

# PROJECT STEP: TRACK II

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## Building STEMcinnati City

### STEP Tanzania Project Pictures



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### STEP Tanzania Project

The NSF funded GK-12 Project STEP, in collaboration with a NGO, Village Life Outreach Project (VLOP), and the Shirati Health Education and Development (SHED) Foundation, is conducting an educational project in Tanzania. This partnership started in 2006 when a STEP Fellow, Sarah Pumphrey, and her research advisor, Dr. Daniel Oerther (STEP Co-PI), partnered with VLOP to study how to improve access to drinking water and nutrition for villagers and students in the Shirati region of Tanzania. They worked to bring Sarah's research into STEP schools to provide first-hand knowledge of water and nutrition challenges in East Africa as an authentic approach for teaching and learning STEM. The US students built sand sifting screens and signed the wood for the screens, which Sarah took to Tanzania and the students there used them to sieve local sand and make their own slow sand water filters. Thus, the students at both places saw how they could impact each other's life. This project was highlighted at the NSF Budget Rollout for Fiscal Year 2008.

In June 2007 Sarah worked with an elementary and a secondary school teacher to initiate plans to improve access to nourishment

through school lunches in Shirati, Tanzania. This preliminary work in Tanzania served as a basis for activities undertaken by STEP, VLOP, and SHED during a recent trip in January 1 to 12, 2008. From October to December, 2007, Fellow Sarah and a REU-supported undergraduate student worked with SHED and the villagers of the Shirati region to improve the quality, breadth, and depth of scientific information supporting the use of coagulation with the seeds from a local tree *Moringa oleifera* followed by slow sand filtration as a culturally appropriate, economically feasible, and environmentally sustainable solution for drinking water treatment in Shirati, Tanzania. Subsequently, Dr. Anant Kukreti, STEP PI, and Dr. Oerther took a team of three in-service teachers, one pre-service teacher, two graduate Fellows, one REU-supported undergraduate student, and one volunteer graduate student to Tanzania to provide

professional development



(article continued on pg 3)

## Lesson: Tanzanian Triangles or Pembe Tatu

Author: Michael Starr



### Duration:

Two 54-minute classes

### Background Knowledge:

Students will need to know what a triangle is and how to identify one.

Familiarity with the characteristics angles inside of triangles would be helpful (i.e., sum of the angles is  $180^\circ$ ). Students can identify the difference between an obtuse angle & acute angle.

### Materials Required:

- **Soccer ball** (more than one is better)
- **Colored paper cut into triangles:** at least 2 of each (right, obtuse, acute) for each group.
- **Colored paper cut into rectangles** (for marking spots in the walking activity)
- **String**
- **Chalk line:** for marking perpendicular lines on the ground
- **Protractors:** enough for one per each group of students
- **Straws:** Same number as number of protractors
- **Washers** (for weights): same number as protractors

### Activity Summary

1. **Catch** – Soccer triangle game with defender
2. **Matching triangles** – pre assessment: students identify acute, obtuse, and right triangles. Additional question asks them to find the hypotenuse of a right triangle given the two legs of the triangle
3. **Triangle walk activity** – measured in student feet (walkers, markers, counters & recorders)
4. **Measuring Landmarks** – measure heights of objects and structures
5. **Review and Post assessment** (same activity and question as pre-assessment)

*This complete lesson can be found online!*

### Summary & How this relates to the STEM Cincinnati Theme

This experiment is an inquiry lesson investigating leg lengths in a right triangle and leading to the “discovery” of the Pythagorean theorem, and the usefulness of geometry for measuring heights and distances.

Angles can be used for many purposes including surveying of land. Methods that involve the measurement of angles are used in engineering to determine dimensions of objects, such as height, and distance to an object. Students will be asked to determine triangle angles, right triangle leg length, and end with using inclinometers to determine the heights of trees and structures in the village. If possible the tangent concept will be introduced as a means of measuring the height of an object off in the distance (a mountain) but the distance to the apex is known by use of a map or some other means.

### Objectives

Upon completion of this lesson, students will be able to:

- Identify right angles and triangles from other angles and triangles
- Measure the height of objects using right triangles and inclinometers
- Estimate the height of an object and be able to write the Pythagorean theorem to see how it can be used in this measuring process.

