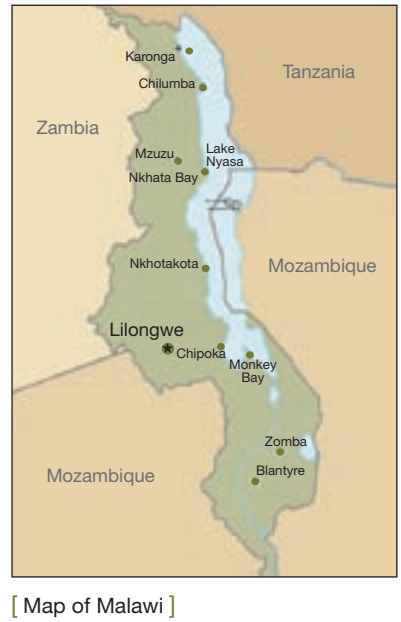
Diffraction demo with the rainbow peephole.

# Unpacking My "Optics Suitcase" in Africa

Alexis Spilman Lanning

My husband and I recently led a group of University of Rochester students to Malawi, Africa, for a three-week cross-cultural enrichment trip. The trip was part of the World Education Fund, a non-profit organization created by my husband (Joseph Lanning) to send female AIDS orphans to secondary school in sub-Saharan Africa. In addition to a few clothes, a sleeping bag and malaria prophylaxis, I packed an "Optics Suitcase."

One of the most enriching experiences of the trip was presenting the Optics Suitcase to high school students at Gowa Community Day Secondary School, a government-run village school in Malawi. The Optics Suitcase is an educational outreach program created by Stephen Jacobs, a professor at the University of Rochester's Institute of Optics. The suitcase consists of a series of tools designed to excite children about science in general and optics in particular. The key concepts highlighted through the Optics Suitcase are diffraction, polarization and selective reflection.




[ Map of Malawi ]

In addition to stimulating the students' interest in optics, my aim was to break down the misconception that only men can be engineers. I began each presentation by asking the class if they thought women could be engineers. Many students replied with an emphatic "no." Their response was discouraging but not surprising. In Malawi, as in many African nations, very few girls continue school past eighth grade. An even smaller number go on to college, and, of those who do, a minuscule number study science.

However, after teaching the 600-plus students, I was encouraged by their enthusiastic response to the material. It was clear I was talking to engineers of the future, both male and female.

A typical Optics Suitcase lesson begins with a demonstration of a portable heating pad to illustrate how engineers improve the lives of others. Breaking a small disk within the heating pad initiates a crystallization process that causes the pad to transition from a cool temperature to a warm one.

In the first classroom I taught, the students observed this change. However, a challenge arose when it came time to

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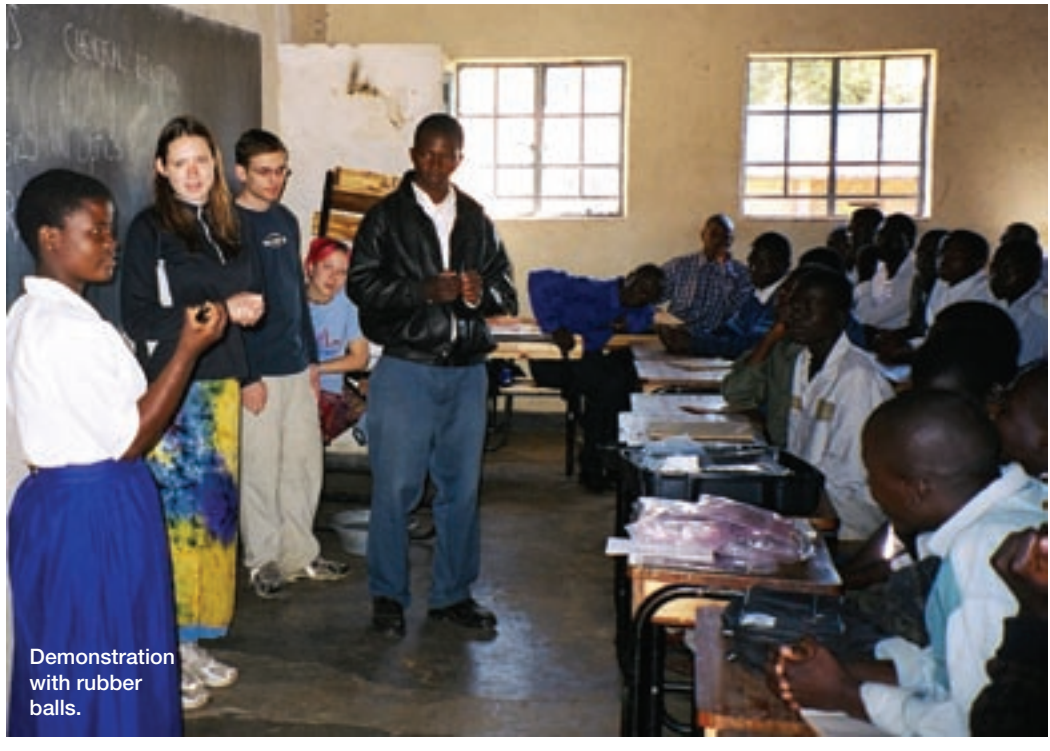

