



# **THE ZERO GRAVITY INSTRUMENT PROJECT:**

## **PROMOTING SPACE EDUCATION AND RESEARCH IN MICROGRAVITY AMONG SCHOOL CHILDREN IN NIGERIA**

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Workshop on Human Space Technology  
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# Introduction

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- ARCSSTE-E, which presently operates under the administration of the Nigerian National Space Research and Development Agency (NASRDA) was established in 1998 by the **United Nations Office of Outer Space Affairs (UN-OOSA)** to develop human capacity and educate Anglophone Africans about the benefits of space science and technology.
- Mandate of ARCSSTE-E is achieved through:
  - The Post Graduate Programs (Masters & PGD)
  - The **Space Education Outreach Program (SEOP)**

# What is SEOP?

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- The Space Education Outreach Program (SEOP) of ARCSSTE-E is designed to **enlighten** and **arouse the interest** of the general public about outer space by organizing fun-filled, space related educational activities to engage **school children and teachers, youths**, decision makers and other members of the public.

# Space Education Outreach Program

## Workshops for Primary, Secondary & Tertiary Institutions

Workshop on Astronomy

Workshop for Teachers

Workshop on the Applications of Space Technology

Science Exhibition

Quiz Competition

Essay Competition

Poster Competition

Debate Competition

## Other Activities

Space Club Activities

**Zero Gravity Instrument Project (ZGIP)**

**Talbott Initiative for Girls in Science (TIGS)**

**Robotics Education Program (REP)**

**Celebration of World Space Week**

**Seminar for Stake Holders**

## Space Science Curriculum & Content Development

## Educational Tours to the Space Museum of ARCSSTE-E



UNITED NATIONS  
Office for Outer Space Affairs

