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Towards a Global Virtual Community of Female Engineering Students and Professionals: II. Overview of Leadership Camp for Liberian Undergraduate Women Studying Engineering

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Towards a global virtual community of female engineering students and professionals: II. Overview of leadership camp for Liberian undergraduate women studying engineering

Abstract. A two week residential leadership camp was carried out in Liberia in August 2015 by five University of Michigan graduate students for thirty Liberian and five U.S. female undergraduate engineering student participants. The goals of this leadership camp were twofold: (i) to empower the Liberian and U.S. women engineers with the skills, support, and inspiration necessary to becoming successful and well-rounded engineering professionals; and (ii) to strengthen the community of female engineers in Liberia by building cross-cultural partnerships among female engineering students resulting in a global network of women engineers. The leadership camp was developed based on continued collaboration between the University of Michigan and Liberian Society of Women Engineers student organizations; their identification of specific Liberian engineering undergraduate women's educational needs; and studies emphasizing and elucidating needs specific to female undergraduates in Liberia, and moreover, undergraduate students in war-torn countries. This paper will present a programmatic overview of this camp. Additionally, this paper will present preliminary data gathered by semi-structured interviews and focus groups with Liberian undergraduate engineering women on the need for and benefit of such an international community. The leadership camp will build on these results, and continue to be held over the coming years to strengthen the partnership between the two organizations and to continue supporting the Liberian students as they persist in the engineering profession.

1. Introduction

The need for strategies to empower Liberian women is exemplified in the recent study carried out by ActionAid International, which examined the state of Liberian undergraduate women in urban areas. The results show that these women often face sexual intimidation by faculty and instructors, women are often excluded from student organizations, there exists a lack of institutional support for female organizations at the universities, and that the women do not feel safe in the university due to low security standards[1,2]. The situation is even direr for the female engineering students with less than 10% of the engineering student population being women[3]. Furthermore, there is only one female engineering professor within the Division of Engineering at the University of Liberia. Thus, women are quite isolated in their engineering studies with minimal role models and professional support as they persist.

Most recently, the Liberian undergraduate women endured the traumatic Ebola outbreak that occurred in Liberia in 2014. As a result of the Ebola outbreak, schools were closed and Liberian students' schooling was put on hiatus for over a year, which was in addition to the personal losses many of the students experienced as a result of the outbreak.

As a means to support the persistence of Liberian women in engineering and to counter these obstacles they face daily, the University of Michigan has developed a peer-to-peer partnership between the collegiate section of the Society of Women Engineers student section at the University of Michigan (UM-SWE) and the newly-formed Liberia Society of Women Engineers (L-SWE) student organization. This partnership recently resulted in two strategic activities carried out in Liberia during June and August, 2015, respectively: (1) a Networking Dinner for

40 undergraduate engineering women and 25 professionals in the Monrovia, Liberia area, and (2) a two-week leadership camp for thirty undergraduate engineering Liberian women and five University of Michigan women carried out by five graduate engineering women from the University of Michigan. Details on the influence of the Leadership Camp on the UM-SWE participants can be accessed in an accompanying paper titled "Towards a global virtual community of female engineering students and professionals: I. Impacts of grassroots international partnerships of student organizations on U.S. engineering undergraduate cultural competency," also presented at the ASEE 2016 Conference[4].

2. Background

The partnership between the two organizations began in 2013 as a result of the formation of L-SWE. L-SWE was formed under the mentorship of graduate students from the University of Michigan who were in Liberia teaching some of its founding members through a USAID-funded co-curricular program designed and implemented by the University of Michigan[5]. After the establishment of L-SWE, the graduate students from the University of Michigan saw a unique opportunity to develop a peer-to-peer partnership between UM-SWE and L-SWE. The partnership was envisioned as a mutually-beneficial collaboration as the UM-SWE members would gain a unique cross-cultural opportunity to support peers internationally and as a result develop their global competency that contributes to their professional development; and the L-SWE students would have an international peer support group from the UM-SWE section invested in their persistence, able to advocate on their behalf internationally to SWE and potential corporate sponsors, and with access to relevant technology and resources to be circulated and disseminated to L-SWE. The primary mechanism of this new partnership was envisioned as a two-week Leadership Camp entitled Setting Up Collegiates for Careers in Engineering through Social Support (L-SWE SUCCESS) to be carried out in Liberia.

