SPACE SCIENCE AND ASTRONOMY POPULARIZATION: A CRITICAL ASSESSMENT OF THE ACHIEVEMENTS OF CENTRE FOR BASIC SPACE SCIENCE, NSUKKA, NIGERIA.

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ABSTRACT: Recently Astronomy has developed beyond naked eye observations to the use of sophisticated instruments, like large telescopes, better imaging devices, satellites and advanced space missions. Research in the field of Astronomy requires large number of dedicated individuals to incorporate ideas and take the quest of understanding the universe to the next level. Presently in Nigeria, fewer students are motivated to take up astronomy as a career option. The main reason for this setback is lack of awareness about the benefits inherent in this field of science. We report the activities of our outreach team, who are selectively knowledgeable in various aspects of research and development in the field of Astronomy, Astrophysics and Space Science in Nigeria to reach out to all our institutions of higher learning, secondary and primary schools where science career are built. In this work, we also highlight the facilities in terms of research laboratories, observatories and state of the art instrumentation needed to motivate young minds.

Keyword: Astronomy, Popularization, Summer School, Regional Node.

I. INTRODUCTION

In recent times, among the official missions of the world’s main astronomy research institutions are; outreach activities and space science popularization programs. This is true for most reputable space science organizations like the National Aeronautic and Space Administration (NASA) in the United States of America. Precisely, their mission statement dwells on “inspiring the next generation of explorers” and “engaging the public in shaping and sharing the experience of exploration and discovery” (NASA, 2003). Based on these, NASA has always taken awareness programs very serious, as its 2004 budget request for education is about 170 million dollars (NASA, 2003). Although we cannot say how much it actually spends on its outreach initiatives, we do know that NASA’s European “counterpart”, the European Space Agency, (ESA) has an education office that is responsible for a number of interesting Astronomy and Space Science projects for various societal and educational levels. In 2001 the European Southern Observatory which is a well-known inter-governmental European organization established in 1962 for astronomical research opened a dedicated Educational Office as part of its education and public relations department (ESO, 2003). This office operates an outreach network with 12-member committee of scientists and communication specialists from different countries. (ESO, 2002).

In Nigeria, the main research institution in astronomy and astrophysics is the NASRDA-Centre for Basic Space Science (CBSS), which is one of the activity Centres of the National Space Research and Development Agency (NASRDA) Abuja. The National Space Research and Development Agency (NASRDA) is a department under the Federal Ministry of Science and Technology and it is overseen by the National Space Council. CBSS is charged with the primary responsibility of conducting
fundamental research in Space Science (Astronomy and Atmospheric Sciences), as well as coordinating such research activities in Nigerian Universities and Research Institutes. The Centre was established in 2001, with the primary aim of initiating and fostering the growth of Basic Space Research in Nigeria in a well-coordinated manner in collaboration with Network of International Partners, Educational Institutions, Government Research Institutes and the organized private sector. Presently, CBSS is building a strong human capacity that is capable of handling numerous challenges of the Centre with highly skilled researchers.

A. The mandate of the Centre includes.

Explicitly, the Centre for Basic Space Science has the following mandates:

1. conducting research to expand the frontiers of knowledge in Astronomy and Astrophysics.

2. development of skills and knowledge of researchers.

3. enhancement of international collaboration with other organizations with similar interests, in well defined projects, in such a way that Nigerian scientists and engineers must ab-initio be involved in the development process.

4. Promotion of the introduction of astronomy into the curricular at all levels of our educational systems.

5. design, fabrication and patent of space science and technology instruments.

6. promotion of outreach and awareness programs capable of exciting young minds and disseminating to the general public the tremendous benefits derivable from space science & technology.

7. encouragement of relevant activities in other to provide the much needed physics education required for a thorough understanding of studies and problems in other areas of space science applications.

8. serve the distinct advisory and policy making roles to government and non-governmental agencies.

Based on mandates 4 and 6 above, the Centre for Basic Space Science has been actively involved in Space Science popularization and outreach programs in primary, secondary and tertiary institutions within and outside Nigeria. These are achieved through organizing Astronomy Summer School for west African students and teachers as well as organizing regular space week for primary and secondary school students. CBSS also receive students on excursion and introducing such students to basic space science. Figure 5 shows (a) class of primary and secondary school students with their teachers during the 2015 Space week celebration in Anambra state, Nigeria. (b) Primary school pupil on excursion to CBSS making their first observation using the optical telescope and University students on excursion to the CBSS observatory in 2014. (c) Students observing a practical demonstration of a locally fabricated water rocket and exhibition of an Unmanned aerial vehicle in 2013 outreach program.

