Increasing the Participation of Young Women in Cybersecurity

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Abstract — *The gender disparity that affects cybersecurity is not new, but it is particularly discouraging for women, who represent only 11% of all cybersecurity professionals around the world. It is also reported that very few have leaderships positions. This study has the goal of increasing the participation of young underrepresented groups of women in cybersecurity education and awareness activities, leading the way to increasing their participation in the field. The project was carried out over a period of several months using data from 213 young girls ages 13-18 that were visited at Junior and High Schools in Puerto Rico. Presentations and other activities were given on the topic and data was collected on their knowledge, previous experiences, and interest in the field. The main objective of this study is to promote awareness and increase their interest in cybersecurity related professions before they start college. The author explains what motivated her to initiate this project, the problems that exist, the activities that were developed, results and the proposed solutions. The author also describes the steps and considerations that are currently being taken to contribute to this effort at the local and national level.*

Key Terms — *Cybersecurity Awareness, Gender Disparity, Research and Education, Women in Cybersecurity.*

INTRODUCTION

The author discusses the problems that exist, the proposed solutions, the activities that were developed, and the results of the research work. The author describes the steps and considerations that are currently being taken to contribute to this effort. Finally, the author will discuss considerations on future work that is required to help solve the problem at the local and national level.

BACKGROUND

Cybersecurity is critical to the national infrastructure; the federal and local government, the military, industries, and even for personal privacy. To defend the USA against cyber threats, there is a significant demand for skilled labor in cybersecurity in the academic, military, governmental, and industrial sectors.

But the gender disparity that affects cybersecurity is a discouraging fact for women that seek careers in cybersecurity. Studies reveal that women represent only 11% of all cybersecurity professionals around the world [1], and that very few have leaderships positions [2]. This present study has the goal of increasing the participation of young women from underrepresented groups in cybersecurity education and awareness activities, leading the way to increase the participation of more women in the field. The author's theory is that if we start to educate girls on the subject of cybersecurity at an early age, they will show interest when they graduate from High School and have a clear idea of what they want to study, where, and how to start.

Through this study the author will explain what motivated her to initiate this project, the steps and considerations taken to make the effort feasible, current efforts, and the future work that can be done to contribute to the solution. Dr. Miriam Pabón, Dean of the Graduate School at Polytechnic University of Puerto Rico has been an important role model that has highly motivated the author by developing activities that promote cybersecurity and STEM education among young female students. The interest of Dr. Pabón and the author on this topic has continued to grow exponentially as

more activities are being developed that involve the communities of interest.

Apart from the effort done through this study, the author has participated actively in prior activities that have been done at the local level in Puerto Rico (many with Dr. Pabón), impacting many groups of young ladies. Through these activities the author has gained an important insight that has led her to a passion for increasing the participation of young women in cybersecurity careers. Some of these activities are repeated each year (and will continue to be done yearly) to promote cybersecurity among young ladies in Puerto Rico.

The Ladies Can Code Camp is a one-week long activity that has been done for the last three years at Polytechnic University of Puerto Rico for young ladies from Intermediate Schools [3]. It has already impacted a total of 80 young girls in these three years and is expected to impact many more. It has been a joint effort of Dean Dr. Miriam Pabon and federal organizations that have provided funding such as the NSF and the NSA. It focuses on the area of cybersecurity and is for girls between the ages of 12 to 14 years old. It has been successful at bringing a hands-on approach through camp activities and workshops that appeal to their ages and interests. It has even included workshops for teachers, where women teachers have been able to participate in these teacher workshops with the purpose of teaching cybersecurity awareness, showing their students about the career opportunities available, and the knowledge and skills obtained in these activities. Some of the topics covered by students and teachers are: the Internet, Social Engineering, Viruses and Threats, Cyber Defense, among many others. Topics are revised to include new topics each year.

STEM Nights is another activity being held yearly for students of K-12 hosted by PUPR. It has the aim of presenting young students with STEM fields and career information and increasing their interest and concerns for these areas of study. Hundreds of students participate each year in this activity. The author has also participated with Dean

Pabón and other female students and staff in visits to Casa Rafaela Ybarra in Hato Rey, reaching homeless young ladies that need this type of orientation to find purpose, a meaning to their lives, and to convince them to continue studying in careers that can change their lives significantly. STEM fields and their relation to cybersecurity is strongly promoted in these activities due to the great demand and the gender gap that exists in these fields. During several months the author developed activities at 5 local intermediate and high schools where data was collected from 213 young girls ages 13-18 years in Puerto Rico (Metropolitan Area). A questionnaire was used to collect information about these students' knowledge and previous experiences related to cybersecurity and their interest in the field. The questionnaire also included demographic and personal data.

