

# The Influence of the Meninas Digitais UFSC Project on the Professional Life of Graduated Girls in Technology Undergraduate Courses

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**Abstract** The lack of women's representation in IT has been discussed for decades in different regions worldwide. The participation of women in this area is fundamental for socioeconomic development. In Brazil, girls have a low interest in graduation courses in STEM areas. This article presents the influence of the project "Meninas Digitais UFSC" on graduated girls' career development. Two surveys were applied, the first before the pandemic period (COVID-19), and the second in the post-pandemic including some questions about the changes in the work or academic environment. The results have shown that the project's participation had a positive impact on the career development of these women, influencing from the hiring to their involvement in other similar actions.

**Keywords:** *STEM, Women in Technology, Education, Gender, Career Development.*

## 1 Introduction

Women are the majority of the Brazilian population, which is reflected in universities. According to data from the Census of Higher Education 2020, released by the Ministry of Education of Brazil in February 2022 (INPE, 2020), 59% of enrollments registered in undergraduate courses are women. Of the total number of graduates, 56% correspond to the female. Although women are the majority in higher education, as the report has shown, the context is quite different in some areas of knowledge, specifically, Computing, Engineering and Information Technology. At the Universidade Federal da Santa Catarina (UFSC), Campus Araranguá, in the first half of 2022, women represented 30% of the Energy Engineering course, 22% of enrollments in the Information and Communication Technology (ICT) course, and only 11% in the Computer Engineering course (UFSC, 2022). That is, an average much lower than that indicated by the Census. About 21% of the enrollments in these courses are women. It is urgent to motivate girls and women to join technology training courses, considering the lack of qualified labour in the technology sector.

Araújo et al. (2021) argue that there are seven key aspects to consider in providing diverse teams that are very important for all society, and the advantages are aligned with: 1. Pioneering; 2. Being part of a community; 3. Partnerships; 4. Practical solutions; 5. Plurality; 6. Persistence; 7. Productivity. The different causes of low female representation have been explored in the scientific literature (Parhami, 2021; Spertus, 1991; Blaney and Stout, 2017; Margolis et al., 1999; Bunderson and Christensen, 1995). The evidence highlights some points: the low sense of belonging, discrimination, social injustice, organizational culture, lack of confidence in themselves, lack of reference models in the area, cultural issues, stereotypes, and previous experiences with computing, among others. Some initiatives

aim to reduce the digital gender gap in STEM around the world like in Italy (Faenza et al., 2021), Portugal (Vasconcelos et al., 2022) and Meninas Digitais UFSC in Brazil.

The Meninas Digitais UFSC Project, a partner of the Meninas Digitais program of the Brazilian Computer Society (SBC), was created in 2012 to help mitigate these issues and especially encourage female students to enter undergraduate courses in the technological area. In this project, several activities and workshops are carried out, which aim to encourage girls to join courses in the area of STEM (Science, Technology, Engineering and Mathematics). Information is provided on women's professional performance in engineering and technology, seeking to reflect on the low female representation in the area, analyzing data on women in technology, promoting experimentation with workshops, and enabling a welcoming environment for sharing knowledge and experiences (Frigo et al., 2020).

To investigate how the Meninas Digitais UFSC Project has influenced undergraduate students at UFSC, the present work aims to answer the research question: What is the impact of the Meninas Digitais UFSC Project on the career development of technology graduates from Campus Araranguá through participation in the project? Two surveys were applied: one before and another after the pandemic period (COVID-19). The qualitative research results are presented to allow reflection and comparison. The impact of social actions is reflected in the transformation of graduates, changing their way of thinking, living and making choices. In this direction, this study aimed to present the perception of students that participate in the project, regarding the actions promoted by the Meninas Digitais UFSC project.

This article is organized into 5 sections, including this section. In the Section 2, the results of the research in the scientific literature are presented, pointing out articles that outline profiles of graduates in the areas of technology. The

Section 3 describes the methodological procedures for the research. Results and Discussions are presented in Section 4. Final considerations, acknowledgments and bibliographic references follow.

## 2 Related Works

Considering that the research was applied in Brazil, it was decided to use bibliographic materials produced by the Brazilian academic community due to the cultural and regional issues involved. An investigation of articles was conducted in an exploratory way on Google Scholar, looking for articles published in journals; in proceedings of the Women in Information Technology (WIT) and Computer on the Beach events; on Brazilian government data; and finally, in the Journal on Interactive Systems (JIS) magazine. The query term used in the databases was: “egressas AND engenharia OR tecnologia” (“graduates AND engineering OR technology”), and five works were retrieved that met the research requirements, which are presented below, in chronological order.

The work of De Oliveira et al. (2017) pursued the collection of data on female graduates from the Computer Science course at the Universidade Estadual do Oeste do Paraná (102 graduates in total) through the DIVAS project. It seeks, from the answers of the graduates, strategies that can contribute to the increase of female participation in the area and motivate women who already have that interest. The authors have identified the challenges faced during the course and after graduation. Via a form answered by 40 graduates, it can be concluded that 55% worked in full-time roles, 27.5% of the students decided to continue at the postgraduate level, 15% went to other areas of activity, and 2.5% worked both in the industry and at the universities. According to the authors, a large portion completed some postgraduate degree, with 20% masters, 17.5% doctorates, and 42.5% various specializations. The authors also presented ways of attracting and motivating the permanence of women interested in the area of Computing since the research shows that graduates still suffer discrimination and criticism within the areas of Computing. According to the graduates interviewed, there should be more significant support from educators to students, showing job opportunities and salaries, and offering lectures in collaboration with successful women. Thus, the graduates suggested: greater dissemination of the course in schools, development of incentive programs and promotion of a greater emphasis on female participation in the area.

