About 80 percent of amputees who need a prosthetic leg live in developing countries, including 25.5 million in Asia, Latin America, and Africa, according to the World Health Organization. Even if someone is lucky enough to receive a prosthesis after years of waiting, physical therapists are seldom available to teach patients how to use their new limbs.

Enter the University of Hartford. For the past three years, physical therapy (PT) graduate students in the Department of Rehabilitation Sciences have been developing concise, clear, educational posters and brochures for patients from different cultural backgrounds, many of whom are illiterate.

This was not merely a class project. Students and faculty have designed vinyl posters, take-home brochures, and a clinician’s manual that will be used worldwide to teach patients how to exercise, climb stairs, use crutches, and generally move safely with their new prosthetic leg. The material also informs people how to care for their amputated limbs and when to go to a health clinic.

The project is a collaborative partnership with LIMBS International, a Texas-based nonprofit that offers low-cost, high-quality prosthetics to amputees worldwide. Two internal grants from the University of Hartford’s College of Education, Nursing and Health Professions, home of Rehabilitation Sciences, have supported the work to date.

Diana Veneri, associate professor of physical therapy, began the project with a group of doctoral PT students. The group hired a model with an above-the-knee amputation and fitted him with a LIMBS prosthetic limb, the same one used in developing countries. Then they documented the entire rehabilitation process, taking thousands of photos of the model taking care of his skin, exercising while sitting and standing, and performing various activities. The photographs were used for the clinician’s manual.

Based on a review of the literature, a second group of PT students realized that photographs of an American white man were not representative of the people they were seeking to help. They knew the photos had to be converted to an image of some sort and that only minimal words could be used.

In a truly cross-disciplinary project, they brought the University of Hartford’s Hartford Art School (HAS) students into the project to help with the final design work. Visual communication design students Megan Johnson ’14 and Jerlyn Cespedes ’14 turned the photos into illustrations for the posters and brochures. The work was done under the direction of Natacha Poggio, assistant professor of visual communication design in HAS.

“We came up with a prototype and gave [the students] the content, and they made it look professional,” Veneri says.

The illustrations on the posters and brochures can be customized to match the skin color and facial features of a particular country. In addition, the posters and brochures will be translated into Spanish, Hindi, Chinese, Arabic, and Swahili.

One of the biggest challenges in the project was figuring out how to communicate the health information to people who may be illiterate. For example, to convey the idea of stabbing pain, the students initially drew several knives sticking into the amputated leg. But when Johnson and Cespedes tested the effectiveness of the poster on classmates, they realized they were way off. The classmates thought the poster warned that if you were stabbed by a knife, you should go to a health clinic. Then they tried using arrows and, eventually, sharp black wedges to describe stabbing pain—with better success.

The third and current group of PT students working on this project has been testing its work with local students and amputees to evaluate the effectiveness of the posters and brochures. They also had the opportunity to test them in Peru, Uganda, and Kenya during spring break this year when students and professors brought them to prosthetic clinics in those countries.

In the next step of the process, LIMBS will test the posters and brochures in a Spanish-speaking community setting in Mexico.
It’s a challenging assignment. Design a prosthetic foot that has the flexibility and spring of a high-tech prosthetic but at a fraction of the price.

Biomedical engineering students in Assistant Professor Mary Arico’s Senior Design class in the University of Hartford’s College of Engineering, Technology, and Architecture, have been asked to do just that: develop a highly functioning prosthesis that costs no more than $20.

For three years, the students in her class have been making prototypes to come up with an energy-storing prosthetic foot that is comparable in its main specifications to the carbon fiber prosthetics you may have seen on athletes and veterans in the United States. The difference is that the carbon fiber foot costs thousands of dollars.

The goal is for the students’ low-cost prosthesis to be available in Africa, Peru, and other developing countries to impoverished amputees who must currently rely on stiff, wooden prosthetic feet that have no give and make a natural gait impossible.

The project is funded by LIMBS International, a Texas-based nonprofit that offers low-cost, high-quality prosthetics to amputees worldwide.

A team of five UHart biomedical engineering students works collaboratively with teams of students in Mexico and at the University of Texas–El Paso to develop the best inexpensive, lightweight, energy-storing foot.

“I’m pumped!” says Lydia Weitzler ’14, of Middleton, Mass. “I’m interested in prosthetic design. To be able to do this is great.”

Last year, Arico’s students came up with initial prototypes made of burlap and epoxy. The prototypes were “springy” but failed under loading, which refers to applied weight. Another prototype that was made thicker to support the loading was too stiff and heavy.

