

Challenges and models in conducting space technology courses with multi-ethnic students group – Assessment of International courses at IIRS & CSSTEAP

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ABSTRACT

Development of human resources in developing countries assumes importance in applying space science and technology for sustainable development of the region and managing disasters through education and skills development programs. The primary motivation is to impart sufficient knowledge at all levels starting from educators, working professionals and decision making officials to empower them reach their individual potential. This would help these workforces to be self-sufficient without looking forward to other countries, especially during national crisis.

The main challenge to the international effort in capacity building to reduce gaps between the developing and developed countries is the large variability in teaching methodologies and medium of instruction. International training programs undertaken at the Indian Institute of Remote Sensing, Dehradun, India have participants from different regions, thus challenging the trainers to manage multi-cultural and multi-ethnic learning environment. Participants come from different higher education systems each with diverse missions, history, and societal context. How to bridge the differences in culturally dependent learning and teaching styles related to cultural identity and heritage in a time bound training.

An effort has been made to develop an approach through a customized survey questionnaire, which brings out pertinent highlights of analysis and review based on feedback through a customised survey conducted from the participants of International courses and training programmes organised at Dehradun in Indian Institute of Remote Sensing (IIRS). The survey questionnaire is divided into broad vertical-themes covering major aspects related to Education, Academic, benefit from the course, amenities-infrastructure, etc. The most important and pivotal part in sample collection is the human-touch given to felicitate participants so that unbiased and open views are received, which includes translating questionnaire to language of participants in case of customised courses for specific countries and then retranslating back in English for deciphering the feedback.

Outcome and findings suggests the gap-areas and strengths in the practices being followed for conduction of international courses at IIRS and CSSTEAP in specific, which may also be useful to any organisation conducting international courses with participants form various counties across different continents.

Keywords: Survey, Questionnaire, IIRS, CSSTEAP, feedback, international-participants, courses.

1. INTRODUCTION

The space technology is a vital tool for harnessing the natural resources to meet the societal needs. Various applications and utilisation programmes in Earth Observation satellites across the globe are trying to bridge the gap existing across continents and dissolving the national boundaries. Training and capacity-building in the field of remote sensing and geospatial techniques plays an important role in making the effective use of space technology to reach the last-mile and help the common-man to receive best end-use applications for human

1.1 Overview and background of IIRS & CSSTEAP

Indian Institute of Remote Sensing (IIRS)- an ISO 9001:2008 institute, is a constituent unit of Indian Space Research Organisation (ISRO), Department of Space, Government of India. Since its establishment in 1966, IIRS has been a premier institution and key player for capacity building in the field of Remote Sensing and geospatial technology, and its applications through training, education and research. The training and education programmes of the Institute are designed to meet the requirements of professionals at various levels including researchers and academia.

The Institute has a strong, multi-disciplinary and problem-oriented research agenda that focuses on developing improved methods/ techniques for processing, visualization and dissemination of EO data and geo-information for various societal applications and better understanding of Earth's system processes. Currently the institute has its major research focus towards microwave, hyperspectral and high-resolution EO data processing and their applications. The institute have state-of-the-art laboratories and field-based instrumentation and observatories network to help meet the research goals and objectives.

The Institute is involved in research activities on high resolution satellite image analysis (space, aerial and terrestrial), 3D visualization of real world mobile applications, hyperspectral RS data analysis, photogrammetry, microwave data analysis, snow melt runoff, landslide hazard modeling, carbon flux measurement and modeling, data assimilation, statistical & numerical modeling in understanding atmosphere and climate, mineral prospecting, hydrological process, soil erosion, wildlife habitat, biodiversity analysis, etc. IIRS houses facilities like atmospheric CO₂ measurement network, observatory for aerosol climatology, carbon flux towers for measuring energy, water vapour and CO₂ exchanges, field observatory for soil erosion and runoff assessment, laser-profiling, Automatic Weather Stations, field observatory for hydrological modeling, besides full-fledged Digital Image Processing and Geo Informatics Systems labs etc.