The main objective of this study was to investigate how to increase the interest and knowledge of these students on the topic of cybersecurity and to promote cybersecurity awareness among high school girls in order to increase their interest in cybersecurity related professions before they start college. This project developed activities and gained insight by collecting information on these girls to be able to conclude what is the best way to increase the participation of young women in cybersecurity. The activities that have been done up to now have been of great help to increase the authors experience on the topic and have provided the author with the required knowledge to focus the effort of this research in the right direction.

The support from Dr. Miriam Pabón, Dean of the Graduate School at PUPR contributed greatly to the author's research, based on the recent activities in cybersecurity awareness and education that are currently being done for young ladies and teachers at the local and national level. The GenCyber Ladies Can Code Activity held at Polytechnic University of Puerto Rico is one of the main efforts being done in Puerto Rico and at a National level.

PROBLEM STATEMENT

According to the study "Women in Cybersecurity 2017" [4] there is a strong gender gap, women only represent 11 percent of the total cybersecurity workforce (Women's Society of Cyberjutsu). One of the basic questions asked is: Where are women in cybersecurity?

The presence of women in the area of technology and cybersecurity is scarce, missing out on the characteristics that women usually have, such as creativity, perseverance, and sensibility to human issues [5]. The lack of women in this sector could be due to various reasons, for example: widespread ignorance, and the lack of: inspiration, motivation, awareness, knowledge and skills (education), among others. What is truly affecting their participation seems to go beyond the stereotypes of the lack of overall acceptance of women in the sector [6]. These could be young ladies in sixth grade to twelfth grade, while they are still deciding who and what they are going to be; or could be women currently in universities or part of the workforce. But they still have their doubts about whether they have the ability or vision to excel in their careers and be efficient and effective enough to move on to more specialized fields and professions. They have not yet achieved their full potential. We need to encourage these women and young girls to pursue STEM and cybersecurity related careers that are of great demand [6].

Most of the young women that were impacted by the cybersecurity activities currently being done at PUPR or through this study had never met a woman who works in cybersecurity. This means that they don't have the required female role models to look up to and be successful in this and other related fields. In addition, many were unaware of the great demand for cybersecurity careers, what these careers are all about, and how they can start to learn and relate these skills to their everyday activities in this technology-oriented society. For years, this has been a challenge for colleges and companies in related areas when it comes to attracting female talent.

Many young women are intimidated due to the lack of knowledge and skills in the area, or because they have no idea on how to obtain these skills, or simply don't dare to. This is part a misconception that this field is only for people that have keen programming and/or computer science skills, when in reality cybersecurity organizations need different professional profiles, and are willing to train in the areas that are most related to the occupation or specific tasks of the position. Due to lack of encouragement, women have questions and doubts about whether they have the correct specialized ability or business vision for excelling in the profession. We should encourage and advise women at young ages and promote young girls to pursue careers in technology fields that are of great demand. These girls could well be our future college students in Computer Science and Cybersecurity education, and the future professionals. Motivating and retaining them is crucial for recruiting and maintaining the number of women in higher education in the area of cybersecurity.

PROJECT GOAL

Four principles are comprehensive towards the project's goals. See Figure 1 below:

1. Inspire: Encourage and develop positive attitudes towards cybersecurity careers
2. Educate: Share information on specific career paths and training opportunities
3. Recruit: Create opportunities such as Scholarship programs and certificates that can help to educate and prepare the next generation of cyber warriors in technical fields
4. Retain: Provide mentoring programs to retain students and transition them into the workforce.

These goals will be accomplished by:

- Researching for methods that are proved to be effective and efficient in helping to increase the participation of young women in cybersecurity education and research.

