Can Female Underrepresentation in Information Technology Be Solved Through An Awareness-Based Approach?

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ABSTRACT

In Bangladesh, there is a significant difference between the number of females and males working as Information Technology (IT) professionals. There are a concerningly less number of females choosing IT as a major as well as entering and staying in the IT industry. It is important to address this gap in participation as it will help in tackling gender inequality. This will result in nurturing a more diverse source of ideas in the industry. This study explored the factors influencing female underrepresentation in IT in the context of Bangladesh through a two-staged survey-based study and a focus group discussion. It also explored the possible solutions to the problem and proposed an awareness-based approach to address this issue. The data collected in the study provided evidence that this awareness-based approach can alleviate the problem to a great extent.

KEYWORDS

Female Underrepresentation, Information Technology, Gender Equality, Awareness-Based Approach

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1 INTRODUCTION

Female underrepresentation in IT has long been a topic of discussion around the world [1]. The nature of this situation varies from country to country as the sociocultural factors affecting this situation are different. Hence, to effectively address this issue, it is necessary to conduct carefully tailored studies considering different contexts. While the research community focused on understanding the aspects in a generalized scale [2] [3] [4] , a few studies have investigated how these aspects really are in the context of Bangladesh.

In Bangladesh, the difference between the number of male and female IT professionals is alarming. According to a study report of Bangladesh Open Source Network (BdOSN), in over 90 universities and institutions of the country over a period of 12 years (2005-2016), only 25% of the students studying computer science or related fields are women. Only 13% of them joined the IT industry after completion of their studies [5]. Moreover, even after couple of years of entering the IT industry, women are seen leaving the industry to either join academia or switch to other fields. According to another study, there are less than 10% females working in the IT sector as professionals [6]. It is high time we explored the factors hindering women to choose IT as a profession in Bangladesh. Also the factors that influence them to leave the IT industry even after joining and working for couple of years, need careful examination. Female students studying CS or IT, tend to participate less in programming contests compared to the male students. From the study report of BdOSN, it is seen that, less than 1% of the female students who choose to major in Computer Science or IT related fields, participated in competitive programming contests in 2015. In the preliminary round of ICPC 2015 Dhaka region, only 5 teams were led by female team leaders [5]. It is important to address this gap in participation. Addressing this problem will play a role in women empowerment in an age where technology based jobs are increasing and ensure diversity in the IT sector. Besides, gender diversity can help nurture innovation in the workforce [7].

To understand the underlying reason of this problem in the context of Bangladesh and to find out the solutions to it, we conducted a survey in two stages. We also conducted a focus group discussion in between the two stages of the survey. The first stage of the survey was conducted on female students studying in 11th and 12th grade in Bangladesh, who were about to pursue undergraduate level studies one or two years after the survey was conducted. This survey provided us with insights about reasons that hinders young women from choosing IT as a career. Based on the data collected in this stage, a focus group discussion took place in the presence of the same participants of the first survey. The parents of the participants and academicians were also present in the focus group discussion. The second stage of the survey focused on the barriers that show up after choosing IT as a career. We used it to measure the coherence of the data collected from the first stage. The participants in the second stage of the survey were female undergraduate students doing majors in computer science or related fields and IT professionals working in various software firms in Bangladesh.

We found that the reason behind the gap in concern is the sociocultural condition of Bangladesh such as social norms, stigma and state of social security. This issue being exacerbated by social factors, aligns with existing literature [4] [8].

2 METHODOLOGY

We developed a questionnaire and performed a survey on 200 11th and 12th grade female students of Bangladesh, whose age ranges between 16-19 years, to identify what they think about the target issue. We will refer to this group of participants as the first target group throughout this paper. Based on the responses of the survey, we also performed a focus group discussion in presence of the students, their parents and industry professionals as well as academicians, to find out the factors that affect their participation and the possible ways to to mitigate those problems. Later on, as an extension of that survey and focus group discussion, we continued collecting data from the female students and professionals in the IT sector who have already experienced the sector themselves. The goal of this second survey was to find out whether the findings from our previous survey holds and if barriers exist after entering the IT sector. There were 40 participants in this survey. We will refer to this group of participants as the second target group throughout this paper. The steps are briefly described in the following sub-sections.

