Astronomy: A Gateway to Science

Telescopes to Tanzania
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Abstract. *Telescopes to Tanzania is a program initiated by Chuck Ruehle in 2010 to use Astronomy as a vehicle to teach science, technology, engineering and math to the Meru community in northern Tanzania.*

The program has moved from teaching students-- to preparing teachers in using hands on educational methods in presenting their lessons---and now will focus on the development of center for science education.

There are three major challenges: 1.Limited resources: in classrooms and the Tanzanian economic poverty. 2. Teachers who have never had "hands on" experience in learning. 3.Locations that lack a regular power source and little internet access.

Keywords.

Tanzania, Astronomy, Center for Science

Introduction:

In 2013 Telescopes to Tanzania began a major shift in focus and intensity. The emphasis will be on creating a Center for Science education (The Center) in Tanzania with leadership that is based in the community and native to Tanzania and East Africa.

Rationale:

The creation of the Center for Science and Observatory is based on an understanding of the critical role of astronomy in teaching science, and the importance of building the curiosity of students for the love of science subjects.

"At the 6th Science Centre World Congress convened in Cape Town, South Africa from 4-8 September 2011 delegates from 56 countries assessed the impact of science centers worldwide and formulated plans that will ensure that they continue to play a constructive role in addressing global issues at the interface between science and society." With this beginning of the Cape Town Declaration it is clear that a science center approach to addressing the need for hands on, "smart play" education is an important community resource.

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The recent year's national examination results in Tanzania have shown poor performance in science subjects as well as a decreasing number of students who are taking science subjects. There are number of reason for this trend, but teaching methodology is one concern according to the assessment report. "While lots of things are important, we need to prioritize on the most important factors that make a big difference in quality learning, such as motivating teachers and holding them accountable, and creating an environment for children that is engaging and interactive ."
"The Quality of Teaching, Learning, and Application of Science, Mathematics, and English in the Education Sector" of 2012 by Tanzania Education Network

Partnership:

Intrinsic to the development of the Center for Science in Tanzania is that it is sustainable. Partnership with governmental agencies, leaders in the educational structures, local authorities and both private and public institutions will be essential for the work to continue. Partnership also with the scientific community is essential.

Since 2011 a Tanzanian partner in the work has been UNAWE (Universe Awareness)-Tanzania, lead by Mponda Malozo. UNAWE Tanzania is a registered non-profit organization initiated by volunteers working with Tanzanian youth. Its aim is to awaken science curiosity among Tanzanian children from very young ages. It works mainly with primary school pupils and teachers in Tanzania, and also partners with different national and international organizations. It offers teaching materials to teachers, children as well as interested individuals and collaborates with other organizations to conduct teachers' trainings for primary school teachers in Tanzania.

TtT has worked in close collaboration with Astronomers Without Borders (AWB), the International Astronomical Union (IAU), Office for Astronomy Development (OAD), Galileo Teachers Training Program (GTTP), Global Hands on Universe (GHoU), Café Scientific and the Meru Diocese of the Evangelical Lutheran Church in Tanzania.

UNAWE-Tanzania and its partners are now working hand in hand with TtT to make sure the initiatives deployed reach a wide audience in Tanzania while continuing to provide leadership in future centers in the East Africa region. The establishment of a Center for Science and an observatory is the strategy which shall serve the common purpose of astronomical organizations in the region.

The need for a Center for Science

The Telescopes to Tanzania Teachers training conducted at Mwangaza Education for Partnership Resource Center in Arusha in November 2012, included 50 primary and secondary school teachers. Teachers learned to employ new ways of teaching science using astronomy as a tool. They learned how to create their own models based on readily available

materials, and experienced researching material on the internet. The entire program focused on how to integrate astronomy into the national syllabus/curriculum as outlined by The United Republic of Tanzania Ministry of Education and Vocational Training.

Most teachers were not aware that astronomy is part of the national curriculum. This is largely because of the lack of training in applying hands on tools and lab style classrooms. Even the national exams fail to ask questions related to astronomy due to a limited understanding of its possibilities. There is still a widespread misunderstanding that our solar system is all there is to the universe. Without further learning and teaching this will continue to be all that is taught.

The establishment of the Center for Science and Observatory will create a path to learning that will help teachers, education officers, students and amateur astronomers understand what astronomy can offer science education in Tanzania through the capacity building activities it will offer.

Specific goals of the Center:

1. To conduct astronomical and science training for teachers and students as outlined in the preceding rationale.
2. To integrate astronomy in the teaching curriculum as outlined in the national syllabus.
3. To develop and disseminate hands on science and astronomy teaching resources.
4. To create a model science laboratory and observatory with telescopes computers, a portable planetarium, internet capacity and global connections to other observatories around the world.
5. To serve as an equatorial dark sky observing center for tourists, this will serve as a source of funding.