Figueiredo et al. (2018) surveyed students with the Bachelor's Degree in Computer Science and Bachelor Degree in Information Systems at Universidade Federal do Mato Grosso where the authors presented an analysis of the position of these students in the job market: remuneration, sectors, functions, geographic locations and aspect of training and gender, by sending an online questionnaire. The survey had 580 guests and 120 respondents, of which only 15 were women. Among the survey results, a high rate of employed graduates (92.31%) who worked in the education area (90%). Regarding gender, all the female graduates

who participated in the research are currently employed and working in the graduation field. However, it is noteworthy that all of them worked in the state of their graduation or nearby states, which is different from the male profile with graduates working in several Brazilian states and even abroad. According to the authors, this may be associated with difficulty moving due to sociocultural gender issues. Of the graduates who responded to the survey and worked in their area of education, 61 worked in the public sector, nine women and 52 men, six women and 41 men worked in the private sector and the majority in technology companies in the region. In this work, it was impossible to establish a relationship between the wages of men and women in the research sample. However, the average monthly salary of all participants was R\$ 7,335.09 (about US\$ 1,400<sup>1</sup>). The aspect that drew attention is that there were six men work abroad, and no women.

The work by Martimiano et al. (2018) has presented an analysis of the profile of Information and Communication Technology professionals in Maringá, Paraná, Brazil. The survey was applied to women working at the Universidade Estadual de Maringá and at the company DB1 Global Software, with a total of 33 respondents, 10 from UEM and 23 from DB1. Of the total, 81.8% of this total are graduates in the area, and the rest are finishing courses related to technology. Among the results regarding professional activity is the position of Professor/Researcher (28%), Test Analyst (25%), Support Analyst (10%), Business Analyst (6%) and Project Manager (3%). One of the highlighted factors was that older and more experienced women in the area reported having suffered less prejudice and showed more confidence in the positions held.

Da Silva et al. (2019) have identified the professional profile of the 2018 woman graduates of the Degree in Computer Science and Bachelor of Information Systems at the Universidade Federal da Paraíba through an online questionnaire. The questionnaire gathered information about the graduates' professional situation, current occupations and the representation of the graduates in different positions. The questionnaire was sent to a total of 43 graduates with 27 respondents considering the two courses, which indicated that after completing the course, most of the graduates (40.76%) remained in the Northeast region, in the capital João Pessoa, working full-time in the IT area, as software engineers, programmers, systems analysts and computer academics. 76.5% worked in a private company or institution and 23.5% in the public sector, occupying different positions. The positions with the most graduates working since the beginning of their professional career are the positions of analyst (70%) and professor (19%). Also, it was possible to verify that some graduates are seeking a higher qualification: specialization (12.5%) in a private institution; master's (62.5%) and doctorate (25%) both in public universities.

The work of Finger et al. (2020) has presented an analysis of the academic education and professional performance of woman graduates of the Computer Science (CS) and

<sup>1</sup>Currency conversion rate of R\$5.28 = US\$1.00 on October 20<sup>th</sup> of 2022.

Software Engineering (SE) courses at the Universidade Federal do Pampa. The work has addressed items such as the participation of graduates in projects during the course, and internships, among other aspects. Thus, based on this information, the authors established the profile of CS and SE woman graduates, identifying their similarities and differences. A questionnaire was sent to a total of 25 graduates and answered by 16 graduates, 11 from CS and 6 from SE. It was pointed out that for the graduates from CS, the contribution of the undergraduate course in academic education was considered “good” or “excellent” (75%), with Data Structure and Algorithms being the most relevant subjects. 64% of CS graduates reported that they had some professional experience. The majority (85%) worked in up to two institutions in the fields of IT or Education, located in the state of the institution where they graduated. The average monthly salary of these graduates was R\$4,714.00 (about US\$900). The Programming subjects were the most relevant to their professional activities. The analysis results for the graduates showed that the majority (60%) has a specialization, and 67% were research assistants in projects. The course’s contribution to the academic education of these graduates was considered “excellent” (67%), with specific SE content considered the most relevant. All graduates had some professional experience, with the majority working in at least three institutions, often in the IT field and located in the same state as the graduating institution. The average monthly salary of graduates from SE is R\$3,700.00 (about US\$700). The disciplines of Software Analysis and Software Processes were highlighted as the most relevant for professional practice.

No publications were found with female graduates who have participated in initiatives similar to the Meninas Digitais UFSC Project, specifically analyzing the relationship between the project and the professional career of graduates of Information Technology courses. While it is not the purpose of the related work to assess the impact of a project on professional career development, much of the related work has been carried out in the same context of the Meninas Digitais UFSC Project. It highlights the novel of this article in verifying the contribution of the Meninas Digitais UFSC Project in the trajectory of the woman graduates who participated in one or several actions over the years, as well as identifying the impact of this contribution on daily applications, whether in the job market or continuing academic study.

### 3 Methodology

Knowing the academic trajectory of the woman graduates and their perceptions of satisfaction with their professional choice is an essential tool to understand if the work developed by the Meninas Digitais UFSC Project is fulfilling the expectations of insertion and permanence of women in technology area. It is noteworthy that the research carried out here complies with current legislation regarding rigor and integrity in scientific research and the privacy of those involved. The precepts of research ethics were followed during the process, as pointed out in resolution *n*<sup>o</sup>

510 of April 7, 2016, considered a normative framework for Research in Human and Social Sciences (BRASIL, 2016). The research presented complies with Art. 1, single paragraph as surveys that do not require registration in the CEP/CONEP, the objects of study to be carried out being established in two items: I – public opinion survey with unidentified participants; VII - research aimed at theoretical deepening of situations that emerge spontaneously and contingently in professional practice, as long as they do not reveal data that can identify the subject. In addition, consent and free and informed assent were established in the resolution. All the questions of the respondents were clarified during the research activity. It should also be noted that the research also complies with Law *n*<sup>o</sup>. 13,709, of August 14, 2018, General Data Protection Law, concerning the data privacy of the participants, (BRASIL, 2018). The stages of development of this research involved: 1. Elaboration of the questionnaire; 2. Distribution of the questionnaire to graduates via email or social networks on February, 2021; 3. Preparation of collected data; 4. Data analysis and discussion of results; 5. Publication of initial results in WIT; 6. Adequacy of the questionnaire for a second approach; 7. Distribution of the questionnaire to graduates via email or social networks on June, 2022; 8. Preparation of collected data; 9. Data analysis and discussion of results.