The L-SWE SUCCESS Program was originally to be carried out in August 2014; however, due to the Ebola outbreak, its execution was postponed. While all members of the L-SWE organization survived this outbreak, many of their family members did not. Furthermore, all of the L-SWE members had been out of school for months, causing a severe discontinuity in their education and threatening to break the already fragile L-SWE network they had strived to develop since 2013. Thus, the UM-SWE section has the capability of serving as a supportive partner to the L-SWE team--both academically and personally--as they continue to recover from the aftermath of the Ebola outbreak.

3. Preliminary engineering education results

Underlying the partnership between the UM-SWE and L-SWE organizations has been qualitative engineering education research in which semi-structured interviews and focus groups have been carried out with L-SWE members to elucidate specific voids they are facing while they persist in engineering, and what specific support the UM-SWE section might be able to provide them. The results from these interview questions serve as the motivation behind the two activities carried out this past summer and described in greater details at the end of this paper.

3.1 Methods

A group of four members from the University of Michigan travelled to Liberia in June 2015 to check on the prospects of carrying out the camp later that summer. While on this trip, the team carried out semi-structured interviews with twelve Liberian undergraduate women in engineering from two universities in Liberia (University of Liberia, Stella Maris Polytechnic). The interviews consisted of questions regarding the students' motivation for studying engineering, how they utilized their peers for encouragement, their professional outlook, their university climate, and the influence of the Ebola outbreak. Each interview lasted approximately one hour in time.

3.2 Preliminary Results

Results of the semi-structured qualitative interviews carried out with the Liberian students revealed themes that prompted the various components of the programs that were later implemented by the University of Michigan.

3.2.1 Lack of role models/ mentors

Many of the Liberian students expressed a lack of female engineering role models:

> "I want to know how I can network with professionals. I want to know how/where I can find internship/volunteer opportunities, I would like to have some experience every year. I want to know what I can do to help my student community."

> "Inspired yesterday at the [networking] dinner. Whenever you guys come, we talk about PhD, I want to be there, get PhD. I get inspired. I want to study. I am quick at getting distracted. When you come, I get back on tracks. With L-SWE you want to be one of the people. Yesterday at the dinner, you don't know people have the same vision as you…. they don't know they have people that can do it. Major boost for me."

> "Already have role models, when you guys came around. Summer start, the idea of getting a Master, I thought I want to be like them. You guys wanted to get a PhD but still take time to help other people, you guys are a great motivation for me."

> "I really need a mentor, somebody to guide me through. Because the more advice you get, the stronger you become. If you are left alone, you will make more mistakes. If somebody is always on your back telling you to do the right thing, you will become stronger. I need somebody that will always talk to me because at times the challenges are there. If the person is there, you will at least know that you have someone to come to."

3.2.2 Discouragement from male professors/peers

The female engineering students described blatant discouragement they often encounter from their male peers and professors.

> "Work on homework every day. I work during nights. Conference calls with cell phones. Try to study with guys, but they ask to sleep over at their place. Don't want to do that, I don't trust them. Best to have a conference call, phone on speaker. If can't ask teacher, go on the internet. If no internet, ask friends."

"Don't care. I want to stay by myself, I don't want to depend on male students. The instructors think the females depend on the males to survive. You have to prove the teachers wrong, study hard, so females can do better than the male students."

"Instructors feel that the guys know more than the ladies. They say that ladies you see in this class today they are just trying but you the men, you have to really work hard."
Interviewer – "does it happen in more than one class?"
"Most instructors say that. So for the ladies, if we know something, we call and talk to our friends, very hard to go on the board practicing. Most days, the male students will do that, during classes or during tutoring sessions. But no girls do that."

"In one of my class, the women students are brilliant but afraid to ask questions. After class they go to other women students but never during class. They are also afraid to ask the instructor questions. They prefer to ask other women students."

3.2.3 Lack of practical hands on experience

Additionally, the Liberian students describe their engineering education system as lacking in practical activities and laboratories, which they have recognized is far different and inferior to the experiences of their international peers.

"Hands on materials, more of the practical material. It will help you more than what we learn in class. We don't have it here. Teachers tell us about concrete, mortar, have to draw a picture or go on the internet to find other people reports. Stress and strain, trusses, all that from internet. If we had a lab, would not need to go to the internet. It would be my own work if we had a lab. Would stay motivated.
Your peers, they know to do things with their hands, if you travel to go for a master, it will help. Not if you stay here."

"But, we have so many differences. Yea, because thing that you do when it comes to the practical aspect. Theoretically, we can discuss but when it comes to the practical aspect, you can beat me down. Because here we don't do the practical. Like the geology course I am doing, we aren't doing the practical. People in the states do practical like field trip and theoretical aspect. Here we only do the theoretical aspect."