2.1 Questionnaire Construction and Survey Conduction (First Stage)

After problem identification, thorough background study and target audience selection, we constructed a survey questionnaire taking into account the variables influencing a person's career choice. According to a study, these variables can be family choices, social predispositions, confidence affected by gender bias, career information [9]. We refined the questionnaire based on feedback from academicians and women who were already studying in IT or related fields at undergraduate and graduate levels. We designed the questionnaire in Bengali according to the convenience of the participants. It contained 8 multiple choice questions and two open-ended questions[1].

The multiple-choice questions were intended to find out the participant's thoughts on the reasons behind the female under representation in IT. We asked them to provide opinion regarding limited participation, peer support, unclear vision resulting from limited information about career paths, stereotyping, social stigma, family and societal pressure, lack of role models and the existing socio-cultural structure of Bangladesh. We also asked them whether steps like proper guidelines, mentoring and raising awareness among the students and their parents are effective ways to mitigate these problems.

Through the open-ended questions we collected the first target group's thoughts on the lack of female participation in the IT sector in Bangladesh and asked whether they wanted to build a career in this sector. Some additional information required for the focus group discussion and workshop were also collected from the first target group, such as, the participants' institution name and the reason behind their participation in the workshop. All the questions were mandatory to answer.

The survey took place in 2019 and we collected the data throughout the months of September and October. The participants were chosen based on Convenient Sample Recruitment Strategy [10]. In total, 200 responses were collected from the first target group. We asked those who did not want to build a career in IT later in the focus group discussion (FGD) about the reasons of their disinterest.

2.2 Focus Group Discussion

Based on the data collected in the first stage, a focus group discussion took place in the presence of the first target group, their parents and academicians. 60 female students, their parents, 3 academicians and 2 undergraduate level students, that is, a total of 125 people were present in the discussion. The discussion was run by a moderators who was an academician. The students and their parents were in the same focus group. We discussed about the factors hindering young women to choose IT as a career and found valuable insights about the problems and their solutions.

2.3 Questionnaire Construction and Survey Conduction (Second Stage)

This questionnaire was also designed in Bengali. It contained 8 multiple choice questions and three open-ended questions. The multiple choice questions were identical to the first survey questionnaire[2]. Through the three open-ended questions, we asked the second target group about their opinions on the lack of female representation, whether they have faced any problem while studying or working in the IT sector, and in their opinion what the steps might be to minimize this gap in representation. Some personal information such as their designation, the name of their organization and their contact information was also collected. We collected data from the second target group throughout the period of December 2021 - January 2022. The participants were chosen based on Convenient Sample Recruitment Strategy [10]. All the questions were mandatory. In total, 40 responses was collected from the second target group.

2.4 Data Analysis

We received responses in both English and Bengali. We translated the responses in English before analyzing them. We applied Straussian Grounded Theory [11] to analyze the responses to the open ended questions, as it does not assume the presence of any previous theory to be tested over the data and it is appropriate for analyzing open-ended questions with exploratory nature.

Firstly, we split the sentences from the survey responses using standard text separator, applied labels to the split parts and assigned initial labels based on the content. We performed this for both the obstacles and proposed solutions. Then, we clustered labels which are semantically similar or identical. We applied the semantic similarity principle [12] in this case. We renamed the labels to better reflect the various categories of obstacles and solutions identified. We iterated over the labels until we reached a theoretical saturation [13], that is, we continued to iterate over the labeling process until we reached a point from which analysis of the labels does not propose newer insights. Lastly, we discovered patterns and relationship between the identified factors that create obstacles for women, both before and after entering the IT sector.

The findings from the collected data are presented in the next section.