II. ASTRONOMY POPULARIZATION IN WEST AFRICA

NASRDA-Centre for Basic Space Science is actively collaborating with other observatories and astronomy agencies in various space development projects and Astronomy popularization in Nigeria and other west African countries

A. Nigeria Joins Global Astronomy Network

According to the Nigerian Guardian Newspaper of Sunday January 10, 2016, the International Astronomical Union (IAU) acknowledged that the National Space Research and Development Agency (NASRDA) now acts on its behalf in West Africa which effectively incorporates Nigeria into the vast global network. A statement released during the 29th triennial General Assembly of IAU in the U.S. city of Honolulu, Hawaii, stated that the world governing body for Astronomy had designated the Centre for Basic Space Science (CBSS), Nsukka, as its Regional Office for Astronomy Development (ROAD). Thus, Nigeria becomes one of the five new coordinating regional offices, which the South African-based Office of Astronomy for Development (OAD) has established, with Armenia, Colombia, Jordan and Portugal hosting the other four ROAD. In an interview with the Guardian Newspaper, Prof. S.O.Mohammed, the Director General of NASRDA noted thus; “it’s something we have fought long and hard for.... The establishment of the OAD is part of the IAU’s Strategic Plan, whose objectives are to disseminate astronomical knowledge as a means of facilitating education, capacity building, and generally promoting sustainable development in countries like Nigeria”.


This event marked the commencement of the activities for the third regional office on the African continent and one of the nine regional offices globally. The event was attended by the Director of the IAU Office of Astronomy for Development (OAD) Dr. Kevin Govender, country coordinators from Gabon, Cote d’Ivoire, Burkina Faso,
Ghana, Nigeria as well as representatives from the host institution as shown in Fig 1.

The inauguration coincided with the First Nigerian Astronomy and Space Science Forum aimed at sourcing fund from Non Governmental Organizations (NGO’s) and interested partners for astronomy development and popularization in Nigeria and West Africa. After the official inauguration ceremony, a discussion session was held with the title: ‘Basic Space Science and Astronomy in Nigeria’. Prior to the inauguration, a day-long meeting of the country coordinators was held at Nsukka, Nigeria. At the meeting, the Regional Coordinator for the West African Office, said “We are pleased to have reached this important milestone towards the development of our region. Our office, together with our host institution, is ready to serve the region with all the skills and facilities we have available”. The West African Regional Office of Astronomy for Development (WA-ROAD) is hosted by the Center for Basic Space Sciences (CBSS), National Space Research and Development Agency (NASRDA) in Nsukka, Nigeria. The WA-ROAD is one of the nine other regional offices around the world, with others located in: Armenia, China, Colombia, Ethiopia, Jordan, Portugal, Thailand and Zambia. Furthermore, the inauguration was graced by distinguished Nigerians among whom are Senator Chukwuka Utazi, and Rt. Hon. Ifeanyi Ugwuanyi, Governor of Enugu State, and Prof. S.O. Mohammed, Director General of NASRDA. In a remark by Kevin Govender, director of the OAD; “The African continent possesses tremendous potential and a great desire for knowledge. We must utilize this knowledge to drive development. We are grateful to Nigeria, a leader on the continent, for assuming this important role of driving development through Astronomy in West Africa.”

III. CAPACITY BUILDING

A. Astronomy Summer School for west Africans Using Inquiry Based Method of Teaching

In October 2013, over 75 undergraduate mostly science students and teachers from Nigeria and Ghana attended the week long West African International Summer School for Young Astronomers (WAISSYA), at Abuja, Nigeria. The school was organized through a collaboration of astronomers from the: Canadian Institute for Theoretical Astrophysics, Dunlap Institute for Astronomy and Astrophysics, University of Toronto, Centre for Basic Space Science Nsukka, Nigeria, National Astronomical Observatory of Japan, IAU office of Astronomy for Development, National Space Research and Development Agency (NASRDA), as well as Institute for Scientist & Engineer Educators at the University of California, Santa Cruz.