# Human Space Technology Initiative (HSTI)

**Zero-Gravity Instrument Project  
(ZGIP)** promotes space education and  
research in microgravity.

<http://www.unoosa.org/oosa/en/sapidx.html>

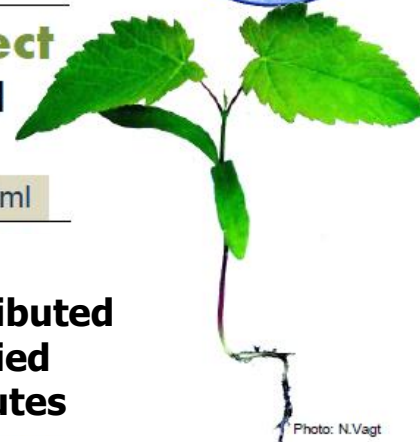


Photo: N.Vagt

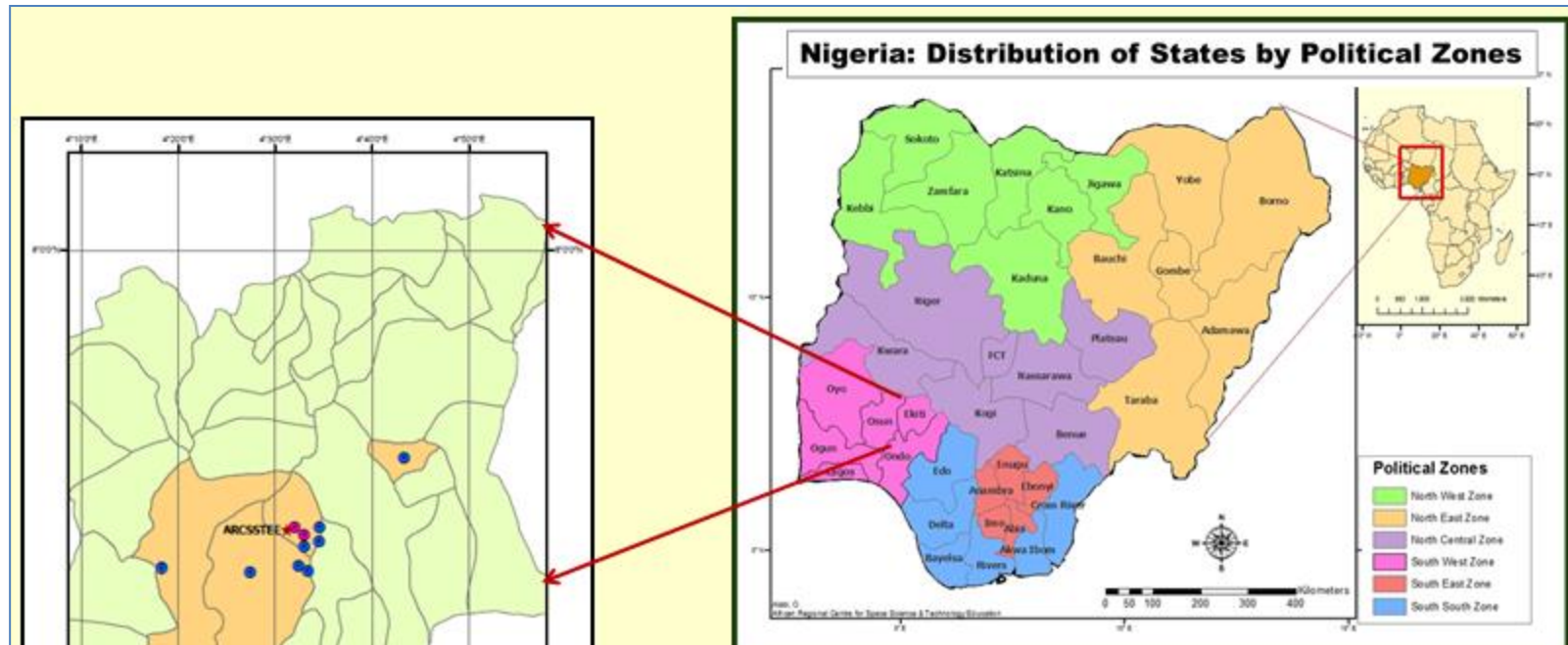
The United Nations Office for Outer Space Affairs  
launched the ZGIP on 1 February 2013, and distributed  
the microgravity simulation instruments to qualified  
schools, universities, research centres and institutes



**CLINOSTAT:** A one-axis clinostat was  
selected for distribution because of the ease  
of use and potential scientific benefits

**ARCSSTE-E received, on a competitive basis, one  
of the 20 Clinostats distributed in 2013**

# The Pilot Phase of ZGIP: Spatial Coverage



## Participants:

- About 100 school children, aged between 7 and 21 years, drawn from ten public and private schools located in Osun State, Nigeria.
- These schools were located within 4 out of the 30 local government areas in Osun State

# **The Pilot Phase of ZGIP: Implementation**

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The pilot phase of the Zero Gravity Instrument Project was implemented in 4 stages:

- 1-Day Introductory Workshop
- The Laboratory Session
- The Poster Presentation and Project Report
- The Project Evaluation.



# Introductory Workshop

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**Introducing participants to the environment of Outer Space**



2

**Introducing participants to the Clinostat: simulation of microgravity conditions in the laboratory**



3

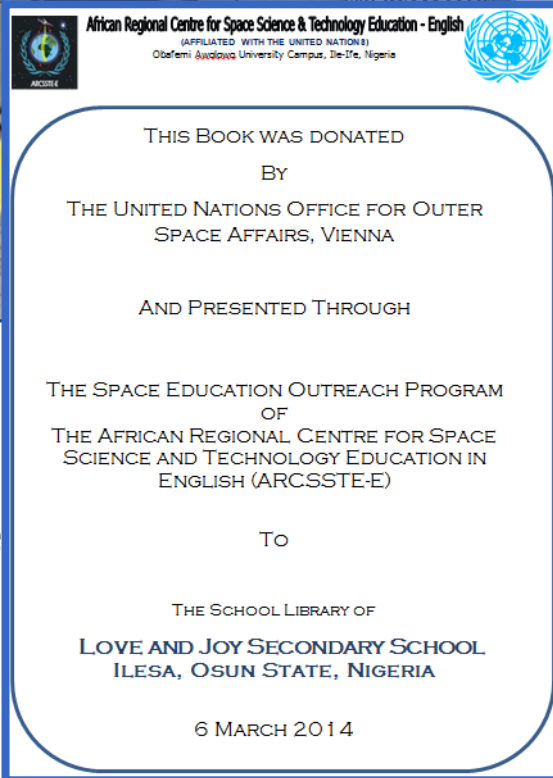
**Introducing participants to the ImageJ software for data analysis**





# Introductory Workshop: Distribution of Instructional Materials

1



- Written by astrophysicist Jeffrey Bennett.
- Winner of 2013 Science Communication Award by the American Institute of Physics
- An exciting and informative book for children to learn about outer space.