[1] https://forms.gle/E3f9Gcb8SAVKvKxMA

[2] https://forms.gle/woJbnnrH91tp8kSt8.

3 RESULT AND ANALYSIS

The results from the study are presented in the following two subsections. In the first subsection, we discuss the obstacles that stop females from entering the IT sector. In the second subsection, we discuss the barriers that show up after entering the IT sector. In the third subsection, we discuss the possible solutions.

3.1 Obstacles entering the IT sector in Bangladesh

Through the two stages of the survey, a total of 240 respondents presented their opinions on the obstacles women face while entering the IT sector during the admission period while choosing their field for undergraduate studies. Among them, 200 respondents were female students of 11th or 12th grade from 30 different institutions from all over the country, 26 of them were receiving an undergraduate or postgraduate level education in related fields in 10 different universities, and 14 of them were already working in the IT industry in 10 different companies as professionals. The findings of the two surveys are as follows.

3.1.1 ***Socials Norms and Stigma:*** Parental influence has an effect on the choices a child makes when choosing a career path [14] [15] [16] [17]. The data we collected from the first and second stage of the study is coherent with this. Most of society and by extension parents directly or subliminally discourage female students from delving into IT. There is a gender based digital divide in the society. A male child is more likely to have access to a personal computer compared to a female child. With this lack of access and experience they develop a fear of the unknown which translates into a lack of confidence in even considering a future in IT. In most places, females are expected to be married and sent off to their in-laws. This exacerbates the family's disinterest in investing in higher education. Moreover, there is a stigma in society that girls can not excel in jobs that require logical and analytical abilities. This stereotyping leads to lack of self-confidence among women. 74.6% of the first target group and 75.6% of the second target group think stereotyping women to particular jobs only adds to the negativity. Even one of the student participants in our survey believed that, girls have less IQ and mathematical ability than boys. This is so severe that it creates an imposter syndrome among females already studying in IT related fields in undergraduate levels.

3.1.2 ***Fear caused by lack of information:*** Due to a lack of career counseling available in most educational institutions in the country, most students have very little idea about most viable career paths after passing high school. This is especially prevalent in females when choosing whether they want to pursue a career in IT. Over 80% of the participants of the first target group and over 60% of the second target group agreed that lack of information acts as a deterrent. Due to the limited information available to them, they misjudge their suitability for the field.

3.1.3 ***Work Culture and Gender Roles:*** In Bangladesh, women are expected to perform certain gender roles such as maintaining household chores and raising children. Hence, they tend to choose jobs with less workloads. Many girls get married before starting their undergraduate studies. Therefore, they don't even consider IT as a career. Those who choose the IT sector in the first place, have to switch fields or quit jobs at some point in their lives due to marriage or pregnancy, as most IT companies in Bangladesh have little work-life balance. Hence we can see, the actual reason women face hurdles in work is due to family responsibilities. And men also switch to suitable fields for similar reasons from IT. Switching or quitting IT is not related with gender. Some of the participants stated that they experienced discrimination in the male-dominated industry, which they think to be a major reason that creates performance anxiety among the female workers. This exacerbates the trend of female workers leaving the industry for academia despite the fact that not all of them are interested in the latter.

3.1.4 ***Lack of Female Icons:*** Studies show that students at a younger age grow more interest in CS, if they see role models who they can resonate with [18]. Lack of such female icons in the IT sector leads to this void in participation of females. Therefore, young women are attracted to those sectors where women visibly excel. It has also been seen that encouragement helps students greatly, to pursue a field or career [9] [18]. Less women in the workplace means less encouragement and peer support for freshers, both in academic and industrial context. This absence of women in IT delivers the idea that this field is not suitable for women and eventually discourages young girls to pursue IT as a career. This creates a cycle of disinterest. 69.6% and 63.4% participants of each target group respectively believe that a lack of female icons is an issue.

