Lending a Helping Hand
El Salvador
Washington and Lee University
Darby Shuler and Johan Garcia, USA

"Lending a Helping Hand" sought to bring affordable prosthetic arms using 3D printing to individuals in need in Ahuachapán, El Salvador. Working with a local clinic and the Salvadoran Mission Projects, we created a sustainable system for supporting local amputees with future possibilities of expansion.

Section 1

Using a Makerbot Replicator 5th Generation 3D printer and guidelines from the creators of the prosthetic arm, Robohand, we began working in Ahuachapán in early June. Unfortunately, Johan Garcia was unable to participate in the actual implementation of this project. However, we selected two competent students from Washington and Lee University, Alessandra Catizone and Eleanor Jones, to take his place. Andrew Shuler, a biomedical engineering student from University of South Carolina, joined us as well. Before traveling to El Salvador, we researched and collected supplies, including screws, nuts, string, and thermoplastic, needed to make the arms. We printed several hands and supporting pieces so that we would be able to begin immediately once we traveled to El Salvador.

Upon arriving, we worked with the Clinica Iglesia Metodista and nurse, Carla Clavel. The clinic had already found ten potential patients. In the first week, we met several patients and chose one, Jose, to begin. We had to make several adjustments to our original plans and to find new supplies. However, at the end of the week, we were able to send Jose home with an arm. After completing the first arm, we had more confidence and smoothed out the process. We met more potential patients and began preparing their arms. Throughout the rest of the summer, we completed a total 5 arms. However, we also trained Carla in making the arms, and she finished several more after we left.

Patients: All of our patients were selected by the clinic before we arrived. They only found ten to start because they did not want to overwhelm the project initially. However, there are many others in the area in need of prosthetic arms. Unfortunately, amputations are common in El Salvador. Some come from accidents or violence. Many come from medical conditions. It is often cheaper for a hospital to amputate a limb rather than treat a complicated condition. Each of our patients had a very different story. Several had had their amputations for years, coming from the civil war or from gang violence. A few had tried prosthetic arms before, but they were expensive to replace later. Two patients were out of work because of their amputation. Fortunately, after receiving the arms they have been able to find new jobs. One of those patients, Urania, invited us to her home a few weeks after fitting her arm to show us tasks that she could complete around the home using the arm. Having a second hand allowed her to cut vegetables and sweep. She could pick up small objects. The prosthetic arm will never replace her original arm, but it allows her to perform basic chores more easily.

Challenges: While we were able to provide several arms this summer and set up a system to continue fitting arms, we faced many challenges throughout the process and will continue to face more in the future. Working with a new technology provides many opportunities. Now that all of the initial equipment has been purchased, our prosthetic arms can be created for around $60-$80. However, the technology also came with many complications. One of the parts, the extruder, needed to be replaced four times throughout the summer: once before traveling to El Salvador, once during our trip and twice afterwards. We initially intended to leave the printer in El Salvador, but replacing the parts there is extremely difficult. A mission team from the US was able to bring it while we were there, but it would be challenging to do this again. The Makerbot company has been supportive in fixing these problems, and hopefully their current model for the extruder will have less problems. However, the printer only functioned for half of our time in El Salvador. This definitely slowed our progress down.

Another main challenge came from the inherent uniqueness of each amputation. Although we had an overall plan for making the arm, each individual was different. We had to adjust to each situation. However, we never gave up on a patient. Sometimes we just needed more time for one than we did for another. After fitting the arm, the patients had to practice gradually to keep using the arm. Oftentimes,

we made adjustments several days or weeks later. With time, they are able to build up strength and become accustomed to the arm.

Future Directions: Throughout the summer, we worked closely with Carla Clavel, a nurse from the clinic, with the intention of her continuing the project. We left enough supplies, excluding the printed parts, to make over 20 more arms. The printer is currently residing in my home in South Carolina, where Andrew Shuler is able to go and print pieces. We will send them through mission teams traveling to El Salvador every two months. If the printer functions well throughout the year, we will consider sending it down next summer to be used there. We are supporting Carla through the best of our abilities from abroad. It is possible that some of us will return next summer to continue developing the project. The makers of Robohand are currently working on developing an open source prosthetic leg. However, this would require close work with a prosthetic expert. Our current prosthetic arm model is only available for those with amputations below the elbow, but we may work to adjust it to also apply to those with above the elbow amputations. We had a little over $1000 left in our budget. This will be used to support these future endeavors and to purchase enough supplies to continue providing arms. Once our funds are exhausted, we have developed several fundraising ideas to continue to provide low cost prosthetic arms to those in need.

Section 2: Lending a Helping Hand- A Project for Peace

Throughout this project, we worked closely with individuals living in poverty who had lost a physical part of themselves. Although peace is traditionally defined in terms of war and violence, it can mean so much more. There is a mental peace that comes with knowing that you and your family are safe and secure, have a place to live, have food on the table, and that you are able to provide a happy future for those you love. When a tragic event takes away an arm, it does not just take away the physical arm. It leaves a questionable future, especially in a country like El Salvador with limited resources and support in the field of prosthetics. Urania, a 33 year old patient of ours, shared with us that after losing her arm she felt an incredible fear and sadness. She worried that she would be a burden to her family and that she could not support her daughter. With her job before the accident making only $100 a month, she could have barely afforded a prosthetic arm. After the amputation, her unemployment made that even more impossible. This project enabled her to take back her life. It provided an initial peace upon receiving the arm, but it also provided long term opportunity. Urania can now help her family and has found a new job. She has hope about her future. Having hope and possibility in the future contributes to that mental peace and provides a source of stability in life, even in the face of difficult circumstances.

This project has definitely shaped the way that I see the world and my ability to affect it. I have always had a passion for both medicine and development in the US and abroad. With the constant technological developments being made, it is essential to use these in new ways to improve the world. Over the past four summers, I have been working in El Salvador with local clinics to provide better healthcare to the community, but I always wanted to do something more. Projects for Peace has allowed me to design and create my own impact in a country that has become my second home. Throughout this project, I took everything that I learned in El Salvador in the past and everything I have learned about technology and science during college and combined them to work to create a lasting impact. This amazing opportunity has taught me to learn how to design a project and implement it with a sustainable future. It has also given me a taste of the challenges that come with this kind of work. This experience will continue to be a part of my life and will definitely shape my future medical career.

Darby Shuler: With the continuous developments in technology today, we have tremendous opportunity and responsibility to contribute to global peace using new and innovative methods. My experience working in El Salvador with 3D printing and prosthetics has only just opened the doors to what will hopefully be a lifetime of using technology and creativity to improve the lives of others.


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