2

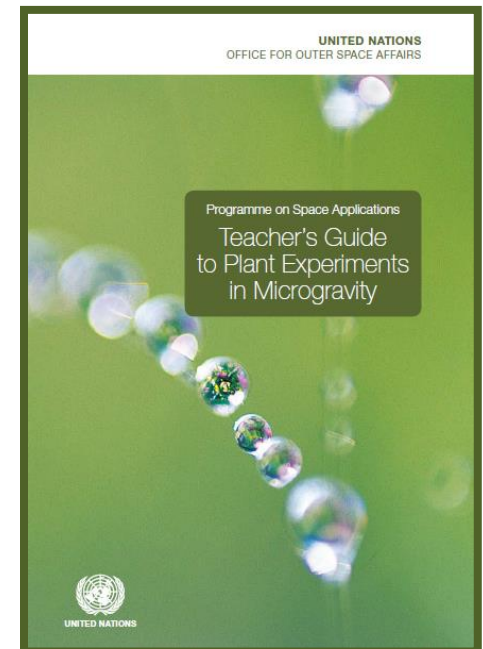


- Power-Point Presentation on the "Zero Gravity" Instrument Project
- UNOOSA Teacher's Guide to Plant Experiment in Microgravity
- ImageJ User's Guide

# THE LABORATORY SESSION

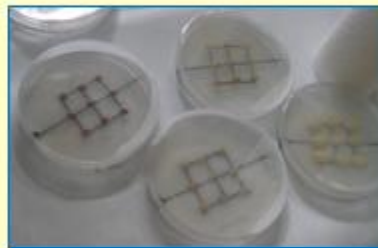
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- At the end of the workshop, each school designed a project to observe the effect of microgravity on the seedlings of some indigenous plants cultivated for food in Nigeria. Some of these seeds include: Black-eyed Pea, Cowpea, Guinea Corn, Maize, Millet, Okra, Rice and Wheat.
- Each school had a period of one week, on a planned timetable, to work in the laboratory of ARCSSTE-E to execute the project designed.
- The Laboratory session was conducted according to guidelines provided in the “Teacher’s Guide to Plant Experiments in Microgravity” published by UNOOSA.



# The Laboratory Session

Preparing a fertile 'soil' (Agar-agar solution) for planting the seeds



Planting the seeds in the Agar-agar solution

Samples of seeds planted in the Agar-agar solution



Preparing the seeds for fast germination



# The Laboratory Session



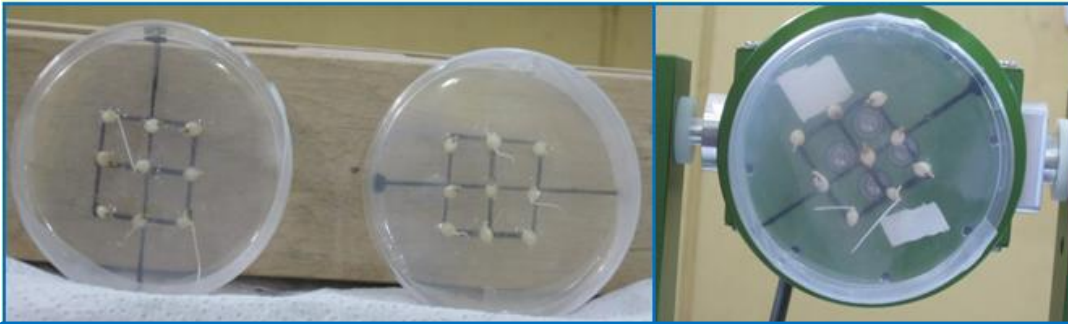
**Mounting the sample on the Clinostat**



