

CROSS BORDER EDUCATION IN GEOINFORMATION TECHNOLOGIES AND APPLICATIONS IN ASIA AND THE PACIFIC- A CSSTEAP EXPERIENCE

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ABSTRACT:

With increasing demand of geoinformation technologies in national natural resources management and developmental planning, developing countries having lack of expertise seek crossborder education for their working professionals from globally recognized institutions/organizations. As the first regional center set up by UNOOSA to train Space Science and Technology Education for Asia and the Pacific region, CSSTEAP has contributed significantly in the last two decades by following methods for effective knowledge transfer to large participants from this region. This paper outlines its efforts in framing programs, uniqueness of training institutions, as well as best practices adapted by this Center. The effectiveness of the training judged by feedback from Alumni show promising impact on their career growth.

1. INTRODUCTION

The emergence of geospatial information technologies (GIT) in infrastructural planning and natural resources management has increased attention for educational and training programs from various stakeholders, not only within borders of the nation but also more importantly across the borders (Samarakoon, 2008). Many developing nations, which are keen to get their working professionals but lacking necessary infrastructure and experienced professionals within the countries, approach globally recognized institutions to get their working professionals well trained for applying these technologies in their national development projects (Molenaar, 2008; Kufoniyi et al., 2008). Crossborder education deals with means and ways of such transnational sharing of knowledge.

Knight (2012) defines the cross border education as "movement of people, knowledge, programs, providers, policies, ideas, curricula, research and services across national or regional jurisdictional borders". She further elaborates crossborder education into three categories. 1). Mobility of students or trainees to a foreign country for the purpose of formal professional degrees, research or field work, internship or exchange programs; 2). Mobility of educational program through joint education programs between two institutions of two different countries and possibly exchanging of the trainers or educators as part of their agreement, and 3) Mobility of students, researchers or professionals with innovation as prime motive which may lead to possible employment away from the parent country.

Cross border education has become increasingly part of establishing human resources development in regional segments of the globe to learn changing scenario due to human impacted climate change. Global organisations (UN, CEOS, GEO, ISPRS, CGMS, WMO and alike bodies) are deeply concerned on cross border education aspect, and strive hard to achieve with large number of training programs on regional capacity building in using GIT for various societal benefit programs and climate

change actions. This is mainly to see all nations contribute to the integrated global development agenda - 2030 Sustainable Development Goals (SDGs), Sendai framework and Paris agreement. Space based observations can play a vital role in supporting the progress of SDGs. (Paganini et al., 2018).

In this paper, effort made by the UNOOSA's regional Centre, namely, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) towards these development agenda is described.

With the Asia and the Pacific region of the globe receiving about 45% of global natural disasters and its consequent loss of human life and livelihood support, it was felt necessary to increase the awareness of the use of GITs for regional disaster management programs and in promoting socio-economic development. The United Nations, through its Office for Outer Space Affairs (UN-OOSA), facilitated the establishment and operation of the Regional Centres for Space Science and Technology Education. In its resolution 45/72 of December 11, 1990, the United Nations General Assembly (UN-GA) endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space (COPUOS) to establish Regional Centres for Space Science and Technology in developing countries. The CSSTEAP was the first Centre established on November 1, 1995 in India, and subsequently five more such Centres covering Central and South America, Africa and the Western Asia.

2. CSSTEAP – MISSION, PROGRAMS AND UNIQUENESS

The Centre aims to support nations in Asia and the Pacific region with a strong human resource building in using space science and technology and applications skills for sustainable development through education to enable all the learners to reach their individual potential. This, in turn, will help to empower the nation's capacity 'ready at home' to manage their natural resources and disasters

without having to look for external support from outside. With this aim, the Centre targets to train mid-career professionals working in Government, research organisations as well as private industries. This is achieved through rigorous theory, hands-on experiments, field exercises and pilot projects. In order to achieve high quality education, the Centre has set up an international Advisory Committee comprising strong subject experts in different topics listed below and the Board of Studies Committee for time-to-time updating of the curriculum. It has a signed agreement with globally recognised Andhra University, Visakhapatnam, India, for participants to upgrade their diploma degree to Master of Technology (M.Tech.) degree.