It should be noted that West Africa has huge potential to develop a strong astronomy community, thanks to its large number of talented students who are interested in science. However, lack of interest from funding bodies and non existence of facilities have greatly impeded its progress. Nigeria is especially interested in building up a critical mass of West African astronomers and establishing collaborations with universities/astronomy institutes within and outside the region; this brought about the idea of WAISSYA through conversations at the IAU General Assembly in Beijing in 2012. The main aims of the Summer School were: (1) to introduce West African students to astronomy, (2) to exchange ideas about teaching and learning in West Africa and North America, with the goal of strengthening teaching in both places; and (3) to build foundation for a sustained astronomy partnership between West Africa and Canada. The teaching activities that were designed included: (1) community
building group discussions, on topics like why one might study astronomy; (2) lectures and problem sets, using interactive techniques like multiple choice questions where students vote, discuss together, then vote again (often called “think pair share questions”), on the topics of stars, the solar system, extrasolar planets, galaxies, cosmology, and instrumentation; (3) solar observing with Solarscopes and hands on lab activities about convection, magnetic fields, and radiative diffusion; (4) lectures on cultural astronomy, astronomy in Africa and the Office of Astronomy for Development, and how to apply to graduate schools; and (5) the focal point, a two day inquiry based laboratory on the Cosmic Distance Ladder team designed by the Canadian partners.

On the Cosmic Distance Ladder laboratory, two of our goals were for students to understand how the methods of parallax and inverse square law for light work for measuring astronomical distances. To improve participant’s ability to make scientific arguments, by arguing for the validity of distance measurements, we developed rubrics to measure student learning in both areas. The lab began with students asking questions about images of astronomical objects (e.g., the Sun, the Small Magellanic Cloud or dwarf galaxy); then they investigated their questions in small groups. The resource persons facilitated by listening, occasionally chatting with groups about their ideas and progress, and introducing new tools for them to consider. Students could explore their questions in many possible ways, and share their learning orally, by writing and by drawing pictures. Through the activity, students progressed from, “What are sunspots?” and “We know the distance to the Sun because we were taught it” to discovering the method of parallax themselves mental steps that were significant and exciting for them to take, and also for instructors to be part of. In later discussions, students enthusiastically debated the nature and applicability of parallax and the inverse square law for light. We evaluated the effectiveness of the school in a variety of ways. Before, directly after, and six months after the school, the participants were given astronomy concept inventory questions and surveys about their self confidence as scientists. (A concept-inventory is a set of questions validated by education researchers testing many students, often including common misconceptions as “distractor” answers).

The self confidence survey was adapted from earlier psychological research by Chemers et al. 2001, which assessed students’ levels of self efficacy for doing science, self identity as a scientist, and commitment to a science career. The fraction of concept-inventory questions our students answered correctly rose by 50% from before the school to directly after the school, with largest gains for topics that we taught most interactively. We also found that quantitative and qualitative assessment of our students’ learning pattern is crucial for offering higher measures of effectiveness of our teaching, and thus pointed to concrete ways through which we can improve for the future (Strubbe, 2014). According to Linda Strubbe, in 2013 and 2015, undergraduate students from Nigeria and surrounding countries experienced unique training opportunities at the West Africa International Summer School for Young Astronomers in Abuja, and Nsukka respectively. The 2015 summer school was organized by the National Space Research and Development Agency’s Center for Basic Space Science, in conjunction with partners that included the Dunlap Institute for Astronomy & Astrophysics as well as the Canadian Institute for Theoretical Astrophysics (CITA).
efficient teaching of astronomy. Team of instructors that included, postdoctoral fellows and graduate students from the University of Toronto, the University of Nigeria and other institutions taught students through lectures, group discussions, solar observing sessions and hands-on activities. Instructors led participants through inquiry-based activities in which students were taught to approach a problem like scientists, by asking questions, and exploring those questions and possible answers with peers. Proof of the success of 2013 summer school came only weeks afterwards as students shared their experience with members of their communities during the 2013 November 3rd partial solar eclipse phenomenon that was visible in most part of Nigeria.

IV. CONCLUSION.

We have successfully reported the popularization activities of our NASRDA-Centre for Basic Space Science, Nsukka outreach team. The team consist of scientist and Educators who are selectively knowledgeable in various aspects of research and development in the field of Astronomy, Astrophysics and Space Science. Our target is to reach out to all our institutions of higher learning, secondary and primary schools where science career are yet to be built. Our outreach program had been extended to other west African countries and we hope to reach out to both English and French speaking African countries in the near future. We have also highlighted the mandate of the Centre for Basic Space Science and hereby solicit for outreach facilities needed to motivate young minds.

REFERENCES

ESO Educational office can exhibit a rich website at http:www.eso.org/outreach/edwoff; at http:www.eso.org/outreach/ a variety of ESO outreach activities and materials are shown.