

Lessons from Liberia: Building Global Partnerships Through Materials Science Outreach

Aeriel D. Murphy-Leonard



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Introduction

“The future depends on what we do in the present,” as the great Mahatma Gandhi once said. Similar to Gandhi, I too believe the access we provide to science and engineering resources in the present will shape global policies, inventions, and technology in the future. Though Africa has the richest reserves of metals and minerals in the world, there are only six accredited, college-level materials science/metallurgy programs on the entire continent, while the United States has more than 100 programs at colleges in every part of the country. Unfortunately, while being a global leader in the extraction and export of minerals and metals, Africa has, to date, provided few contributions to technological advances and scientific innovations in the field. Many students in Africa are unable to access university-level opportunities in materials science due to geographic constraints compounded by economic barriers. These disparities lead to a global deficit of talent and loss of potential innovations in materials science. It is my main goal and passion to create a pipeline to materials science for students on the continent of Africa, specifically in West Africa.

Liberia is a small, West African country overlooking the Atlantic Ocean with very close ties to the U.S. In the early 1800s, the American Colonization Society created a settlement of freed African American slaves on the continent of Africa in a region now known as Liberia. From that moment on, Liberia reigned as one of the wealthiest and most prosperous African countries. However, more recently, a 14-year civil war and the Ebola outbreak of 2014 have decimated the country.

Motivation and Goals of the L-SWE SUCCESS Camp

The Liberian education system has suffered greatly from long periods of civil unrest compounded by school closures due to Ebola. These issues, coupled with strong cultural beliefs that encourage families to invest in the education of young boys at the expense of young girls, have left very few women in the pipeline to collegiate success. In fact, women account for less than 10% of the engineering student population at the University of Liberia. An exploratory study performed by the University of Michigan Chapter of the Graduate Society of Women Engineers (UM Grad-SWE) at the University of Liberia revealed that a major threat to the retention and success of women in engineering was the lack of a supportive network. This, along with gender-based discrimination, creates a hostile and unfriendly classroom environment for female students. With this knowledge, UM Grad-SWE and female engineering students in Liberia founded the Liberian Society of Women Engineers (L-SWE) to create a peer-supported community among female engineering students in Liberia. The peer-to-peer partnership between SWE at the University of Michigan and L-SWE is a mutually beneficial collaboration that allows both groups to gain unique cross-cultural experiences and create an international network of female engineers. The first outcome of this partnership was the creation of the leadership camp Setting Up Collegiates for Careers in Engineering through Social Support (L-SWE SUCCESS), first implemented in 2015 in Monrovia, Liberia.

The SUCCESS camp is a two-week long, residential leadership camp focused on developing skills in science, technology, engineering, and mathematics

(STEM) for female engineering students in Liberia. The goals of the camp are two-fold: (i) to provide American and Liberian female engineers with the skills and support necessary for becoming successful engineering professionals; and (ii) to strengthen the community of female engineers in the U.S. and Liberia by building cross-cultural partnerships among female engineering students resulting in a global network of women engineers. In the first week, the curriculum is focused on professional development with workshops on the graduate school application process, preparing resumes, writing personal statements, and presentations from engineering companies in Liberia. These sessions are designed and taught by the UM graduate students. The second week focuses on developing skills in STEM through various hands-on lessons as well as sessions on leadership. During this week, sessions and workshops are led by both UM and L-SWE students. The SUCCESS camp is now in its sixth iteration.

Best Practices and Lessons Learned from International Outreach

From my experience, there were three specific strategies that were crucial in ensuring the effectiveness of the SUCCESS camp:

1. Build Partnerships Not Relationships

When working with international communities, it is important to build partnerships. Partnerships involve a long-term, mutually beneficial commitment where each group contributes to the success of the other. These partnerships with local leaders, organizations, or institutions are important for building trust in the community and are key to the success of the program. The time differences, language barriers, and cultural differences make it difficult to communicate with the community effectively and these partnerships enable inroads into different communities. From my experience, this is the most important and challenging aspect of the process because it requires an investment of time, planning, and resources beyond what is

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usually required for domestic outreach.

These partnerships were important for recruiting students for the SUCCESS camp. In Liberia, it is taboo for young women to stay away from home and is only allowed with trusted family members. Through partnerships with L-SWE, the University of Liberia, and other community leaders, we were able to nurture relationships with parents and guardians through in-person meetings, video calls, and social media. There are several things to consider when developing local partnerships, including:

- Identify organizations and/or people who have access to communities you are looking to serve.
- Nurture partnerships with local organizations, community leaders, and institutions with respect and consistent communication.
- Engage with community members about the expected cultural barriers, available resources, and needs of the community. Do not pretend to be an expert.
- Clearly communicate the purpose, goals, and possible outcomes for participants with the local community members. Trust is key.

2. Think Long-Term When Designing the Outreach Program

It is imperative to develop a program or curriculum from the perspective of how it affects the community in the long-term. For the SUCCESS camp, through our exploratory study, conversations with professors and students, and pre- and post-camp surveys, we had a clear

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understanding of students’ expectations and outcomes of the camp. With this information, we designed a curriculum that was relevant and beneficial to the long-term success of the participants that utilized our particular skills and knowledge including the following:

- Understand what information participants want to learn versus what they already know. This can be gleaned through surveys, in-person meetings with potential participants months before the outreach program, and conversations with local educators.
- Create a challenging curriculum. Do not underestimate student abilities.
- Flexibility is important. Plan breaks between sessions. Be prepared for power/water outages.
- Be prepared for university schedule changes. For example, the SUCCESS camp starts at the end of the final exam schedule. In most cases we have students who need to leave during the camp for finals and/or meetings with administrators.
- Know what local resources are available (i.e., computers, materials, space/classrooms).
- Choose activities the participants can use for local K–12 outreach. Remember the pipeline is the most important outcome of the outreach program.

3. Teaching Materials Science in Liberia

The field of materials science is very important in Liberia with iron and rubber being two of its main exports. Many of the camp participants are studying geology or mining engineering and have a basic understanding of materials science concepts.

As a materials scientist, my main goal was to develop an MSE curriculum that both expanded and extended beyond the

student’s prior knowledge. The first strategy was to gain an understanding of what students were learning in-class and what critical information was missing from the curriculum. Through conversations with professors and class syllabi provided, I knew that the lack of application-based learning and laboratories were key barriers for both students and professors. Using this information, I developed materials science experiments based on what students were currently learning in class. These projects ranged from innovative ways to use shape memory alloys to solve infrastructure problems in Liberia to designing reinforced concrete for crack-resistance.

Conclusion

Across the continent of Africa, college programs in materials science are sparse and unattainable for the majority of citizens. These challenges pose a grave threat to the future and sustainability of our field. Professional societies and organizations in MSE have the potential to use their position to lobby companies and institutions to recruit and invest in exceptional engineering talent across Africa. Through global partnerships with institutions such as the Joint Undertaking for an African Materials Institute and local universities, we can develop the next generation of materials scientists and engineers. Diversity is more than the race or ethnicity of the people in the room. Diversity also comes from the unique experiences and journeys of all people in the room. When these experiences come together, we can build innovative solutions for global impact. My experience in Liberia taught me that every human regardless of race, sex, or class deserves the best opportunity to succeed in whatever they choose.

Ariel D. Murphy-Leonard is currently an NRC postdoctoral fellow at the Naval Research Laboratory. As a TMS member she is involved in several committees and received the 2020 Structural Materials Division Young Leaders Professional Development Award.