“You want something that’s about the weight of a foot. If it is too heavy, it will change [the wearer’s] gait,” Arico explains.

This year’s prototype is made of a plastic called Delrin and a thin sheet of flexible metal. LIMBS already manufactures a prosthetic knee made from Delrin, so it has this material on hand. Another goal of the project is to develop a sustainable foot that can be made from inexpensive materials already available at local LIMBS clinics around the world.

For the seniors in Arico’s class, the challenge gives them a chance to work on a real-world problem and experience collaborating and testing their designs.

“This is totally student driven. I guide them so they can make all the design, manufacturing, and testing decisions for each foot design,” says Arico.

“What happens next? The prototypes will undergo various kinds of testing at UHart and LIMBS, with the hope that one of the students’ prototypes will make it to field testing with patients at one of the LIMBS clinics.

“This is a multiyear process, with a lot of redesign built in,” says Arico. “But field testing with LIMBS is the ultimate goal.”
In the span of just three months, Nicole Coumes ’16 and Cindy Lau ’16, students in the University of Hartford’s Hartford Art School (HAS), traveled through parts of Africa, played a big role in a major Nigerian tradition, and attended a summit hosted by the Clintons (Bill and Hillary)—all thanks to a collaboration with Amanda Carlson, associate professor of art history. And they’re just getting started.

Coumes, a visual communication design major, and Lau, an illustration major, joined Carlson on a research trip to Nigeria this past winter. Carlson, who received a grant from the University of Hartford’s Women’s Education and Leadership Fund (WELFund), brought the students to help her study the ways African women use art and symbols to decorate their bodies. Carlson has been traveling to the Cross River region of Nigeria since her college days, but she says Coumes and Lau greatly enriched her research.

“They taught me a lot about what is happening with youths,” explains Carlson. “It expanded my perspective to learn through their experiences. There’s so much fieldwork that one person really can’t do it, and to have them there was invaluable.”

Coumes and Lau spent most of their time in Nigeria working on the Calabar Carnival, a monthlong festival in southeastern Nigeria. Lau designed sketches for one of the event’s makeup artists. Coumes worked on costumes for the massive parade that is a carnival highlight. Millions of people saw their designs, either in person or on television. To top it all off, they were asked to be part of a float and rode through the crowded streets of Calabar for 10 hours.

The rush of Calabar Carnival was a sharp contrast to life in the Nigerian village where Carlson and the students went next. Carlson previously conducted some of her research in the village before shifting it to the country’s urban areas, so she wanted the students to see how different life can be within one country.

“The village was a really humbling experience,” says Coumes. “They aren’t as modernized and the people aren’t as used to seeing foreigners. One of the highlights was going to a Sunday school and [seeing how] the kids’ eyes lit up. They were excited to see us.”

“This trip forever changed the way I see things, from everyday conversation to more global issues,” says Lau. “Traveling to Africa has taught me more about life than I could ever imagine.”

The trio next traveled to Ghana to join University students who were taking a short-term study abroad class, Art and
Environment: The Sustainable Studio in Ghana, that Carlson cotaught with Carol Padberg, HAS associate professor of painting. Local Ghanaian artisans taught them weaving, dyeing, and assembly techniques, including the West African batik method of designing dyed fabric with melted wax. They collaborated on projects and experimented with traditional techniques in new contexts, including the philosophy of sustainability.

Their heightened interest in sustainability after returning from Africa led Coumes and Lau to apply to attend the Clinton Global Initiative University annual meeting at Arizona State University. Thanks to another financial contribution from WELFund, they spent spring break with more than 1,000 student leaders from around the world talking about solutions to some of their generation’s biggest concerns. They returned to campus with the goals of making more local food available to University students and finding new ways to repurpose food waste.

“Our proposal was inspired by some of the work we talked about over the winter (in Africa),” explains Coumes. “We’re trying to bring a little bit of Ghana back here. It’s a continuing project, and I’m sure we’ll be working on it at least until we graduate.”

Carlson is not surprised by the impact the trips had on the students.

“We do gain inspiration and energy from these experiences,” she said. “[They] took away a sense of community and a sense of what it can mean to be an artist who is socially engaged.”

Editor’s note: Amanda Carlson recently published the book Africa in Florida: Five Hundred Years of African Presence in the Sunshine State (University Press of Florida, February 2014), which was coedited with Robin Poyntor, professor of art history at the University of Florida. You may read about this publication on her blog, “Africa in Florida: From Book to Blog” at africaflorida.blogspot.com. She is currently working on a second book based upon her research on a graphic writing system in Nigeria.