- Introducing cybersecurity awareness activities at the early stages of the young ladies' educational and social endeavors:
  - Create workshops for cybersecurity awareness in and out of schools.
  - Develop cybersecurity modules that teach them the basic concepts at the early stages, for the Intermediate and High School curriculum.
- Educating on cybersecurity careers among young ladies:
  - Continue to develop and support extracurricular activities that help young ladies gain an insight on cybersecurity related careers and how to continue studies in the field.
  - These outreach activities open the door to many young women who would have not previously considered the cybersecurity field as a career opportunity.
- Encouraging interest for cybersecurity starting from early grades at school.
  - It is important that adolescent women find interest in technology related careers in the early stages (Intermediate and High School) to obtain a college degree.
- Closing the gender gap by interviewing and interacting with other women who are currently working towards these goals in Puerto Rico and the United States.
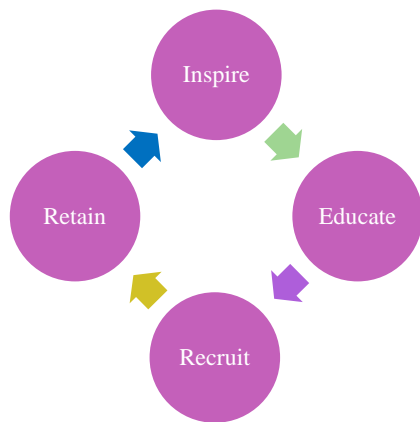

Figure 1
Steps to Increase Young Ladies' Participation in Cybersecurity

PROJECT QUESTIONS

These are some of the project questions that will be answered throughout the study:

- How can the participation of women in cybersecurity education be increased?
- How can young women be motivated to study cybersecurity?
- How can more young women be attracted into cybersecurity careers?
- Are there resources for mentoring women in cybersecurity education and careers?
- Do organizations exist to teach young women cybersecurity topics?
- How can we motivate young women to pertain to different cybersecurity associations and organizations?
- How can negative stereotypes be changed in a way that can increase the interest of young women is cybersecurity careers?

RELEVANCE AND SIGNIFICANCE

This study can help to fill the gender gap in cybersecurity and lead to greater opportunities for women by helping to leverage their skills and strengths. By tackling discrimination (that on some occasions is self-imposed), the cybersecurity field must to be tempting for both men and women, as the demand and salaries are projected to continue rising significantly [7]. Although most men in the field would welcome and encourage women to enter the field, many young and talented women choose to enter fields where they're better represented [8]. Fortunately, research is being done in the field and solutions such as those investigated in this study (isolated steps and national efforts) can lead to big changes that benefit women in Puerto Rico and the Nation. The time is perfect to support this effort; in order to be able to fill the demand for jobs in the field, women will have more and more opportunities, proving to be essential in fulfilling the need for more cybersecurity professionals. The need is obvious and finding women who have knowledge and skills would be significant in the

solution to fill top cybersecurity positions in academia, government, and the industries, where they are in great demand. This is what motivates the interest in Puerto Rico and the United States (the effort is also world-wide) to educate young girls and recruit them to study and follow STEM and cybersecurity related careers [9].

BARRIERS AND ISSUES

The urge to boost young ladies into the field of cybersecurity has its barriers and issues. From one perspective, there is one lady for each nine men in cybersecurity related jobs [10]. Ladies who work in the field of cybersecurity do not earn as much as men, and do not occupy significant positions that are well remunerated. At large, a cybersecurity proficient female is paid 3% less than a male co-worker [10]. Many don't have the required female role models to look up to. Others are unaware of the great demand for cybersecurity careers. Many young women are intimidated because they have no idea on how to obtain knowledge and skills in the area. Attracting female talent is not an easy endeavor for academia, government, and the industries. This lack of encouragement brings questions and doubts. Motivation is crucial for recruiting and retaining a significant number of women in the area of cybersecurity. Some of the main barriers and issues encountered by young ladies are:

- Cultural issues (especially in Puerto Rico) that still exist.
- They still believe they have unequal growth opportunities compared to men.
- They hear about the gender bias at different workplaces.
- Lack of woman mentors.
- Lack of female role models in the field.
- They recognize themselves as an underrepresented group.
- Lack of career orientated outreach activities.

The author believes that organizations should take measures to promote the cybersecurity profession among students, young ladies, and professional women. One of the measures that could be taken is to promote cybersecurity education at Elementary, Intermediate and High Schools, in addition to offering workshops, summer camps, internships, and summer jobs for girls interested in the field.

BRIEF REVIEW OF THE LITERATURE

Literature research was done to investigate the challenges and opportunities facing YOUNG women IN the cybersecurity profession. According to a study published earlier this year female employees are vastly under-represented in cybersecurity, making up only 11 per cent of the global information security workforce and 10 per cent in the region [11]. More than half of women in cybersecurity have experienced some form of direct or indirect discrimination, compared to 15 percent of men [12].

Author G. Nott states that "Barriers to girls and women commence early from primary school and continue throughout women's careers to the executive levels. Barriers also exist at all stages of the employment life cycle, from recruitment to career development and performance management, culminating in women leaving the industry" [11]. Although cybersecurity is a critical IT area, women continue to be underrepresented.