The Universidade Federal da Santa Catarina graduates who participated in the Meninas Digitais UFSC project received a questionnaire containing 21 questions.

The questionnaires were elaborated and adapted from the work of Da Silva et al. (2019) - previously mentioned in “related works” - where the professional profile of graduates of the 2018 degree courses in Computer Science and Bachelor in Information Systems at the Universidade Federal da Paraíba was identified. The authors’ work considered the performances of the graduates in the business and academic fields and resulted in the collection of information regarding the professional situation of the graduates, current occupations and the representation of the graduates in the different positions in the area.

The questionnaires were developed on the Google Forms platform and sent online to 17 female graduates who graduated from the engineering and technology courses at Campus Araranguá and have participated in the Meninas Digitais UFSC Project. Some girls were part of the project coordination team, while others were available to coordinate in some actions. Among the objectives of the questionnaire were: i. identify the involvement of graduates in the IT areas; ii. verify the degree of performance in the chosen professional life; iii. understand the relationship and influence of the project on the admission and hiring process and post-process actions.

The questionnaire questions are described below and were divided into five blocks:

- **Profile of the graduate:** age, course and year of graduation;
- **Practice Area:** area of activity, the institution where you study or work, salary range;
- **Participation in the Meninas Digitais UFSC project:** action in which she was involved; time of participation

in the project during graduation; how much the project influenced her education.

- **Influence of the project in the area in which she works:** how much the project helped in the admission or hiring process in the university or company; how much the project influences the actions carried out within the university or company; participation in similar actions or projects within the institution; how much the project influenced the choice of area of activity;
- **Contributions:** The last block was defined to freely check each graduate's trajectory and each one's contributions to improve the project. Four questions were asked: 1. "If you could go back in time and include any action or activity in the project, what would it be?"; 2. "Would you like to mentor undergraduate students in the project?"; 3. "Make a summary of your professional trajectory since your graduation"; 4. Extra suggestions or comments.

The first survey was sent to 17 eligible respondents, of which 12 returned the answers (86%). To continue answering the survey, the graduates had to sign the consent form on the first page of the form. Questions from Questionnaire 1 are available at the link: <https://forms.gle/8DmbeRr7tb3e8PtU9>

The article published in WIT 2021 (Moro et al., 2021) reported that questionnaire 1 had been sent to 19 girls. However, with the return of the answers from the graduates, 2 of them reported that they had not completed the course, and therefore, they could not be considered graduates. This correction is made in this article, stating that although the questionnaire was sent to 19 girls, only 17 were able to respond.

After the publication of the WIT 2021 proceedings, new questions were also included to verify the potential impacts of the pandemic period (COVID-19) on the professional development of these female graduates. COVID-19 is a rapidly spreading viral infection that can cause pneumonia-induced death (Gao et al., 2020) and the COVID-19 pandemic has changed how people work and shop and these changes will drive more demand for STEM occupations.

Three new questions were added to the second questionnaire, in addition to those presented in the first questionnaire, with the aim of:

- To check the skills and competencies acquired and the evolution and progress from participating in the Meninas Digitais UFSC project. One question was added to the section "**Influence of the project in the area in which you work**" of questionnaire 1.
- To check the changes caused during and post-pandemic in the work or academic environment. With this purpose, 2 new questions were inserted in an extra section referring to the "**Impact of COVID-19 on the trajectory**".

The second questionnaire was sent to 17 graduates invited to participate in the research, of which 12 answered the questionnaire (70%). The number of invitations remained the same, although part of the invitees was changed, some

because we were no longer able to return contact (exclusion from the social network, for example) and there was the inclusion of new graduates in the period. The results of this research are presented in Section 4. It is noteworthy that the three students who had not graduated in the previous questionnaire had already received their diplomas in the period in which the second questionnaire was sent. Questionnaire 2 can be accessed at the link: <https://forms.gle/v4r8SskYwwKkjJ2k8>

## 4 Results

The results of the first questionnaire were published in the proceedings of the XV Women in Information Technology 2021 (Moro et al., 2021). This section will present a comparative analysis of the results of the data collections (questionnaire 1 & 2). Each subsection represents a block of questions from both questionnaires that were described in the previous section. Section 4.6 is an exception, as it represents a block with two questions referring to the impact of the pandemic period on the trajectory of the graduates, a topic included only in questionnaire 2.

### 4.1 Profile of the Graduates

As for the profile of the female graduates, there are informations regarding age, course and year of graduation. The age of graduates ranged between 24 and 33 years in the first questionnaire, with 25 years being the age most frequently. In the second data collection (questionnaire 2), the age range was between 25 and 36 years, with 30 years being the most frequent age. As for the degree, as shown in Table 1, six (50%) graduates from the Information and Communication Technologies (ICT) program, five (41.7%) graduate from the Computer Engineering program and only one (8.3%) is a graduate of the Energy Engineering program. It can be noted, observing the table, that the same proportion was identified in the second questionnaire. Although, it is believed not to be the same respondents, as seen in Table 2.

Table 1. Degree of the Graduates

Degree	Questionnaire 1	Questionnaire 2
Computer Engineering	5	5
Energy Engineering	1	1
Information and Communication Technologies	6	6

As for the year of graduation, it can be observed according to Table 2, that in the first questionnaire six (50%) of them reported having completed their studies in 2019, three (25%) in 2016, two (16.7%) in 2017 and one (8.3%) in 2014. It shows a growth in the number of graduates, with most of the 2019 graduates being Computer Engineering graduates. In the second questionnaire, the scenario had little change, one graduate (8.3%) said she had graduated in 2021, five graduates (41.7%) of respondents reported completing their studies in 2019, two graduates (16.7%) in

2016, two graduates (16.7%) in 2017, one graduate (8.3%) in 2014, and one graduate (8.3%) in 2015. It is important to note that according to the 2019 Brazilian Census of Higher Education, released in October 2020 by the National Institute of Educational Studies and Research Anísio Teixeira (INPE, 2020), only 13.6% of women completed graduation in Computing and ICTs courses in Brazil. From the graduation year data, according to Table 2, it is evident that it was not the same people who responded to both questionnaires, even though the proportion of respondents per course was maintained, according to Table 1.