3.1.5 ***Lack of Security:*** In our focus group discussion, participants said they think that there are security issues for girls in the IT sector. This is because in companies that are not well-structured, employees have to work late hours. Even in well-structured companies, employees have to stay late during release time and other emergencies, i.e. server crash. Considering the social condition of Bangladesh, working late and commuting at night is not a safe option for girls, which only intensifies the existing problem.

3.2 Do the barriers still exist after entering the sector?

We performed the second survey on female students who are currently studying IT or related fields and professionals who are currently working in the IT sector to justify if the perceptions of the young students of the first target group and their parents are real. After analyzing their opinion, we discovered the following barriers that exist after entering the IT sector.

3.2.1 ***The sunset law:*** According to the participants, studying in IT requires staying longer in classes as there are longer labs. If the university doesn't provide secured residential facilities, it becomes difficult for the female students to continue or excel in lab works. The traffic issue makes this problem more severe. Again, girls in most of the cases can not participate in co-curricular activities that require them to stay out for longer as a result of this. Hackathons are one such example where females have a tough time due to the stated reason. They can not even participate in programming contests that end late or that is far from home due to longer commute and security issues.

3.2.2 ***Professional challenges:*** As previously mentioned, not all the software companies ensure much work life balance. Hence, it becomes tough for the female employees to continue their job handling other responsibilities. In some cases, companies don't even want to hire female employees as they can't work overtime outside of office hours. In LinkedIn, job postings can be seen mentioning 'females are not encouraged to apply' or 'male employees only'. Another issue is, if any female developer performs well in her job, that is considered to be unexpected by the senior developers. This issue is prevalent in the industry but not in academia. That's why females prefer academia over industry. Again, female developers who do not have to face this discrimination, are not highlighted enough. Their stories are not shared with the younger females. So the young women think that discrimination prevails in the sector.

3.3 Proposed Solutions

Analyzing 240 responses from the surveys, we see that, lack of awareness among students, parents and policymakers is the main obstacle on the way solving female under representation in IT. Hence, an awareness-based approach need to be introduced to solve this. After analyzing the survey responses, we identified and categorized the following possible solutions.

3.3.1 ***Mentoring:*** Over 97% of participants of both stages think mentoring and proper guidance can help women at a young age to see a clear picture regarding how life in the IT sector would be. Once they can see the clear picture, they will be able to clarify their confusions, uncertainty and fears that existed in the first place. Near-peer mentors [18], with whom the young girls can resonate well, can play a significant role regarding this issue

3.3.2 ***End Stereotyping:*** To break myths in the society and put an end to stereotyping, awareness needs to be raised among parents who play a vital role in influencing their childrens' career choices [14] [15] [16] [17]. Once the parents are reassured that the IT sector is safe and convenient for girls, they will no longer pressurize them to avoid the IT sector and will see it as a viable career choice for their daughters. Over 90% of both target groups share this view.

3.3.3 ***Focus on achievements:*** 72.7% and 78% of participants of each target group respectively think that female achievements in IT lack exposure. Highlighting female professionals and students, sharing their stories and perceptions, experiences, focusing on female icons may help change the existing perception. A source of inspiration can always act as a trailblazer.

4 CONCLUSION

Solving the issue of female under-representation requires understanding the different aspects of this problem first. In this study, we have designed a survey, collected data from a total of 240 respondents as well as performed a focus-group discussion. After conducting this two stage survey, we found out that there indeed exists some barriers that hinder females of our country to get into and thrive in the IT sector. In this paper, we have identified and presented those barriers. Clearing misconceptions, providing the general public with necessary information related to women's participation in the IT industry and raising awareness to change social outlook are exactly what we need to do right now. We showed that, an awareness-based approach can break the stigma, break the barriers, prepare the young female students, and help them grow a positive mindset from a very early age. Additionally, this can help their parents through clearing the misconceptions, so that they can guide and support their children accordingly. This awareness-based approach can also be used by educators and policy makers to deal with this issue in practice, like designing work routines that better accommodate female workers and many more.

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