The educational programme of the Centre is face-to-face training based, and is oriented towards the dissemination of knowledge in relevant aspects of space science technology and applications. The major educational and training programmes of the Centre are in the following disciplines:

- Remote Sensing and Geographical Information System (RS&GIS) –Post Graduate 9 months course conducted every year since 1996
- Satellite Communications (SATCOM) – Post Graduate 9 months course conducted every alternate odd year since 1997
- Satellite Meteorology and Global Climate (SATMET) – Post Graduate 9 months course conducted every even year since 1998
- Space and Atmospheric Science (SAS)- Post Graduate 9 months course conducted every even year since 1998
- Navigation and Satellite Positioning System (NAVSAT)- Short Course conducted during 2012 to 2014
- Small Satellite Missions (SSM)- Short Course (2weeks) conducted every year since 2012
- Global Navigation Satellite Systems (GNSS) – Post Graduate 9 months course conducted every alternate odd year since 2015
- Short course conducted every year on one of the theme-Geospatial, image Processing & RS technology, Disaster Risk Reduction & management; Coastal & Terrestrial Ecosystem, Natural Resource Management, Infrastructure, Climate Change Studies, etc.
- Short course/ Workshops on a theme on SATCOM, SATMET & SAS disciplines.
- In addition to above, Centre also organizes user demand short courses from Governing Board countries/ organizations, UNESCAP, UNSPIDER, IWMI and other agencies.

The uniqueness of the Centre's above courses lies on prime institutions or centres wherein the courses are undertaken. The Indian Institute of Remote Sensing (IIRS) at Dehradun has more than 50 years of services for remote sensing and GIS to the nation. The Gazette of India, the certifying body of academic quality in India, has recognised IIRS as the centre of excellence for technological education. IIRS has a signed agreement with the global institute – the University of Twente, Netherlands – to conduct Master of Science course in Geoinformatics. Space Applications Center (ISRO), Ahmedabad, is the nodal centre for conducting SATMET,

GNSS and SATCOM courses, and the primary ISRO centre for conceptualizing and building earth observation satellites, communication satellites, state of art infrastructure and developing applications tools to data exploitation. The Physical Research Laboratory, Ahmedabad - the cradle of Indian space programs – conducts the SAS course. It has many state of art observatories for astronomical and solar studies and contributed pioneering research in space and atmospheric sciences. UR Rao Satellite Centre, Bengaluru, which conducts small satellite mission course, has involved in design and development, integration and testing of all satellites. The training also includes total spacecraft project management and in orbit space operation elements.

3. CURRICULUM STRUCTURE OF COURSES

The 9 month PG diploma course is conducted in 3 modules, somewhat similar to modular training structure of Geoinformatics Professional Masters course of ITC (Kraak, 2005). The duration of these modules are 4 months, 2 months and 3 months respectively. The modular structure is found to be effective in terms of segregating theory, practical and field studies on eight specific themes as well as projects and educational tours. Average breakup of time for various activities are mentioned in Figure 1. As can be inferred, the practical experiments and field work (put together hands-on training comprises 75% of time, thus giving ample information for participants to familiar with practical knowledge. Teaching methods include classroom lectures, computer assisted practical/ assignments and demonstrations, laboratory experiments, group discussions, seminars and field work/case studies (as applicable). Lectures, practical and reading course material is provided to the students. The third module is oriented towards executing a pilot project, thus enabling student to apply the knowledge gained during the course under expert supervision from host institution.

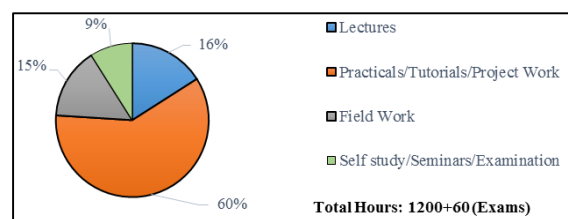


Figure 1. Course organization -percentage of time spent for various activities

4. OFF-SHORE TRAINING PROGRAMS

Besides the regular on-campus training efforts in both short-term and long-term formats, recently the Centre has taken a new initiative to take up "off-shore" campus training programs. The advantages of such type of courses are that many-concerned organizations of theme can join the course at their own country, thus increasing the reach manifold without increased cost. The recent example of such a special course was the one in Myanmar Yangon, during March 28 - April 2, 2017 on 'Post-Disaster (Earthquake) Rapid Damage Assessment' jointly

organised by UN-HABITAT, CSSTEAP and UNSPIDER. The training course was hosted by the Yangon Technological University in collaboration with Ministry of Social Welfare, Relief and Resettlement, and the Myanmar Engineering Society and Myanmar Earthquake Committee.