**Table 2.** Year of Graduation

Year of Graduation	Questionnaire 1	Questionnaire 2
2014	1	1
2015	0	1
2016	3	2
2017	2	2
2018	0	0
2019	6	5
2020	0	0
2021	0	1
2022	0	0

## 4.2 Area of Activities

According to Sterling et al. (2020), the areas of Engineering and Computing draw attention for having some of the lowest levels of occupational entry by women and large numbers in the wage gap between genders. For this reason, the second part of the questionnaire pursued to know the position of the graduates on the chosen path to verify, together with parts three and four of the questionnaire, the impact of the project on the permanence of the area.

As can be seen in questionnaire 1, the results were positive considering that most of the graduates continue to work in IT, adding up to 91.7% of the respondents, and only one is no longer working in the area, this being the graduate in Energy Engineering who works with Solar Energy projects. In total, as shown in Table 3, seven (58.3%) graduates reported that they are working, especially in companies in the IT sector, two (16.7%) exclusively in academia, one exclusively in entrepreneurship (8.3%), one (8.3%) works in academia and business, and one (8.3%) works in the three areas simultaneously. In questionnaire 2, all the girls reported continuing in the Information Technology area, and most responded that they continued to work in a company. In total, eight (66.7%) graduates work exclusively in companies, two (16.7%) work in the academic area and two (16.7%) work in the company and academia. None of the graduates is currently entrepreneurs, contrary to questionnaire 1, none of the graduates responded that they work in all areas.

Taking into account the chosen area of activities, the sub-areas mentioned by respondents in questionnaire 1 were: Web development; innovation; Software Engineering; telecommunications; educational technologies; applied computing; artificial intelligence applied in education; ERP

**Table 3.** Area of Activities

Area of Activities	Questionnaire 1	Questionnaire 2
Academia	2	2
Company	7	8
Entrepreneurship	1	0
Academia & Company	1	2
Academia & Company Entrepreneurship	1	0

systems - SAP; management of innovation projects; solar energy; marketing or social media; and power systems and programming education. For questionnaire 2, some new sub-areas were mentioned by the graduates, such as: UX design, engineering and data science, systems analysis, product management, software quality and cybersecurity; and sub-areas mentioned above continued to be mentioned such as: software engineering, educational technologies, artificial intelligence applied to education, project management and photovoltaic solar energy.

In questionnaire 1, companies such as WEG, DB server and Happy Code are mentioned as work institutions by the graduates. Graduates who continue to work in the academic area are linked to public educational institutions such as UDESC, UFRGS, UFSC, UFSCAR and UFSM, and continue to research in the *Stricto Sensu* modality (master's or doctorate level). As a result, the main positions held and cited are: developer (three); researcher (three); coordinator (two); support (two); engineer (one); teacher (one). The multiplicity of sub-areas and positions within the chosen working areas shows the variety of the graduates' profiles.

In answer to questionnaire 2, companies such as iFood, CAST Group, MB Labs, Clara Pagamentos LTD, Grupo 3778 and Fundação Certi are cited as work institutions by the respondents. The graduates who continue to work in the academic area are linked to public educational institutions such as UFRGS, UFSC and UFRJ and continue to research in the *Stricto Sensu* modality (master's or doctorate level). With this, the main positions held and cited are: data engineer (2), systems analyst (2), developer (1), researcher (3), project coordinator (1), UX design (1), leader (1) and product manager (1). We can notice about questionnaire 1 a greater diversity of areas in questionnaire 2. Despite the variety of areas and positions, there are still few leadership positions. And the most experienced woman has 8 years in the area.

Regarding the monthly salary range answered the questionnaire 1, six of the respondents receive from R\$2,000.00 (about US\$379) to R\$4,000.00 (about US\$757) as can be seen in Figure 1, with the values of Q1 (Questionnaire 1) in the table that represent the yellow bars of the Figure 1. Only one of the respondents earns between R\$8,000.00 (about US\$1,515) and R\$10,000.00 (about US\$1,900) and works in the academy, in a company and her enterprise. One of the graduates earns between R\$4,000.00 (about US\$757) and R\$6,000.00 (about US\$1,136) and one of the respondents did not want to inform her remuneration. It can be seen, in the answers to Questionnaire 2, represented with the values of Q2 (Questionnaire 2) in the table, which are related to the bars in purple of Figure 1, that there was a growth in the range of salaries of graduates with the

pandemic. There was a reduction of about 20% in the lowest salary zones and an increase in graduates with a monthly salary range above R\$ 8,000.00 (about US\$1,515).

### 4.3 Meninas Digitais UFSC Actions

The third part of the questionnaires is related to the participation of graduates in Meninas Digitais UFSC project actions. Frigo et al. (2020) have reported the importance of the project and its actions for several girls in the region where it is located, both for the volunteers who organize the activities and for the students who only participate. The actions mentioned range from hands-on workshops and computer workshops; to holding events, fairs and lectures; to research production. Figure 2 highlights the participation of more than half of the respondents of the questionnaire 1 in research projects (nine); event organization (eight); workshop monitors (six); teaching material design (six); publicity design (four); lectures (three). The yellow bars represent the responses to questionnaire 1, the purple colored bars represent the responses to questionnaire 2.

As for the activities they participated in during the period involved in the project, Figure 2 highlights the participation of the respondents of the questionnaire 2 in research projects (eight); event organization (four); workshop monitors (seven); teaching material design (six); publicity design (three); lectures (four).

It is essential to emphasize the inseparability of teaching, research and knowledge exchange. Being a project with strong knowledge exchange, it has actions to integrate research and the community, which is described in the main actions performed by the students during the project, as shown in Figure 2.

Regarding the time and duration of the project, Figure 3 shows the comparison of answers in Q1 and Q2 (in the chart table). Regarding Q1, 25% of respondents claimed part-time participation, and respectively 16.70% participated for a period of one year, 33.30% of the respondents stated that their participation in the Meninas Digitais UFSC project was for up to two years, 16.70% participated for a period of up to three years. Only 8.3% of the graduates indicated that they had participated for a longer period, which was indicated in the survey as more than three years. Regarding Q2, it is possible to notice that most respondents of the second questionnaire (33.3%) said they had participated in some part-time activities of the Meninas Digitais UFSC project. Three graduates (25%) participated in the project within one year, two (16.7%) within two years and two within three years; and only one (8.3%) respondent mentioned having participated for more than three years.