Another study of women in cybersecurity professions examined the required skills, existing challenges, and key success factors for women in the field [13]. The report states that increasing women's participation requires a "systemic and organizational change". It suggests arousing the interest in IT careers in the school and family environment. Although still a minority, today we can find examples of women professionals who have excelled in the IT sector and specifically in cybersecurity. Publishing their research and experiences can be another way to inspire young women who are in the process of opting for a professional career.

Research suggests that these social and cultural barriers can be diminished or overcome by effective

role models, mentorships, and scholarships [14]. In addition, there are currently other life-changing events for women in cybersecurity, such as the Women in Cybersecurity Initiative, Grace Hopper, and Cyberjutsu, which are excellent for networking and supporting women and students entering the field.

The author believes it is essential to interest young people and underrepresented groups in the diversity of STEM fields. This brings new ideas and new ways of doing things, including different approaches and different backgrounds. As an anecdote, the author participated this year in a conference for women WiCyS (Women in CyberSecurity) held this year in Pittsburg (2019). The students who assisted had the opportunity to meet with professionals, discuss their curriculums, get interviewed, and ask questions. Most striking to the author was the unique opportunity for students to sit down with women mentors and professionals in the field, discuss their careers, future goals, and receive all that input with people who have already succeeded and can share their experiences. This was very meaningful to all participants, including the Author.

METHODOLOGY

The author visited the following Intermediate and High Schools: Specialized School of Science, Mathematics, and Technology; Holly Spirit College; Perpetuo Socorro Academy; Rosa-Bell College; and San Benito College. She gave presentations and talks on various topics of cybersecurity such as: Virus and Threats, Social Engineering, and basic areas of: Digital Forensics Analysis, Cyber Defense, Cybernetic Operations, Cryptology, Machine Learning, among others. A total of 10 School Directors and teachers were educated on the topics that were going to be presented. A total of 213 young girls were impacted by the activities from ages 13-18. Of these young ladies a total of 213 participated in a survey that gathered information on demographics, experiences, and interests in cybersecurity.

The main steps taken to develop the methodology of the active research done by the author in this project started by going to schools to talk with professors and/or teachers about the research work and explain that the author's main goal was to obtain information on how to increase the number of young girls interested in careers in cybersecurity. A letter was made to obtain the required permission from the Principals to visit the schools and give a cybersecurity outreach activity titled: "How to increase the participation of girls in cybersecurity activities". This included a presentation, awareness activities, information on career and educational opportunities, a survey, other general information, and the authors experiences at PUPR as a participant of the CyberCorps NSF-SFS Scholarship. The survey measured the interest and knowledge in basic cybersecurity of approximately 213 participants. The author's interest in this topic grew as she continued to develop and deliver the different activities. To be able to go to the schools to give talks, and thus be able to expose these girls to topics related to the cybersecurity field was exciting to the author. The author always encouraged the girls; she never underestimated the influence of this simple effort and the overall approach taken. The importance of young women in STEM and particularly in cybersecurity was stressed.

The methodology included the following steps:
1. A letter was made and sent to the principal or relevant person in the schools. They accepted.
2. The author talked to school officials about the need to offer education in cybersecurity.
3. The author talked to the girls about why they should consider a career in cybersecurity.
4. The author talked to girls and other school personnel about unconscious biases and how to deal with them.
5. Girls were presented with early experiences in technology and cybersecurity. They were presented with several specific topics: Computer Science, Cybersecurity, VPN, Phishing, Virus, Passwords, QR Code, and CTF.

6. A presentation on cybersecurity was delivered to young girls at the High Schools. The PowerPoint presentation was about the authors experience in the CyberCorps NSF- SFS Scholarship, the GenCyber activities, how to participate, and succeed in cybersecurity careers.
7. After the presentation, the girls were given two challenges (exercises) which had to be done and then discussed, the topics were: Pigpen Ciphers and Cryptography.
8. A survey on cybersecurity was delivered to the girls. This survey measured their interest in cybersecurity.
9. A review was done of the collected data. The data was summarized to obtain the findings.
10. The findings of the data were analyzed. The results of the survey included responses from approximately 213 participants.