**Adjusting the speed of rotation of the Clinostat**



**Using a digital camera to collect periodic data from the rotating clinostat**



**Germinating seeds: samples of data collected**



**Data analysis with ImageJ software**

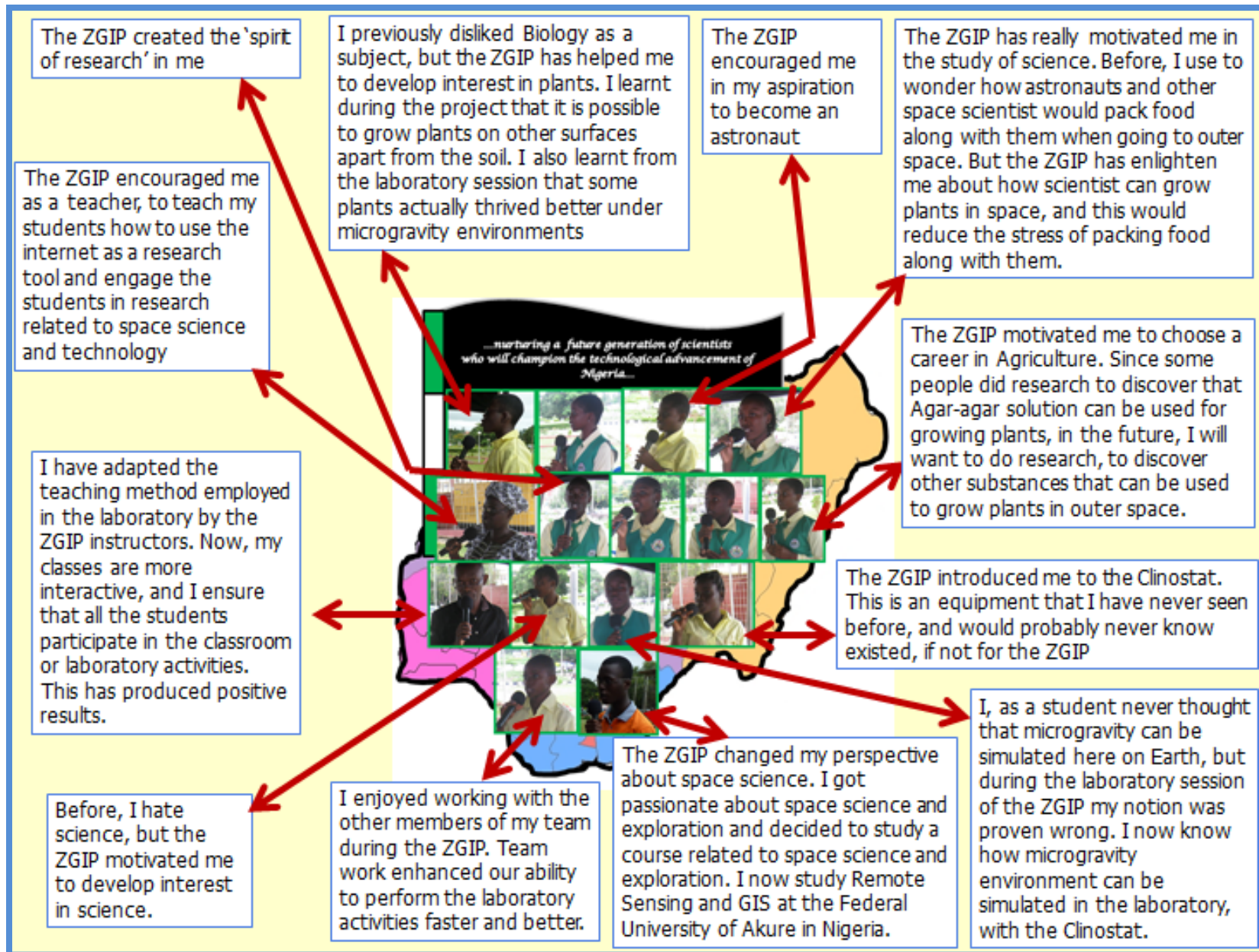
# Project Report & Poster Presentation



- The students learnt how to make posters, and presented their study in a Poster Competition in November 2014.
- The poster competition was evaluated by university professors and other eminent scientists. These role models encouraged the young aspiring scientists by their presence as they assessed their work and provided valuable feedbacks to the youngsters during the Poster Competition.
- Winners of the competition were awarded prizes.