### 4.4 Influence of the project in the area activities

It is noteworthy that for 66% of the respondents, the project strongly influenced their undergraduate education. It is important to observe this question in the fourth part of the questionnaire, which relates to the influence of the project on the professional trajectory of the graduates after graduation

and considering the environment in which they have started to work. This relationship is shown in Figure 4.

In Figure 4, the project's influence on professional trajectory can be observed; ten respondents declared that the Meninas Digitais UFSC project had a significant and very significant influence on the admission or hiring process; eight respondents said that the project had a significant and very significant influence. Seven and ten respondents reported a significant and very significant influence on the professional field and education, respectively. The graduates (67%) indicate that they were involved in activities, work groups or actions that involve gender and technology within their institutions. One of the questions addressed graduates' interest in acting as mentors for students, and the interest in this type of action is relatively high (83.3%). It is noted that collaborative network and mentoring puts the graduate in a position for example, becoming an incentive for several women to enter the area and continue in the company or the academic environment. In the second questionnaire, there was a reduction in graduates' interest in involvement with other actions involving gender and technology in their work institutions (58.3%). As for the graduate's interest in acting as a mentor or volunteer in actions such as the project, the majority (75%) said they would like to collaborate.

It is noteworthy that for eight of the respondents, as shown in Figure 5, the project strongly influenced their undergraduate education. Only 2 graduates considered the project to have little or no influence.

It is highlighted in Figure 6 that the most cited skill in questionnaire 2 was Teamwork (11 responses). It is important to note that this question was included only in questionnaire 2, so there is no comparison with questionnaire 1. This result is because the project participants formed teams that worked collectively in an adequately equipped space when developing the didactic content of a workshop or programming activity. In addition, ten respondents indicated Research Development, and nine respondents indicated Public Speaking as the primary skill acquired. Other responses worth mentioning: four said they had improved their knowledge of programming and four acquired skills in robotics, one considered Leadership and one studied in the Technological environment as a skill or competence provided by the project. None of the respondents considered the knowledge of Artificial Intelligence as something provided exclusively by the project. With this, it is understood that the Meninas Digitais UFSC project contributed to the acquisition of knowledge and personal evolution of each participant in the research.

### 4.5 Contributions

Finally, an open question to know more about the professional trajectory of the interviewed graduates through brief reports. The answers of students one and two refer to the first questionnaire, and the others refer to the second questionnaire. The authors translated the respondents' reports. Due to anonymity, it was impossible to forward the authors the translation for verification. In this way, the original text is available at: <https://bit.ly/3sXFLXK>



Figure 1. Range of Salaries (questionnaire 1 and questionnaire 2)

- Student 1: “As soon as I presented the final course project, I took the exam for the master’s degree at the university and already knowing the laboratory’s projects, I wanted to continue and explore the research even more. I migrated to the area of AI in education and discovered that I never stopped learning in the Meninas Digitais UFSC project. I saw that it was possible to work in an area that I found complex (AI) as a woman. I presented the master’s dissertation, finished the admission steps for the Doctorate, and was accepted. One of the reasons that led me to be accepted was certainly the participation in projects such as Meninas Digitais UFSC, mentioned by the evaluators. To this day, I try to help and encourage women in the area because the support I had to get to the place I got to was fundamental.”
- Student 2: “Graduated in Applied Computer Science. Master in Science, Technology and Society from UFSCAR. Bachelor in ICT from the Universidade Federal de Santa Catarina. With additional education in Telematics Engineering from UAH (Spain). Passionate about research and development, which professionally unites both passions. I am a researcher affiliated with the Institute of Technology and Equity - IT&E. In addition to research, I have been working since 2013 as a professional in the field of Software Engineering. In 2018, I founded Muutos, a technological development and research company, which has already participated in projects in startups in Brazil and California (Nasa Research Park) in areas such as Social Technology and Health. Muutos has also been dedicated to researching algorithms, interactive technologies, bots, software design and quality, social movements and gender.”
- Student 3: “In 2019, I entered the job market, in the data area, as an intern at WEG. There, I was hired as

a junior data engineer and learned a lot from a project that involved a consultancy specializing in data. In June 2021, I joined Akross and learned much about AWS cloud. In 2021, I also started writing articles about my area of expertise. In June 2022, I got my first international opportunity to work in a Mexican company and use English for communication.”

- Student 4: “During DB server, an internship in AI, then I worked as a python programmer and data scientist in the innovation lab, then I worked as an outsourcing data scientist at the Klabin company. I was hired by the iFood company as a senior data scientist.”
- Student 5: “After UFSC, I had the opportunity to work in large startups in Brazil and California (USA). Nowadays, I am the HEAD of one of the main health techs in Brazil. In addition to my experience in the market, I developed myself in research. Today I work as a collaborating researcher at UFRJ at the NUTES laboratory and the Institute of Technology and Equity - IT&E. I continued my education with a Master’s degree from UFSCAR and a postgraduate degree from CLACSO (Argentina).”