For the questionnaire tool a search was made. After analyzing the various survey platforms it was decided to use the Google Form for the survey. This platform is very easy to use and effective, data can be migrated to Excel where data can be extracted, and the information analyzed. Questions asked in the Cybersecurity Questionnaire:

- Age
- Grade
- Did you know what cybersecurity is?
- Do you have a smart device?
- Which browser do you usually use?
- Can you identify a secure password?
- Do you have antivirus software installed on your device?
- Could you identify a phishing attack?
- What theme was the one that most caught your attention?
- Does a VPN minimize the risk of using insecure WI-FI networks?
- Would you like to study cybersecurity?

ANALYSIS AND INTERPRETATION OF RESULTS

The objective is to analyze and interpret the information obtained in the surveys and present a graphical representation of the data that allows the author to present the results more effectively. For this part of the data analysis, Excel was used because it is one of the most manageable data analysis and graphic tools on the market. The analysis of this research is done through descriptive statistics since each question is analyzed and results are presented graphically. The graphics used are Pie Charts. The following results were obtained for each question in the student questionnaire:

In general, a total of 213 young girls were surveyed. All of them (100 %) were High School students from ages 13 to 18.

Demographics

- *Age:* From a total of 213 girls, 3.3% is in the range of 18 years old, 12.7% is in the range of 17 years, 33.3% is in the age range of 16 years, 21.1% is in the age range of 15 years, 20.2% is in an age range of 14 years, and 9.4% is 13 years old. The age groups were well divided, as almost half were from 16-18 years old (46%) and the other half from 13-15 (54%). See Figure 2 below:
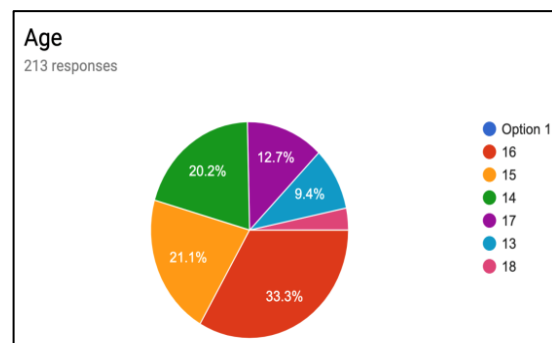

Figure 2
Percentage of Each Age Group

- *Grade:* Of the total of 213 girls, 8.9% percent are in Grade 12, 28.2 % are in 11th Grade, 30.5 % are in 10th Grade, 20.2 % are in 9th Grade, and 12.2 % are in 8th Grade. The biggest age groups were 10th and 11th grade. (58.7%). Very significant grades where they are in the process of defining their interests and careers. Most of the 8.9% from 12th Grade usually have already defined their career interests. Please see Figure 3 below:
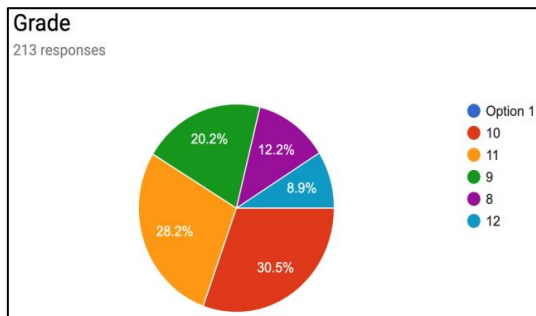

Figure 3
Percentage from Each Grade

Knowledge in Cybersecurity

The following survey questions permit us to know what the girls know about basic cybersecurity:

- *Do you know what cybersecurity is?* Of 206 responses, 66.5% knew what cybersecurity is, the other 32.5% did not know. A very low percentage was not sure (only 1%). Seven did not respond. It is very significant to the study hat 66.5% already know what cybersecurity is. See Figure 4 below:
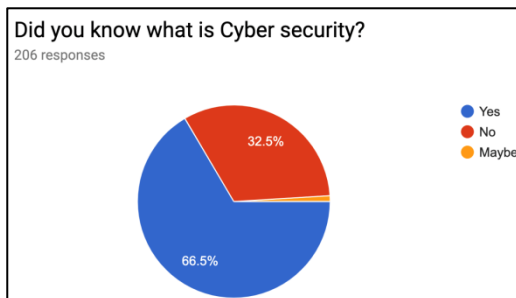