A total of 44 participants from 16 organizations of Myanmar joined this course. The role of high resolution satellite data and also the use of drone imaging along with GIS was emphasized with theory and practical classes on rapid damage assessment of buildings and monuments. The faculty was pooled from CSSTEAP, UNOOSA, and UNSPIDER. The second similar short course was co-organised by Regional Centre for Space Science and Technology Education for Asia and the Pacific (RCSSTEAP) and the UNOOSA in which CSSTEAP supported a short course organized on Integration of Multisource Earth Observation Data for Disaster Damage Assessment at Beijing, China during Oct. 26-31, 2017.

5. ADAPTED BEST PRACTICES

Following are some of the best practices followed in CSSTEAP training and education programs.

a. Continuing Education: Mentoring of participants who come for 9-month long PG Diploma training programs at CSSTEAP has revealed that they show keen interest in pursuing higher studies to receive a professional Master of Technology degree from a globally recognized Institute. It has been observed that participants are more focused and attentive when they are aware that there is an opportunity to extend the training work to further higher education. As this higher degree requires a minimum of twelve months project, this, however, may not be possible to carry out here in India. In the case of participants from India, as most of them students, the CSSTEAP offers one year fellowship with monetary support to pursue research. In both cases, the project reported submitted for the Master of Technology is evaluated an internal and an external experts. Figure 2 shows the schematic of procedure followed by the CSSTEAP for higher education.

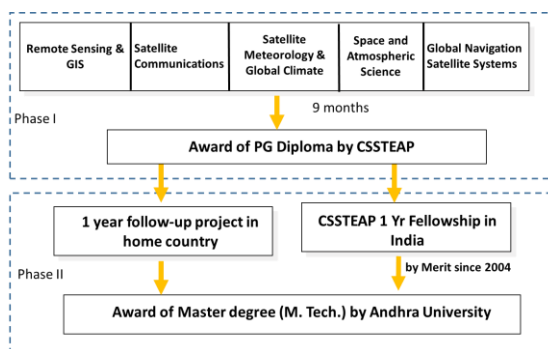


Figure 2. The schematic of procedure followed by the CSSTEAP for higher education

b. State-of-art Knowledge from International meets: To provide further exposure to advanced research, it is greatly beneficial if participants are able to meet pioneers, educators, lead scientists and researchers. Such opportunities exist in Symposia / Conferences / tutorials. The CSSTEAP has been sponsoring its participants during

their course period to attend national and international events for familiarizing them with current research areas. It has also been observed that the participants were enthusiastic about attending these events and volunteered to participate such occasions. Some of the events that the CSSTEAP participants attended in recent past are as given below.

- Course participants of RS GIS attended Asian Conference on Remote Sensing organized at New Delhi, INDIA during October 23-27, 2017. They have also attended Tutorials on GEO Global Agricultural Monitoring (GEOGLAM).
- Course participants of RS GIS, SATCOM and GNSS PG courses participated in Asia Pacific Remote Sensing organized by SPIE during April 4-7, 2016 at New Delhi.
- Course participants of RS & GIS course have participated in ISRS Symposium & National Convention during Dec. 7-9, 2016 at Dehradun. They have also attended tutorials on UAV, Hyperspectral RS, Microwave RS, Watershed, Health GIS, Close Range photogrammetry based on their choice.

c. Post-training Feedback from Alumni: This is about feedback on the effectiveness of the training programs after participants get back to their countries and do their regular professional career/job. Recently, a feedback survey was made through email questionnaire to alumni members for recent batch of participants from 2010-2015. To the question of the benefit of the course undertaken in their current job and assignments, about 91% of them voted for "highly beneficial" category, while 9% for "moderately beneficial". To another query if they would need any refresher course, more than 91% of them have strongly voted positive to it.

In addition, the CSSTEAP uses every opportunity to meet the Alumni members in person in their country, to exchange views and suggestions from the consumers. This in-person meeting not only helps the above objectives, but also brings together participants of different courses from the same country on common platform and facilitate the Centres to know about their achievements and how the Centre helped them in grooming their professional research career. The Alumni suggestions and recommendations for improving the course structure and even new short courses will help the Centre to plan for future course of activities.

d. Women Participation in CSSTEAP programs: An educated women prove more value to society by her proficiency in teaching on the entire family, neighborhood and ultimately to the nation. Realizing the importance of the capacity building for women participants, the UNOOSA has initiated a "Space for Women" project to encourage strongly its regional capacity building centers to empower the women in developing countries towards strengthening capacity-building activities focusing on women's perspectives in addressing goals and targets enshrined in the interlinked 2030 Agendas, namely the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015-2030, and the Paris Climate Agreement.