#### 4.6 The COVID-19 pandemic period

The other 2 questions exclusively included in questionnaire 2 assess the impacts of COVID-19 on their professional life trajectory. As the previous research was carried out in the period up to 2019, the objective of the first question was to analyze the possible changes related to the period of social confinement during the pandemic, when physical activities were compromised - the period from March 2020 to December 2021. Figure 7 shows that most graduates (seven) started to work from home during the period. Two changed jobs or the company in which they worked and one changed

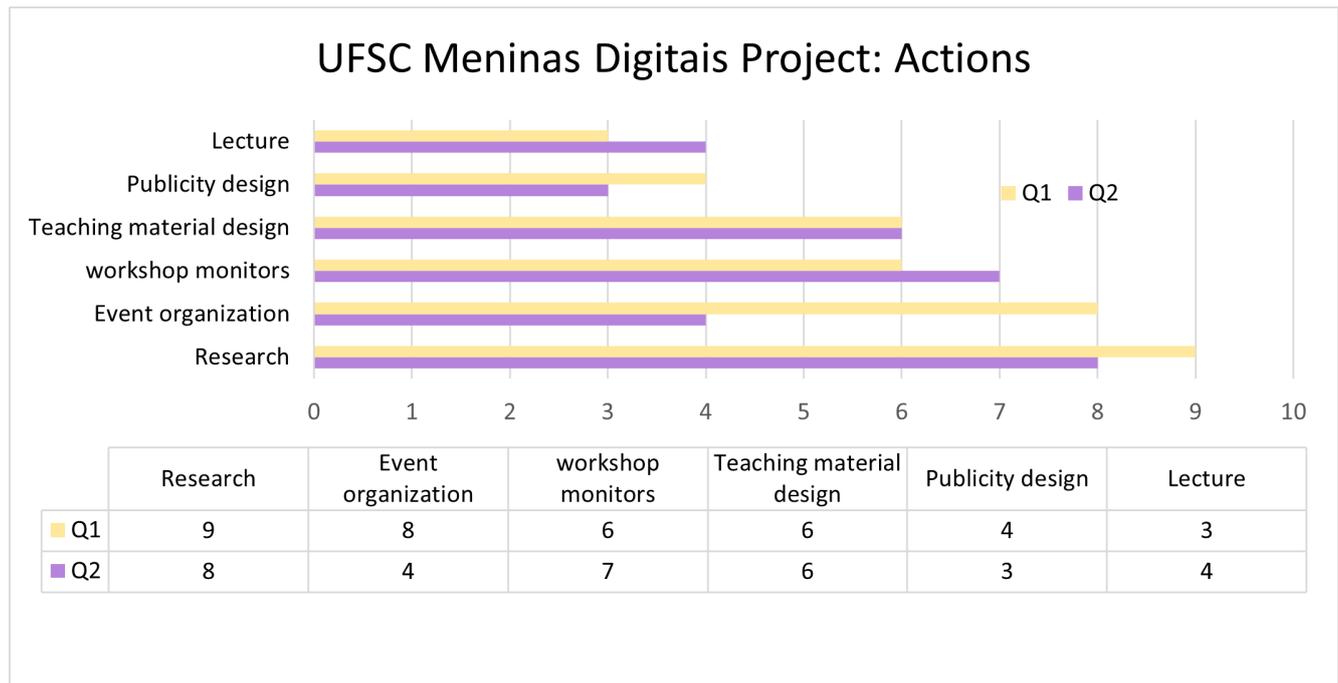


Figure 2. Meninas Digitais UFSC project: Actions (questionnaire 1 and questionnaire 2).

their area of work. None of the graduates was fired or had their salary reduced. Notably, five graduates answered that none of the alternatives represents them in this question (N/A indicated in Figure 7).

The second question investigates the changes caused by the period of return to face-to-face activities, which comprises January 2022 to June 2022. In this research, the period is called “post-pandemic”, in which it is understood the return of face-to-face activities in the most sectors. As can be seen in Figure 7, seven respondents continued to work from home during the period. Four graduates reported having been promoted during this period. The salary increase or change of company was pointed out by 2 graduates with the return of face-to-face activities. The IT market has been increasing the number of opportunities in several areas, mainly because of the digital transformation and acceleration due to the pandemic. We have no data to confirm if the responses about a reflection of the recognized competence of women professionals or a general reflection of post-pandemic need to retain IT professionals due to the current employment crisis. In addition, 2 answered that none of the alternatives assigned to the question represented what they experienced in the period (N/A in Figure 8). None of the graduates changed their area in the period.

#### 4.7 Discussion

According to the researched scientific articles in the related works, some important points are highlighted in line with the research presented. Through these studies, it is possible to identify some of the reasons why female graduates are lower than the national average in higher education. In some of the works, it emerged those female students suffer prejudice and criticism, and they recommended that support be given to the students by the universities. In addition, actions were

suggested to schools to encourage girls to enter the area. The Meninas Digitais UFSC project already carries out school activities and tries to minimize similar issues at UFSC. The result of this analysis emphasizes the importance of helping girls to face these difficulties within educational institutions.

Regarding the presence and performance of female graduates in the productive sector, it was identified in the literature the need for more female students in the technology areas (De Oliveira et al., 2017), the Meninas Digitais UFSC project plays this role at UFSC, and the results are reflected in the outcomes of the graduates’ research. An interesting point that had not been considered was the issue of the geographical distribution of the activities of graduates. In the scientific literature, in one of the works, it was shown that no female graduate works abroad. Also, it was mentioned that it is due to a sociocultural issue that limits the location of female graduates to work in the area closest to the educational institutions. In contrast, male graduates work in several regions of the country.

The sample in both questionnaires is quite the same because there are few graduated girls in the undergraduate courses in this research. There is a limitation in this issue because the questionnaires were sent anonymously so we expected that some respondents were the same.

The results of questionnaires 1 and 2 show that the Meninas Digitais UFSC project dramatically influences the development of technological and personal competencies and skills for the graduating respondents. The Meninas Digitais UFSC project has influenced around 500 students between elementary and graduate schools during its ten years. Actions that encourage women in technology areas, such as those promoted by the Meninas Digitais UFSC project, were suggested in De Oliveira et al. (2017) by the interviewed graduates where they point out that there should be greater support from teachers to students in the areas of