*This lesson was designed for a 3rd-7th grade Geometry class, but could be used with alterations for many other level mathematics.*

### Ohio Standards [From the Ohio Science Benchmarks]

#### Ohio Standard: Mathematics

**5-7 Benchmark C:** Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area of triangles, quadrilaterals, circles and composite shapes, and surface area and volume of prisms and cylinders.

#### Standard: Geometry and Spatial Sense

**3-4 Benchmark D:** Identify and draw right, obtuse, acute and straight angles.

**5-7 Benchmark G:** Describe and use properties of triangles to solve problems involving angle measures and side lengths of right triangles.

**8-10 Benchmark I:** Use right triangle trigonometric relationships to determine lengths and angle measures.

### More STEP lessons to use:

For more information, including lesson plans and handouts, visit the STEP website at <http://www.eng.uc.edu/step/activities/>.

## Tanzania Project



(Tanzania article, continued from pg. 1)

to elementary-primary school teachers in the village of Roche, Tanzania, through Project STEP.

The STEP team conducted a three-day professional development workshop for the teachers from Roche, Tanzania. They used four STEP lessons to show how inquiry-based and active learning techniques are used in developing and delivering STEP lessons. They explained lessons about animal cell components (using analogy of a village), virus attack (using analogy of "knot theory" in math), geometry to measuring heights of objects using a hand-made inclinometer, and effect of surface area on the rate of chemical reaction (as it relates to chewing and digestion). The participating teachers then met the STEP team members individually to discuss how they can take this experience back into their classroom. Four participating teachers developed and taught their own lessons using the concepts learnt in the workshop, which were observed and evaluated. Finally, the STEP team discussed with the participating teachers ideas for four lessons on health and nutrition to bring back to their classrooms in the US to showcase their experience in Tanzania. Math Skills Test and Student Learning Styles Survey were conducted to evaluate the impact on student learning and to know how students in Tanzania prefer to learn.



## Local STEP Teacher Happenings



**Jaz Dhillon**  
**STEP Teacher**

Standing at the front of his classroom, Math teacher Jaz Dhillon can feel overwhelmed by the responsibility of guiding his students through a year of Algebra 2. Moreover, those 15 through 18 year olds can be pretty demanding. So he has to be on his game to keep them engaged.

Fortunately, this year he is participating in STEP (Science and Technology Enhancement Program) and receiving support from graduate fellow Michael Starr. Starr has played an integral role in developing activities which draw links between Dhillon's curriculum and Starr's background in chemical engineering.

When he is in class, Starr is often called on by the students to provide help with assignments. Starr moves around the classroom with ease offering insight and assistance that is invaluable to Dhillon's classroom. Of Starr, 11th grader Randy Hill says "he's cool and smart."

Recently, during one of Dhillon's Algebra 2 classes, many students could be seen intensely engaged in an experiment that related bone tissue replacement to systems of equations. In fact, some of the students even smiled as they worked through the hands-on simulation and later completed a related assignment. Thanks to Starr and STEP, Dhillon's class has seen marked benefits.



**Sara Garrison**  
**STEP Teacher**

At Norwood High School, STEP fellow Colleen McGannon is working with STEP teacher Megan Urbaitis to create a lesson on flight to present to several freshman physical science classes this winter. Following the lesson, approximately 85 freshmen will be traveling to the General Electric Aviation Training and Education Facility here in Cincinnati. While on this field trip, students will hear a presentation from General Electric staff about how aircraft engines work. Then, students will tour the facilities where General Electric aircraft engineers are trained. During the tour students will be able to see several engines, including aircraft engines that have been transformed into naval engines. In addition, students will get a closer look at the aircraft engines through the use of mobile cameras that can be placed inside the engines and through actually standing inside an aircraft engine.

As a result of this field trip and the lessons on flight, students will gain a better understanding of how aerodynamics and the transfer of air molecules allow heavy aircraft to fly long distances. Students will also be exposed to math and science-related careers. The field trip also relates, therefore, to an engineering lesson that freshman will complete in STEP teacher Sara Garrison's geometry class at the end of the year. During this lesson, students will work in teams to design and sketch a scale model of a corporate park. Colleen McGannon will also assist with this lesson.