Figure 4
Percentage that Know What Cybersecurity Is

- *Do you have a smart device?* Of the 213 responses all have smart devices, even if they

are of different categories, 42.3% have cell phones, 31.1% have laptops, 21.5% have tablets, 3.7% have consoles and 1.4% have other devices. All the respondents are conscious of technology, as they use smart devices of all sorts. See Figure 5 below:
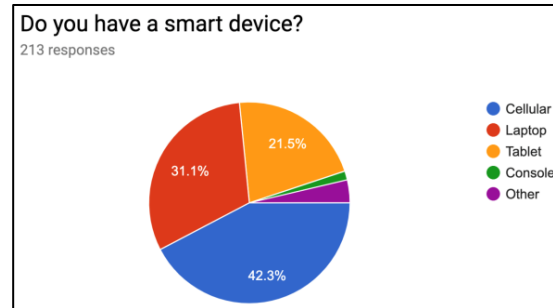

Figure 5
Types of Smart Devices Girls Have

- *Which browser do you usually use? Of the 213* responses, most use the Google browser (88.5%), 7.3% use another browser, 3.4% use Firefox and the other 0.9% use Mozilla. See Figure 6 below:
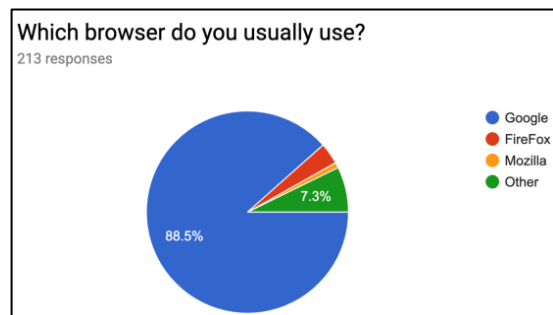

Figure 6
The Browser Most Used Among the Girls

It was notable to observe that all respondents know what a browser is, and that most use the most recognized and functional browser available, that is Google.

- *Can you identify a secure password?* Of the 209 responses, 82.3% of girls can identify a secure password, and 17.5% cannot identify a secure password. Four did not respond. It is good to know that most of the girls already recognize what a secure password is. See Figure 7 below:
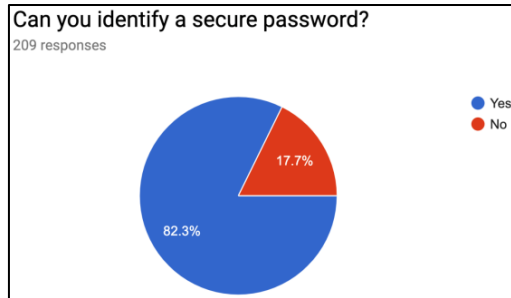
Figure 7
Percentage That Can Identify a Secure Password

- *Do you have antivirus software installed on your device?* Of the 212 responses, 48.6% have antivirus software installed, 32.1% don't know, 17.9% do not have, and 1.4% are not sure. One did not answer. Only 32.1% don't know if they have antivirus software installed. All the rest seem to recognize the use of antivirus software. See Figure 8 below:
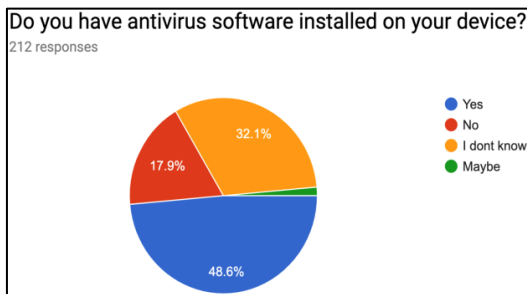

Figure 8
Percentage that Have Antivirus Installed

- *Can You Identify a Phishing Attack?* Of 213 responses, 51.2% indicated they could identify it, 29.1% answered they could not, and 19.7% were not sure. See Figure 9 below:
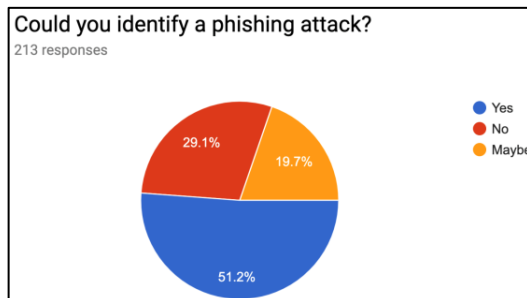

Figure 9
Percentage that Can Identify Phishing Attacks

It is impressive to observe that more than half can identify a phishing attack.