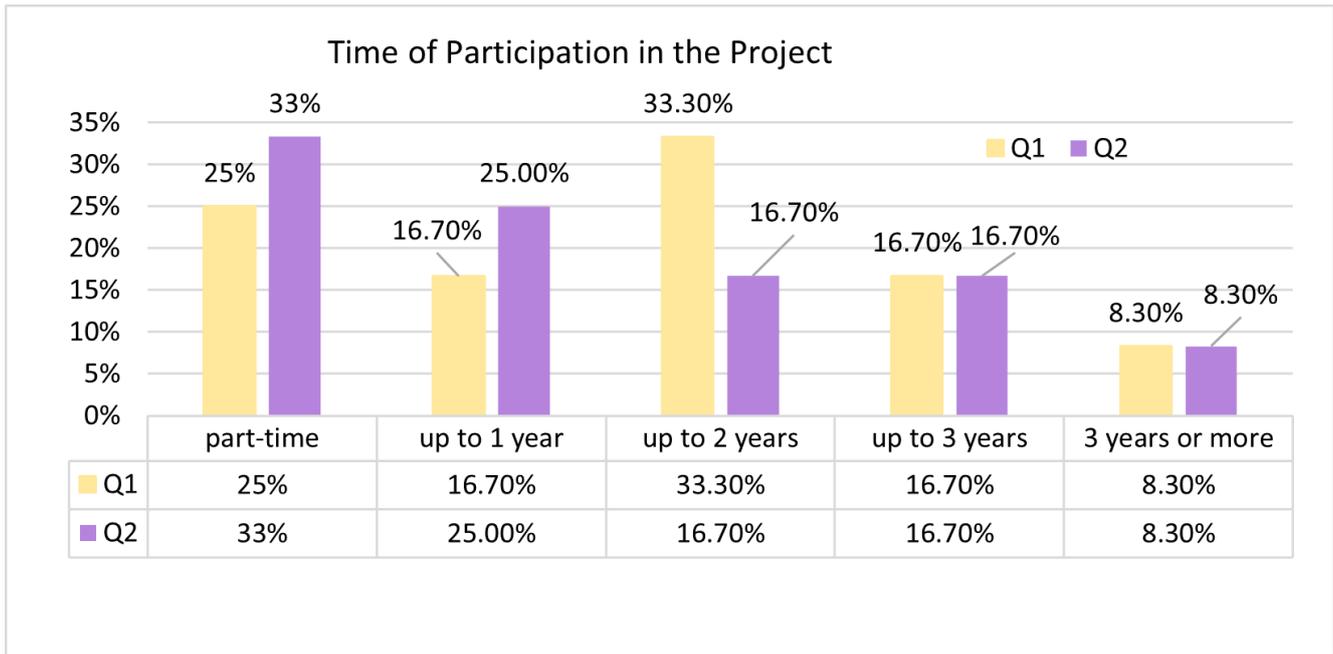


Figure 3. Time of participation in the project (questionnaire 1 and questionnaire 2).

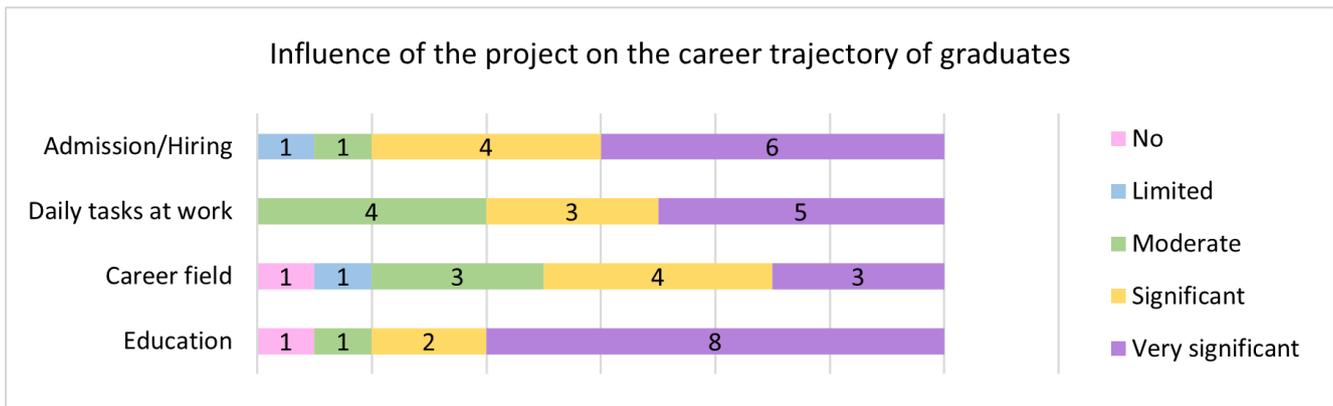


Figure 4. Influence of the project on the professional trajectory of graduates (questionnaire 1).

technology, presenting the labour market, salaries, having greater dissemination of courses in schools, development of incentive programs, such as promoting meetings with successful women in the areas and promoting a greater emphasis on female participation in technology. The answers of the graduates confirm the importance of the project for the maintenance of women in the technological area and the personal and professional development of these graduates.

However, some results are essential to redirect the actions of the Meninas Digitais UFSC project in the coming years. For example, improving activities that develop leadership skills and the engagement of participants in actions of this type. In the responses, only one respondent pointed to leadership as an acquired competence. It is known that leadership positions in the job market are not easy for women. Thus, a point to have more weight and importance in the future actions of the project. According to (Olinto, 2012) there are indications of several subtle mechanisms that are established in professional environments making it difficult for the professional progression of women. These aspects

involve cultural and family issues that could be addressed in future research. Another issue highlighted is that in a new survey, both soft and hard skills (presented in the survey as skills and competencies) can be analyzed separately in the questionnaire. The technological market has aimed to diversify hiring and has given importance to personal skills such as assertive communication, leadership, proactivity in problem-solving, and teamwork. Since the pandemic, with activities, carried out remotely, this type of skill has had a greater weight in the technology sector (Silva et al., 2020). Teamwork was identified as a differential of the project's influence on respondents' lives. Another critical analysis concerns the permanence of students in the project. Although about 33% of the respondents stayed for two years in the Meninas Digitais UFSC project, 25% of the graduates participated in the actions sporadically. Despite the short participation of a quarter of the respondents, the project still greatly influenced the education of students in technology courses at UFSC in the City of Araranguá/SC, Brazil.