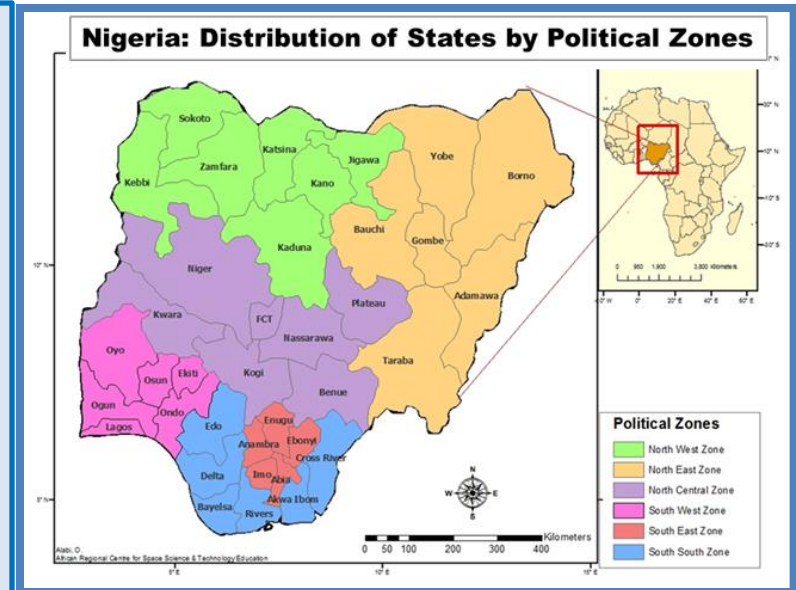


# ZGIP Project Evaluation



# Follow-up on ZGIP Project

- National Workshop for Teachers
  - A replica of the pilot phase focussed on teachers from all the six geopolitical zones of Nigeria.
- Distribution of Instructional Materials:
  - All the Instructional materials distributed during the pilot phase of ZGIP
  - Technical Report on the Pilot Phase of the ZGIP (documentation of the posters and reports from the schools that participated in the pilot phase of ZGIP)
  - **Clinostats (teaching tool) to be made available to participating schools at a subsidized rate.**



# Follow-up: Robotics Education Program

## 1<sup>st</sup> Female Nigerian to Participate in the World Robot Olympiad



➤ **She wants to do a lot of Programming in her life, and in the future, she looks forward to a career in Robotics or Artificial Intelligence**

- Miss Fiyinfoluwa Shoyoye
- Building and Programming Robots during REP sparked her interest in Programming and influenced her to commence an undergraduate study in Mechatronics Engineering at Bells University in Nigeria (GPA: 4.8/5.0)
- At Bells, she influenced the University to purchase some Robotics kits, and participate in the National Robotics Olympiad. Her team represented Nigeria in 2014 WRO held in Russia
- During her summer vacations she taught building and programming Robots to about 20 (Female: Male= 8:12) primary school children aged between 7 to 10.
- 1 of 60, and the only female Nigerian to participate in the Millennium Youth Camp, an international Program organized by the Academy of Technology, Finland in June 2014.
- Presently an undergraduate at the University of Helsinki in Finland.

# Conclusion

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**This 'Catch them Young'** approach to develop human capacity and prepare school children for careers in space science and technology **can be effectively implemented to a larger audience if the UN-OOSA would act as a coordinating center** and collaborate with space agencies and academic institutions in developing nations (such as Nigeria and other African countries)



# Acknowledgements

- UN-OOSA, for making the Clinostat available for the project
- All the people who offered voluntary services to ensure the successful completion of the pilot phase of the ZGIP. These people include (but are not limited to) the ZGIP team of ARCSSTEE; students and teachers from all the participating schools; and university professors and other eminent scientists who evaluated the poster presentation.



The ZGIP Team of ARCSSTE-E