**Carol Dunn**  
**STEP Teacher in Tanzania**

Being part of the NSF/STEP December trip to Tanzania was extremely rewarding. Since I had visited Roche Primary, Shirati, Tanzania, in June, as part of the Education Team of Village Life Outreach Project, I felt more prepared and aware of what the trip entailed. The basic questions about living conditions, travel and food were virtually non-existent. I knew to keep the basics of hand sanitizer, toilet paper and snack food always available. I'm not a camper but I can go with the flow fairly well and all was fine.

Preparation for my cell analogy lesson also relied on my prior knowledge of the school conditions. I knew that the supplemental materials must be self-contained, requiring neither electricity nor batteries. This posed a problem finding some sort of microscope to use in the lesson. I finally decided on using the old standby 'view scopes', which are totally sunlight driven. Presenting my lesson to the teachers of Roche was exciting. Their English skills permitted them to participate in the lesson with a translator assisting, as needed. They had the same novice usage skill of using microscopes as the students did. Everyone is afraid to put their eye close to the ocular, instead trying to see from six inches away. Christopher Nestory, Head Master, taught my lesson to Standards 5-7, before we left. Just seeing the pride and excitement on both sides, having new equipment to use and learn from was very rewarding.



## An Interview with Michael Starr, STEP Fellow, about his recent trip to Tanzania...



Teacher Kennedy & Michael Starr

**Andrea:** Where did you go?

**Michael:** We went to the Tarime region of Tanzania (Africa), which is in the Northwest part and stayed in the village of Shirati.

**A:** Why did you go?

**M:** A former STEP fellow, Sarah Pumphrey is doing water purification research there. Through VLOP (Village Life Outreach Project) and the SHED (Shirati Health Education and Development) Foundation current STEP participants went to continue the research and develop lessons for cultural exchange.

**A:** What are the most interesting things you can remember?

**M:** It's a different way of life in Shirati. Time isn't important. There isn't much running water and electricity isn't constant. There is no clean water because the water comes from Lake Victoria without treatment. The people accept the fact that they will get sick every so often. The school buildings were very simple but yet the school system was incredibly structured. The classes were full of content and the students were well behaved.

**A:** What was your schedule?

**M:** I'll give you the highlights for each day...

- \* We landed Sunday, Dec. 30th in Nairobi, Kenya.
- \* On Monday we drove through a safari park because of a road block to Tanzania, and we had an unexpected, pleasant stay at a safari lodge where we spent our new year's eve.
- \* Tuesday, January 1st we made it to Sharati, Tanzania.
- \* Wednesday we went to the Roche Primary School in the afternoon.
- \* We had a three day professional development workshop with the teachers at Roche Primary School. Thursday Carol Dunn, a STEP teacher, and Tara Ivory, a teacher in CPS (Carson Elementary), went through their lessons on cells and viruses.
- \* On Friday, January 4th, Anna Hutchinson, a STEP teacher, and myself conducted a professional development with lessons on surface area and triangles.
- \* Next we wrapped up the workshop & finalized the teaching plans.
- \* Sunday, January 6th we had a break and climbed a mountain where the water storage tank is for the village, however, the eight pumps used to pump water to the storage tank were inoperable during our visit, hence the reason for no running water.
- \* Monday, the Roche Primary School teachers taught the lessons we brought from Cincinnati. Madame Cecelia and Kennedy incorporated our content, but definitely made it work for their students.
- \* Tuesday, January 8th, Madame Defense and Headmaster Nestory taught our lessons. Our educational systems are similar in regulations and government standards, but they are different in methods of teaching. The teaching style there is very structured with students having little input. Student questions are saved until the end of the lesson.
- \* The 9th we left the village and were re-routed through Tanzania.
- \* Thursday, January 10th we drove through the Serengeti. The Ngorongoro Park is amazing. We stayed by a volcano crater and saw fantastic animals in the park and on the crater floor. We saw cheetahs, elephants, giraffes, black rhinos, hippos, and more.
- \* Friday we drove from the crater to a major city in Tanzania, Arusha, where we only saw one traffic light (but a bunch of streets and intersections) & stayed the night.
- \* Saturday and Sunday were spent getting back to Cincinnati. It was an incredible experience... life changing even.

Thank you to  
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