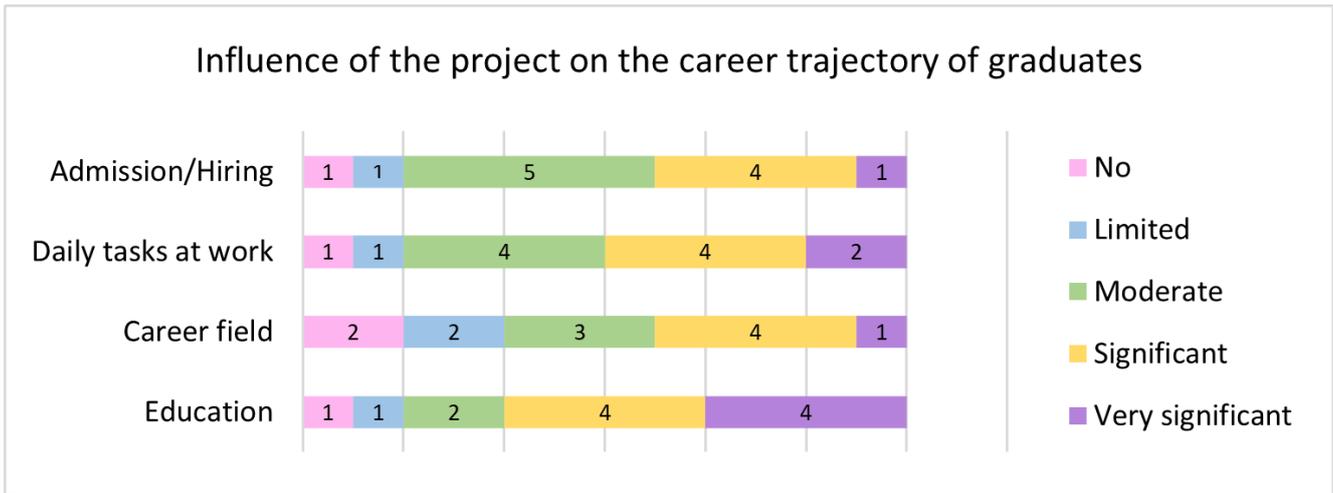


Figure 5. Influence of the project on the professional trajectory of graduates (questionnaire 2).

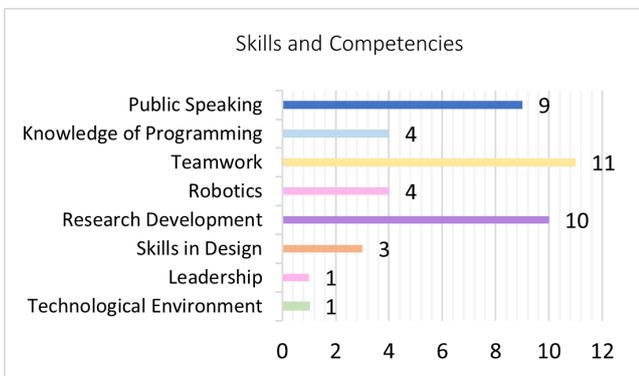


Figure 6. Skills and competencies acquired from the project.

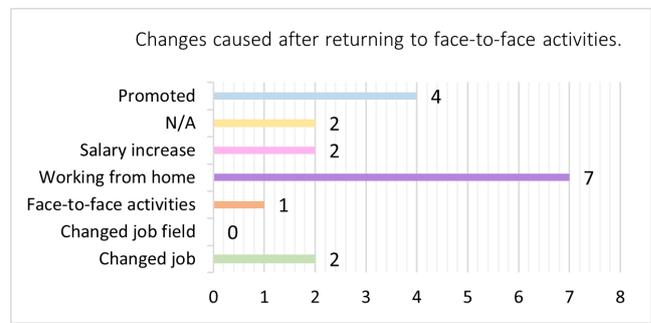


Figure 8. Changes caused after returning to face-to-face activities.

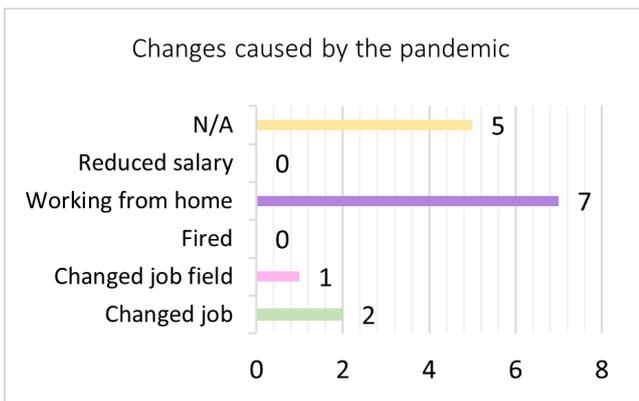


Figure 7. Changes caused by the pandemic.

## 5 Final Considerations

This article reveals the positive impact on the professional lives of graduates associated with participation in the actions of the Meninas Digitais UFSC project. The graduates were very satisfied with participating in the Meninas Digitais UFSC project and recognized the skills and abilities acquired during the training. They have highlighted that the teamwork ability developed during the project was vitally important in the job market. There is an increase in the group's remuneration. Among the changes after the COVID-19 pandemic, many continued to work remotely, we do not

consider comparing our sample with other groups, which represents a research limitation. In addition, the students reported several testimonies about the impact of participation in the project. Among the social contributions of the Meninas Digitais UFSC project, it should be noted that the project works in public elementary and high schools, some schools with a high level of social vulnerability. Providing support for undergraduate students to know the process of developing computer technologies and technical and behavioural skills to strengthen themselves and remain in the area has been one of the objectives of the Meninas Digitais UFSC project. Knowing the academic trajectory of the graduates and their perceptions of satisfaction with their professional choices is fundamental in directing the activities carried out at the university. The graduates who participated in the Meninas Digitais UFSC project emphasized the importance of their training during their participation in the project, with positive effects on their professional choices. They pointed out associations between success in selection processes, in areas of interest, gender and technology with participation in the project. Another point that strengthens the idea of the project's success is the high interest of these graduates in acting as mentors for undergraduate students, as they know that this type of action can be decisive in their professional life of many of them.

In future work, it is proposed to apply actions with the participation of graduates to maintain a link between them and the project, seeking to encourage other girls to join, develop and remain in the area. Also we intend as an

important issue to include a specific section about geographic distribution of girls' jobs.

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