A description of the Center:

The Center shall be a non-governmental organization based in Tanzania with majority of its members and teachers being Tanzanians who work hand in hand with astronomy or are connected to science education and affiliated members in other East African countries and the international astronomical community.

It shall be located in Northern Tanzania off the Moshi-Arusha tarmac road which is the major tourist circuit of Tanzania, near or close to secondary schools which have already worked

with and have established relationships with TtT.

The Center shall consist of science demonstration laboratory, roll off observatory for the scope(s), guest accommodations for up to 12 persons, library and administration offices. The laboratories shall be fully equipped with resources necessary for doing astronomical demonstrations and provide hands on science, math, and geography training that will be in line with the national curriculum.

The Center is intended to be financially sustainable through astro-tourism activities and other relevant legitimate aids. Once operational, the money generated shall be used to sustain the center on a daily basis. Minimal support from external sources will be necessary for its day to day operation. By being located in the tourism circuit within Tanzania it shall be an attraction for those who wish to observe equatorial dark skies from Africa.

Expectations and hopes:

The sincere intention of this project is to insure that the young people of Tanzania and their teachers are not "left behind" in the pursuit of scientific inquiry. With the further development of the East African Economic Community the quality of education must be at a level that students can compete in a more technical and science based job market.

We have seen that computers in most schools are used as a writing or record keeping tool or as a tool to teach computer classes with little if any understanding of the power of teaching or researching using the internet or even using a program as simple as Stellarium to introduce astronomy subjects.

We have seen that many teachers are currently using notes they recorded during their own education. They have not had the resources to access current materials or ideas.

And, we have experienced that most science education is done from a perspective of "giving the right answer". Teachers were not prepared to have discussions on: "Why Pluto is or is not a planet"; or "How the number of moons of Jupiter may change as scientists gather more information". The notion that "what we know now" rather than the definitive all time truth answers was totally new to many of the science teachers.

With these observations and experiences we are developing techniques, materials, and ideas to help teachers change how they approach teaching not just in hands on experiential techniques…but with the ability to encourage students to explore, learn and discover on their own.

Sustainability:

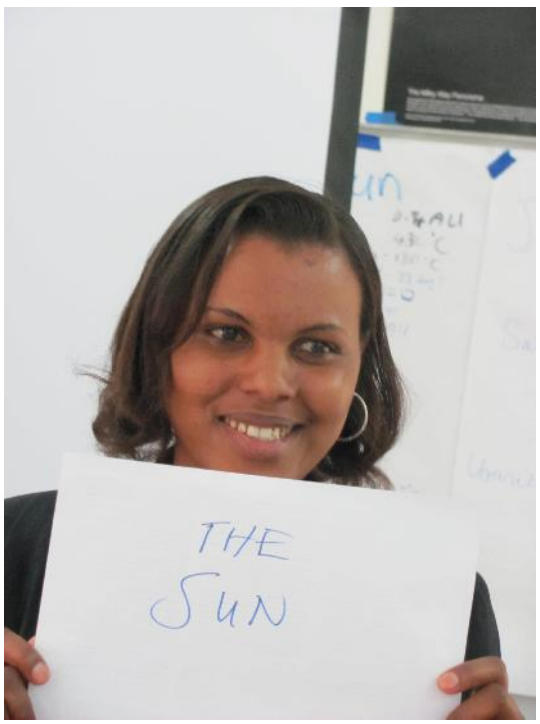
The project will collaborate with relevant people, institutions, companies and the ministry of natural resources and tourism to bring astro-tourism as one of the major components in the development of the Center. With increasing light pollution in most parts of the world Africa still

possesses a dark sky beauty which creates a growing astro- tourism market in Africa.

Currently one of the most important assets of North East Tanzania is its dark skies. As it has developed a viable tourism based on safaris into the national parks, the potential for Southern Hemisphere dark sky observing is significant.

We are currently working to build a sustainable business model for the ongoing work of the Center. The importance of astro-tourism is not only to serve those who desire to be exposed to the great skies of Tanzania, but to raise the awareness of sustaining a dark- sky environment.

It is our hope that teachers in Africa and astronomers from around the world will be able to meet and share the wonder of the night sky, the importance of astronomy as a gateway to science and build relationships that will further science education around the world.



Request for help:

GHOU will be an important event for Chuck and his wife Sue Ruehle this summer in exploring the many possibilities of the science center. We are seeking to:

1: gain insights and ideas for teaching science

2. learn how others have worked in science centers with both teachers and students

3. gain insight into materials and resources that are needed or that may be available for the center.

4. gain support for the project both financially and with those committed to teaching science through astronomy.

5. build a network of people who will support and help in creating a strong base for science education in Tanzania and East Africa.