"They are more sophisticated and have technology available to them. We do not have any labs in our curriculum. They are more hands-on."

"When my cousin came from China. She said that for us in this country we hear the name for tools but never see them because we don't have a good lab in this country…. For other people, they know the theory and practical. But when you are from this country [Liberia] you know the theory but you don't know the practical. You know the name of a transformer but you haven't actually seen it yet. So you do not know it."

3.2.4 Broader vision of being an engineer in the global society

Many of the students interviewed have already critically thought about their international peers, and the subsequent differences in their experiences. Additionally, many of the students expressed a desire/need to continue their education past undergraduate specifically because of deficiencies they have recognized.

> "Stella Maris is the only institution that offers architecture, not an engineering degree but an associate degree. So I passed the entrance exam that's why I was there. Actually obtain a degree to a higher level so I can help Liberia."

> "wish for Liberia to be more like other countries for architecture. If this opportunity can come to Liberia, it will be a good help.
> Stella Maris only offers degrees at the associate level, in other countries, it's at a higher level. If Liberia can also be like that, it will be very good. And we won't need to go outside to find people to do our work."

> When asked about attending graduate school after undergraduate, one student specifically pointed to a lack of laboratories as necessitating her desire for further education:

> "Would love to start with 6 months, lab internship. Don't want to start over. To learn the applications of what I studied. Labs more practical, technical drawing for 2 or 3 months. Go get ideas from other countries, learn different methods from other countries. Want to learn technical stuff. I feel that I didn't learn enough in class, tutors explanations but not the full part."

3.2.5 Lack of books/internet access

Many of the students described their lack of books and poor internet access as being limiting to their education.

> "...or us, we need internet access. Most of us the internet gives us a hard time to do researches. Like I said the books are arcane and there are limited computers. So at times you wait for your friends and when you finish signing up, you friend waits for you and then you have class to go to. So you are supposed to do your assignment today but you have to wait until Wednesday or Friday. The internet business when it comes to books, internet service."

3.2.6 Ebola and motivation

With the Ebola crisis still hovering and influencing their daily experiences, it was not a surprise that the majority of the students were still navigating the trauma they face from the outbreak and its influence on their schooling.

> "I have family all over. Completely broke down. The president said first 90 days and then the lock down. When it got so serious, I forgot about my books, was worried about my family."

> "Wishing family was safe. Upsetting to see the child, and the mom had Ebola and the child had Ebola too. Not enough facilities, they were putting people in the streets. When I graduate I am going to build facilities for everybody in case of emergencies or diseases. People will get a place to stay. Ebola centers were full, better treatment and higher chance of surviving if they have a place to stay. So instead of crying why can't I study [and] do something better for the future."
>
> "I had lost all expectations of graduating on time. I was motivated when I talked with friends … At first I used to study but I lost motivation to study as the days went by."

3.2.7 Need for a supportive community

A few of the students described how the support from their friends, families, and professors have had a clear influence on their persistence in engineering.

> "We call each other if anyone has family problems, my mother passed during ebola and my friends called me a lot and helped me. They called me frequently and consoled me. Back on campus it was difficult for me to complete my semester, but my friends encouraged me and I completed the semester."
>
> "One prof, in a class I took before, I did very well in his class since then, he really likes me. He really encouraged me, he told me, don't leave this place, I see something good coming out of you, and you can do more than this if you put the time.
> I took his advice, I really love science, I really feel fine when I am sitting and doing something with technical. Really do have a passion for it."
>
> Yet, while many of the students were a part of the founding of L-SWE, it was clear from these interviews that the functioning of L-SWE was struggling, and there was still a void in and great need for a supportive community as they persisted.
>
> "No women tutors. We can do it with people from L-SWE team. Everyone that is good can do their specialty. We can have male students, but not equal to female students. Majority of female students. Women always teach an alternative method. Men just want to get it over with."
>
> "Guys don't really care, that's the frustrating part, no girls can be the first. Competition mostly with the female."
>
> "L-SWE has helped build a community among female students at UL. We have one goal, all female students should achieve. L-SWE helps with keeping that goal in mind."
> Interviewer: "Have you met anyone new because of L-SWE?
> "Yes, Denise (pseudonym), Ladies from Stella Maris, Desiree (pseudonym), Favour (pseudonym). All students ahead of me in school."
>
> "I would like to network with other SWE members, members from other countries. An exchange program between members of SWE will be nice. Conferences. I want a SWE conference in Liberia"

One student described how a supportive community can help navigate any information and resources about opportunities they encounter, primarily on the internet.