Demonstration with rubber balls.

present the heating pad demonstration to the next class. In order to reuse the pad, the label suggests that users should "simply microwave or boil the heat pack to return the crystals to their liquid 'charged' state."

In a rural village with no electricity or running water, microwaving is out of the question and boiling water is not a simple task. To do so would require taking a two-kilometer hike to the borehole to get water, carrying the heavy bucket back, gathering firewood and then starting a fire. It became clear to me that presenting the Optics Suitcase in Africa would require flexibility and modifications.

Following the heating pad demonstration, I asked two volunteers to each hold a rubber ball. The students described their ball to the class, and then exchanged balls and described the second one. Both balls were the same size, shape and color. I then asked the students to hold the balls at the same height and drop them on the count of three.

When the balls were released, one bounced and the other did not. One of the balls was made of fully vulcanized rubber, retained its shape, and bounced. The other contained rubber that was more easily deformed and thus did not bounce. As the students climbed on the desks to get a better view, I could see reactions of disbelief, shock, and, in some cases, fear, written on their faces.

Why had the room become silent after the balls dropped? This was supposed to be the funny part of the lesson. My husband told me that the students thought I was practicing *juju*, or witchcraft, with the two balls. I dispelled the notion that witchcraft was responsible by explaining to them what accounted for the difference in the balls.

Next, I handed out microencapsulated liquid crystals for the students to observe selective reflection. The students held liquid crystal patches on the inside of their wrists to make sure no vampires were sitting among them. The patches react to heat by changing color. Since vampires are the living dead and give off no heat, the patch would not change color when placed on their wrists. The students were relieved to discover that there were in fact no vampires in the room.

The Optics Suitcase was an overwhelming success. Many students were so amazed and intrigued by the demonstrations that they sought me out after school to learn more. We pulled out a woven mat, sat on the ground and performed demonstrations together for the rest of the afternoon and into the night, by candlelight. At a formal school-wide assembly, I presented the Optics Suitcase to the headmaster for the continued study of optics at their school.

In a letter I received from the school, the students thanked us for donating the Optics Suitcase and informed us that the suitcase will enable their science teachers to make abstract concepts easier to understand. Headmaster Frackson Chalunda wrote, "This suitcase is a great blessing to the 600 pupils who will benefit from this gift. Such types of donations are very important because you have assisted in building the Malawi of tomorrow …"

There is nothing more rewarding than igniting students' interest and enthusiasm through teaching, especially among a group that may not have had the opportunity otherwise. Presenting the Optics Suitcase in a rural African village is an experience that surpasses all others.

## Acknowledgments

I would like to thank Dr. Stephen Jacobs and his students for providing me with an Optics Suitcase to use in Malawi and donate to Gowa Community Day Secondary School.

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