- *What topic most caught your attention?* Of the 212 responses, 32.7% answered that the topic on passwords, 24.6% the topic on Phishing, 21.4% the topic on viruses, and 21.4% on VPN. It is evident that these girls are technology oriented and know about cybersecurity in their daily lives because they seem to understand the topics well in order to answer this question as they did and see Figure 10 below:
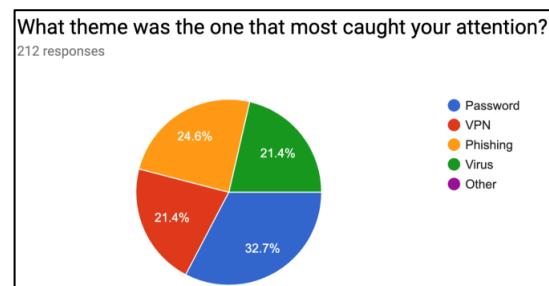

Figure 10
Topic that Most Caught Girls Attention

- *Does VPN minimize the risk of using insecure WI-FI networks?* Of 212 responses a total of 94.8% answered yes, 4.2% answered no, and 0.9% answered maybe. See Figure 11 below:
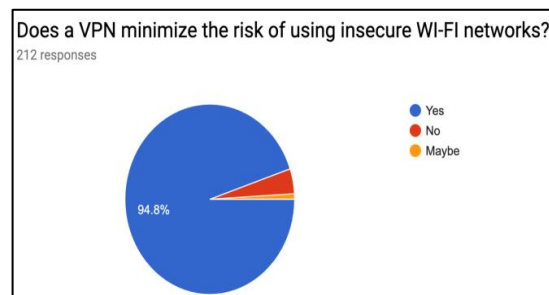

Figure 11
Girls That Consider that VPN Minimizes Risk of Using Insecure Wi-Fi Networks

These girls were very receptive to the topics covered in the activity as before the activity many did not know what a VPN was. Yet they demonstrated that they were receptive and interested in acquiring knowledge on cybersecurity topics through their answers.

- *Would like to study cybersecurity?* Of the 213 respondents, 53.5% answered no, 28.6% said maybe, and 17.8% answered yes. Even though it seems from the last question of the survey

data that few girls are interested in studies in cybersecurity, we have to consider that if 38 of every 213 girls that go to college enroll in cybersecurity related studies that would represent a significant increase in the quantity of females in the field. See Figure 12 below:
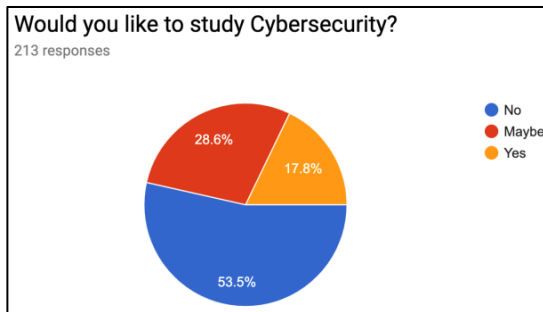

Figure 12
Percentage of Girls That Would Like to Study Cybersecurity

We need to consider that an increase in awareness and other activities that are recommended in this study will lead to an increase in the number of girls interested. We need to continue motivating these girls, educating them and making them aware of the benefits of studying cybersecurity. This would have a significant impact on participation of women in cybersecurity.

RESULTS AND DISCUSSION

The author visited five Intermediate and High Schools and gave presentations and talks on various topics of cybersecurity to 213 young girls ages 13-18. A total of 10 School Directors and teachers were briefed on the topics that were going to be presented. All of them, including the young girls showed great interest in all the activities. The girls were given a survey that gathered information on demographics, experiences, and interests in cybersecurity.

The lectures were effective in teaching specific concepts related to data science, ethics, phishing, VPN, viruses and passwords. With longer workshop sessions, we could add more practical components. In this way, students can obtain more visual exposure and experiential learning opportunities. Modular topics can help them understand the topics better. While students have

the option of downloading a software tool related to cybersecurity at home by themselves, they may not get the guidance and instruction needed to make the most of it on their own.

More tools must be provided to inspire, teach, motivate, educate, recruit and retain girls. To increase the participation of young women in the area of cybersecurity we need to create new strategies. Pipeline strategies are a thing of the past. We need to collaborate and dedicate efforts to increase women in the area of cybersecurity.

They can also be inspired to compete in Capture the Flag (CTF) competitions as their knowledge increases. Additionally, school trips to government and private facilities that deal with cybersecurity can be organized. Self-learning is always an option. We also need to motivate young girls to learn through the Internet, where there are free and available materials that they can use to educate themselves online. Summer cybersecurity camps for students developed by public and private organizations for children and teenagers are great for acquiring knowledge and skills.