> "SWE can help with that process ... can help with investigation process. If I am only in school and no one is looking after me, it's possible to fake information, also they can help track you and keep you safe"

One student described the importance of having female instructors they can reach out to.

> "More female instructors it would be a help for us. Because some students, even if you are in school and you have a problem, you cannot go to the male instructors to explain, you will not feel comfortable as a female going to a male instructor to tell them what is going on with you, what is happening, but with a female instructor you can confirm within her and you can explain things to her in that way she can be able to help you out. But there is no female instructor."

4. Programmatic Overview

Based on these interviews, two programmatic mechanisms were developed and implemented by the L-SWE and UM-SWE partnership: (1) a Networking Dinner and (2) the original Leadership Camp that was originally meant to be carried out the year prior.

4.1 Networking dinner

One theme through all of the interviews with the students was the lack of professional role models and a support network with vested interest in their persistence. Thus, while in Liberia during June 2015, the team of four along with L-SWE leadership carried out a "Networking Dinner" for forty Liberian female engineering participants and over twenty professionals from the engineering, NGO, and governmental sectors. The Networking Dinner was envisioned as an event for engineering female students to engage with interested and supportive professionals who were able to encourage them and make connections for potential future opportunities. The evening prior to the dinner, a Networking Workshop was held with the students attending to prepare them for the event and impart them with skills and advice on how to network. The Networking Dinner also served as the launch for the SUCCESS Leadership Camp in August in which many of the professionals and students subsequently participated.

4.2 SUCCESS Leadership Camp

The SUCCESS Leadership Camp was later carried out in August 2015 in Kakata, Liberia as a two-week residential program for 30 Liberian undergraduate participants, along with five undergraduates from the University of Michigan; the SUCCESS Leadership Camp was carried out by five graduate students from the University of Michigan. The SUCCESS Leadership Camp had a workshop-based format with the following themes: (i) academic development, (ii) professional development, (iii) community development (iv) leadership development, (v) engineering design activities, and (vi) student organization development. The activities

developed and taught by the University of Michigan graduate students for each of the themes can be seen in Table 1.

Table 1. Overview of workshops carried out at L-SWE SUCCESS Leadership Camp in Aug. '15.

Theme	Corresponding workshops/activities
Leadership development	Personality testing Leadership styles Goal setting Identifying values Identity Communication skills
Community development	Conflict resolution - individual Conflict resolution - cross cultural Constructive communication Gender dynamics in engineering Imposter syndrome Stereotypes and micro-biases affecting underrepresented populations
Academic development	Overview of graduate school Graduate student panel Personal statements Extracurricular activities Professional panel of professors Overview of research Research presentations
Professional development	The job search process Resumes Cover letters Professional panel of female engineers Networking skills Mentorship
Engineering design activities	Delta Design activity[6] Bottle rocket design competition Cellphone battery charger
Student organization development	Goal setting for L-SWE Best practices for sustaining organizations Elections for L-SWE officer positions Becoming a SWE section

In addition to the above activities, microSD cards were purchased and given to each of the camp participants. The microSD cards were loaded with the materials from the camp activities, as well as open source notes, textbooks, and materials related to the students' university courses. The

idea for these microSD cards was developed due to the lack of resources at the students' respective universities, and their inconsistent and often expensive access to internet. Additionally, as cell phones are prominent in the students daily lives, microSDs were able to fit the widest range of cell phone sizes.

Ultimately, all of the above activities facilitated a strong international peer community of women in engineering, the development of skills in voids communicated by the Liberian students, and coordinated the continued development of a robust SWE student organization in Liberia, which is the first of its kind on the continent of Africa.

5. Future implications

While the programs developed and described throughout this paper can in no way account for all of the difficulties faced by the Liberian students and the shortfalls of their respective institutions, they were designed and implemented to provide some supplementary skills and experiences that will address some of the voids in their education. Additionally, the international network of peers has fostered the ability for continued peer networking to occur between L-SWE and the undergraduates from the UM-SWE. It is planned that the Leadership Camp will be carried out by the University of Michigan graduate students for multiple years until members of L-SWE begin to graduate and are able to facilitate the camp's programing thereafter. Additionally, the partnership will look to expand its capacity as it supports L-SWE members past their undergraduate education, as they look for engineering employment and to apply to graduate school.

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