The CSSTEAP strongly encourages women participation, in tune with declaration. So far out of about 2000

participants benefitted from CSSTEAP courses, 31% are women. This has been achieved through selection process of participants.

e. Digital Knowledge repository: For retention of knowledge gained from the training programs, the participants often would like to refer back the training material used during this course. For such applications, the Centre has developed digital knowledge repository in which not only the course content but also videos, demonstration software, case studies, tutorials, e-learning contents etc. are placed for participants to refer before, during and even after the completion of the training program.

f. Education Dashboard for learning: Even after spending considerable amount of time with existing dashboard with various satellite data and associated layers of information, it has been observed that a good number of participants appear reluctant to use when they come to use for their own countries data. To overcome this, it was decided last year to prepare an education dashboard with specific emphasis of the use of space based data and other information needed for handling disasters. A case study was taken up to design and demonstrate the weather and disaster information service portal named "System for Weather and Apadaa Management Information for Sri Lanka" (SWAMIS).

This Education Dashboard consists of 1) data and information which cover base layers, socioeconomic data, hydrology and flood information, elevation data, satellite images and also satellite data driven meteorological parameters (rainfall, cloud fraction, surface temperature, relative humidity, surface wind speed. It has additional features on tools and utilities (open source GIS, GIS navigation tools, overlay of user defined GIS data, layer transparency and swiping tool, to mention a few. The aim of this utility is to educate the participants and at the same time encourage them develop on their own with their countries inputs.

g. Campus Life and cultural activities: Campus life and classroom ambience are two important elements for any successful training program, especially long term PGD programs. The CSSTEP provides a large set of facilities to make its participants to 'feel at home' atmosphere. All the participants are provided with a monthly fellowships as living expense; all their travel (local and international) support for all its participants. Each participant is accommodated in a single occupancy comfortable hostel room, equipped with kitchenette. They can access 24x7 digital library and avail medical facility, subsidence allowance and waiving of course fee, satellite data, book, project and field work allowances, visa and baggage for their travel costs, English language coaching in initial months, and importantly cultural visits to important monuments and technical visits to many institutions for exposure to gain knowledge. They also actively involve national and international festivals to keep their interest in cultural exchange events within the campus.

6. ACHIEVEMENTS

It has been witnessed that there has been steady growth of participants in the CSSTEAP programs. Figure 3 shows the number of participants year wise enrolled in various programs. More than 2000 professionals have been so far trained. It was also observed that the number of participants enrolling in short courses of 2-4 weeks are on the increase; most of them have professionals working in various government organizations. The very purpose is to gain skills development in utilizing the geospatial information technologies in their respective departments. The distribution of overall participation spreads across various countries in Asia and the Pacific regions, as depicted in Figure 4. Many participants have been benefitted in their career promotions in their organizations and also presently play important roles in their national building effort, as the recent survey of Alumni feedback reveals.



Figure 3 Year wise enrolled participants in CSSTEAP training programmes

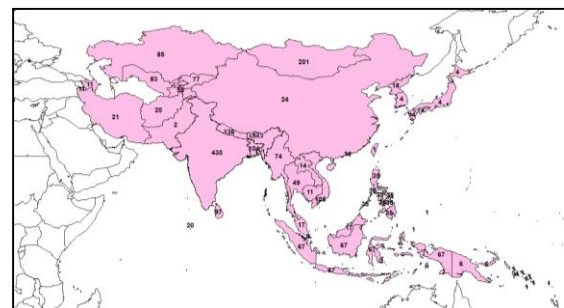


Figure 4. Countries benefited with no. of participants

7. CONCLUSIONS

Geoinformation technologies has tremendous potential to meet societal applications, thereby helping nations manage and monitor their natural resources and urban planning and infrastructure without affecting the nature. The Asia Pacific region faces recurrent natural disasters, and needs strong capacity building efforts on Geoinformation technologies and its applications in order to develop required human resources without looking for expertise from other countries, especially during the crisis. To achieve this, UNOOSA has chosen to establish its affiliated Centre for Space Science Technology Education in Asia and the Pacific in India. This Centre has taken steps to follow good practices in its training programs to effectively improve the imparting of knowledge coming from various countries in this region. Efforts are underway to improve scope of its training programs in line with UNOOSA's Space based Sustainable Development Goals to all the regional partners in this Asia-Pacific region.

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