Young girls are becoming more receptive to STEM and cybersecurity fields. Schools and universities should emphasize on the field and its applications. Programs that promote technology for young women and girls should be encouraged. An excellent example is the GenCyber Ladies Can Code Camp, that promises to increase the number of women in IT and engineering. By educating young ladies in cybersecurity issues we help to:

- Reduce the gap in the cybersecurity workforce
- Understand the barriers facing the cybersecurity profession
- Discover solutions that help to lead these talented young ladies to excel in a related profession.

With the increase in the frequency and variety of cybersecurity incidents and attacks affecting our society, it is essential to establish an approach to integrate cybersecurity into Intermediate and High School education. We need to develop a strategy that helps to relate cybersecurity to the everyday

activities away from school and to the different classes that are part of their education. One of the approaches is to provide undergraduate and secondary students from underrepresented groups (women) with mentors and role models that can increase their interest in cybersecurity, help them define their professional goals, and subsequently, improve their performance in science and math courses that are critical for careers in Computer Science. The interest in this topic continues to grow as more activities, and collaborations are developed that involve the communities of interest. Some of these activities that have been very successful in this endeavor at the local level are: Ladies Can Code Camp, which focuses on the area of cybersecurity for girls between the ages of 12 to 14 years, STEM Night for students of K-12, with the aim of presenting STEM and increasing interest and the concern for these fields, and activities with Casa Rafaela Ybarra in Hato Rey.

There is a need to leverage collaboration and social skills in these activities by creating teams and providing more opportunities to build more communities of interest. We need to reduce intimidation by creating an environment where the less technical are not intimidated by the "know-it-alls." We also need to provide personalized training to help evaluate each individuals strengths and weaknesses and customize a training program. Cybersecurity education has to be more accessible in schools at the early stages. More visits need to be done to intermediate and high schools, and plan awareness day activities, workshops, conferences, etc. More subsidies such as scholarships and incentives that compensate studies, books and trips for meetings need to be provided by local and federal entities. There are actually about 10 grants available for women (NSF, Military etc.). We need more seminars to raise general awareness of cybersecurity and safe online behavior of high school students, showing the need to increase diversity in the US cybersecurity workforce. We need to talk to school officials about the need to offer education in cybersecurity. We also need to talk with the girls about why they should consider a career in cybersecurity and the unconscious biases and how to deal with them. Encouragement at all times. Never underestimate the power of this simple effort.

RESOURCES

During the activity, the girls were recommended to register, read and look for information on the following Associations for women in the area of cybersecurity, since they are very good at helping, motivating and teaching women to study this career. From her experience the author considers them very good associations, since she is enrolled in several of them and has participated in the conferences which have helped to empower her, optimize her resume, and find jobs, among other things. Some of them are free, while others have required a membership fee of no more than $ 35.00 dollars. The majority of these are non-profit organizations, focused on increasing the presence of women in the cybersecurity workforce by eliminating the obstacles that disproportionately affect women. Some have volunteers and help other women to grow in the field. For example, WSC's mission is to promote women in cybersecurity careers by providing programs and partnerships that promote hands-on training, networking, education, mentoring, resource sharing and other professional opportunities.

List Of Women In Cybersecurity Associations:
1. The Executive Women's Forum (EWF) serves female executives in security, risk management and privacy.
2. The League of Women in Cybersecurity (LoWiCyS) is a non-profit organization focused on helping to fill the cybersecurity workforce gap by increasing the percentage of women in the field.
3. Women in CyberSecurity (WiCyS) was launched in 2013 with support from a National Science Foundation grant.
4. Women in Defense (WID) — incorporated in 1985 and an affiliate of the National Defense Industrial Association (NDIA)

5. Women in Security and Privacy (WISP) promotes development, advancement, and inclusion of women in the cybersecurity field.
6. Lisa Jiggetts is founder of the Women's Society of Cyberjutsu (WSC), a nonprofit for women in cyber. Cyberjutsu sounds like a martial art.

CONCLUSION

In summary, through the activities the author was able to make the students interested and aware of the issues of privacy and cybersecurity. Data-driven decision making is an important part of our daily lives, and we want our young people to understand how it affects them. The motivation to acquire skills and technical knowledge related to cybersecurity will help our future generations to grow academically, professionally and personally. The girls have received a set of skills ranging from computer science, programming, cryptography, phishing, secure password, and many others. This experience has equipped them for a future where all these skills are valued, and that will give them an advantage over other students. Among them are future scientists and engineers that the world needs to guide us towards the next technological revolution, cybersecurity. The author is proud to be a part of this movement to: inspire, educate, recruit, and retain young ladies into the cybersecurity field.

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