For this particular question, answers can be grouped into four categories:

• It is a career with many opportunities
•It is a career in which products are made, problems are solved and solutions are delivered.
• It is a career that requires to work with other disciplines of knowledge.
• It is an applied career.

Participants commented that job opportunities are broad, there are many options and specializations. In addition to this, other things and ideas that they would share with people who have not heard of CS are:

• CS has many areas of specialization.
•Software products are made: "throughout instructions we obtain results".
• It requires constant learning and actualization.
•There's an umbrella of possibilities due to its interdisciplinary nature.
• It has mathematics, but it is a different kind of math.
• It has a theoretical component and a practical component.
• You learn to find needs and create opportunities: "You learn to solve problems differently".
• It is a "career of service".
•It has an important social component, because it solves problems or needs from other people, groups and entities.
• Soft skills are important.

If they were going to talk with students, they will advise that:

• It's a career like any other, "you have to put in the effort".
• It must be complemented with English.
•They must learn to cope with failure. You need to have patience and tolerance, "little by little, solutions emerge"
•Try it, and see if you like it.

I- Thoughts about gender gap…

Women were asked, in their opinions why were the reasons behind the gender gap in this career. The reasons given by the interviewees could be grouped into:

• Gender roles and stereotypes
• Myths and fears regarding the career
• Little information and little vocational guidance

They mentioned that: There are social prejudices that mark gender roles and lead to beliefs that there are careers for men and careers for women. The expectations for women are low: "Women are not expected to do or study difficult things." Also, women have always been associated with care tasks and therefore care careers are the only ones for them. In this sense, they believe that the stereotype of gender careers must be worked out for both genders.

Regarding the myths, they consider that the one that keeps people away, both men and women, is that the person must be

extremely good at math and that the career in general is very difficult. They say that, "it is difficult as many others", but that doesn't mean it is impossible: "If you like it, go for it" is their advice.

They also say that you have to demystify and lose your fear to a computer, as the physical device tends to look distant, abstract and intimidating, even more so if you have never had contact with one before. They consider that more work should be done in school, to let those fears back.

Another myth concerns to personality where it is thought that people who are dedicated to computing are boring, lonely, have no friends, and spend their time immersed in the computer. Attracting people both men and women, with other personalities types to the career then becomes very difficult because of these ideas.

Another belief they mentioned is that technology is complicated and that it is easier for men than for women. Here, they mention the importance of reducing the digital gap, "we have to use technology to be interested in it." They think that women should try and use technology more and promote safe spaces for this to happen, so that it is not just men who "jump into the water." Likewise, they emphasize that they must lose the fear of failure, since "people who program fail every day" and this must be more normalized respecting the learning curves of each person.

They also feel that there are few inspiring people, few role models, there is not enough motivation in schools and in general vocational guidance is lacking. At the same time, they think that there is still a lot of toxic masculinity despite the efforts.

They consider themselves the exception and not the rule by having studied engineering. Two of the interviewees mentioned that there is a belief regarding the appearance of women in CS as "ugly" and if she is pretty, then she cannot be intelligent and their accomplishments come from others help.

"The majority of my colleagues were men, I felt very discriminated on many occasions and one of the stereotypes that existed was that women are ugly. - Don't try to find a pretty woman in Computing-. They don't look for a girlfriend there because all the women are ugly. Pretty women are in other Schools. When there was a woman who was attractive in computing, she was more likely to be discriminated against, more like - She's pretty, but stupid -. I got into a big conflict because I felt that I couldn't look good or I couldn't have an attractive appearance because I would lose credibility with my colleagues" –Emi (B)

"They told you things that were a bit sexist like: Do you really study computer science? or even rude things like: Are there pretty women there?" –Lau(B)

They emphasize that they do not know why so few women choose this career. They also remember how many of their female classmates dropped out or eventually switch careers and study something else for many reasons: personal, economical, the career was very difficult or they just felt bad.

Several of the participants added actions or ideas that they would do to improve the gender gap, highlighting that it is always better to start at an early age.

- "Start programming from a young age with Scratch or games"
- "Give information about different job options"
- "Talk from experience, let them see what you do"
- "Schools should teach the interesting part"
- "Women only events and workshops to make"
- "Hackathons or game jams events for women"
- "Vocational tests and career guidance"
- "Exploratory workshops"

They mentioned the importance of carrying out dynamic and attractive activities as well as the importance of improving the computer science program in schools, since now the program is far away from what the career really is and can be a cause of confusion.

IV. Future work and limitations

Three invitations were made to participate in this study, throughout the year. Originally, 59 women showed interest. However, only 22 attended the final interview. Setting up a date with them was difficult as school and work schedules were different between participants. Many of them, where interviewed individually.

As future work, focus groups are considered important to explore this topic even further, securing representativity and heterogeneity in the population that participates.

Additionally, the effectivity of STEAM interdisciplinary events (such as hackathons or game jams) could be studied as "exploratory options" to get informed about the career and attract women to CS in high-school settings.

V. Conclusions

Women who enter CS in Costa Rica didn't have role models close to STEM areas. For them, it was a missing piece. They also value the role CS female teachers take as role models.

Women are aware of the mathematical component but this didn't limit them. Rather, they highlight how, like many new students at university, they noticed the differences between high school mathematics and University mathematics. For them, a "sudden change." This feeling was felt even by those who had a good foundation. They think the transition should be different as many drooped out because of this.

Computational Thinking was seeing as a challenge but learning that gave them tools for solving and addressing problems in and outside the discipline.

School vocational guidance was not enough according to them (except for the generation that studied in the 80s and 90s). Newer generations consider that aptitude tests and

vocational fairs fall short and they would have preferred more personalized guidance.

Initial generations "suffered" more, since people had less knowledge of CS. More traditional careers for women were expected back then. Currently, women do receive more advice to study CS given the good job market and the professional opportunities it has. However, there is still the stereotype that it is a technological career more suitable for men abilities.

Women find out about the career through their close circle, whether cousins, brothers, recommendations from "the neighbour's son" or "dad's friend" This closeness in the recommendation motivates them to seek information and make the final decision.

The career itself has a lot of stigma. It is considered a closed career, "for intelligent people only" that requires a lot of time and effort. Therefore, there is little time for socializing. Women consider that this vision has to change if we want to attract new people, not only women, but also men. They like the interdisciplinarity and problem-solving aspects of the career. They don't see themselves in the stereotype.

They consider that women do not study the degree mainly due to stereotypes, but also due to the lack of information and access to opportunities to explore and experiment the option.

Women highlight the importance of technical and vocational schools. Most of the students who study computing as a school specialization, continue with the same college path. The school in this case was its own "experimentation workshop"

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