IIRS is also one of the most sought after institutions for conducting specially designed courses for the officials of Central and State government ministries and stakeholder departments for the effective utilization of earth observation (EO) data. The institute organises about 40 courses every year and it has trained has trained 10,899 professionals (till August, 2017), including 1064 professionals from abroad representing 95 countries mainly from the Asia, Africa and South America. A total of 180 students in M.Sc. and 263 Students in M.Tech. courses have graduated since 2002. Special tailor-made/on-demand courses are conducted at the request of the User Departments, both national and international. In the last few years, demand for such tailor-made courses has increased significantly.

To widen its outreach, IIRS has started live and interactive distance learning programme (DLP) in 2007. Further, 684 institutions/ organisations in the country are currently networked with IIRS/ISRO through outreach programme and 53,288 students and professionals have been benefited so far since 2007. Under e-learning programme of IIRS outreach activity there are currently 2928 learners wherein 855 have registered for certificates including 160 participants who have paid the fees and 71 certificates are issued so far.

As a follow up of the National Meet held on September 07, 2015; IIRS is also given a responsibility of Capacity Building needs for good governance in Central Ministries and state governments. IIRS provides support to conduct all its remote sensing and GIS training and education programmes at postgraduate level.

The Institute campus also houses the headquarters of the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), affiliated to the United Nations and first of its kind established in the region in 1995. IIRS provides support to CSSTEAP. The centre has a Governing Board consisting of signatories from 16 countries from Asia-Pacific region and two observers, (UN-OOSA & ITC, The Netherlands).

Various programmes of CSSTEAP are executed by Scientist/ Engineers in Department of Space (DOS) at campuses in Dehradun, Ahmedabad and Bengaluru. The centre has arrangements with IIRS, for Remote Sensing and Geographic Information System (RS&GIS); with Space Applications Centre (SAC), Ahmedabad for Satellite Communication (SATCOM), Satellite Meteorology (SATMET) and, Global Navigation Satellite System (GNSS) and Navigation and Satellite Positioning Systems (NAVSAT); and with Physical Research Laboratory (PRL), Ahmedabad for Space and Atmospheric Sciences (SAS).

Till date the Centre has conducted 52 PG Courses (21 in RS&GIS, 10 in SATCOM, 10 in each SATMET and SAS and 01 in GNSS). CSSTEAP has conducted 52 short courses and workshops in past 21 years. These programmes have benefited 1919 participants (PG-917 and short courses-1002) from 35 countries of Asia-Pacific region and 30 participants from 18 countries outside Asia Pacific region. Till date, 143 PG students (69 in RS&GIS; 37 in SATCOM; 18 in SATMET and 19 in SAS) from 16 different countries have been awarded M.Tech. degree. Three courses are presently ongoing, namely RS&GIS, SATCOM and GNSS.

IIRS is one of the premier Institute of excellence of Government of India in the field of remote sensing and geospatial technologies and also at Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), an United Nations affiliated centre, with headquarters in IIRS campus.

2. METHODOLOGY OF CONDUCTING THE SURVEY

The methodology may be broadly explained in terms of organisation of the questions, followed by the way of conducting the survey and finally tabulating the results in summary.

The primary data source for this survey is a uniform questionnaire formulated by selecting a close-ended objective type questions with a maximum of four choices which requests candidate to rate each question/statement using the scale wherein 1 is the minimum and 4 is the maximum. However some of the questions do have less than two choices (generally two options only), wherein minimum is equivalent to 3 and maximum equals to 4. Besides aforesaid two categories there are certain questions with open-ended answers also like asking for providing any other comments/observations the candidate wishes to make about the course. For unbiased framing of questions and selecting amongst various types of queries the authors consulted volunteering colleagues who provided their independent opinion in editing the 'survey questionnaire'. The final questionnaire is very user friendly and self-explanatory with only four pages and 37- questions clubbed under four categories

2.1 Sample size and pertinent figures

The ambit of this survey included multi-ethnic international participants coming to IIRS and also in the CSSTEAP. The survey majorly aimed in the mechanism of conducting a special session on the last or penultimate day of the course completion for collecting the feedback in all international courses organised at IIRS and also CSSTEAP during November, 2016 to June, 2017. The authors also travelled to outstation centres of CSSTEAP like Physical Research Laboratory (PRL), Ahmedabad and Space Applications Centre (SAC), Ahmedabad for collecting the primary feedback data from the international course participants of ten-months Post Graduate Diploma (PGD) course conducted in CSSTEAP for the programmes on Satellite Meteorology (SATMET) and Space and Atmospheric Sciences (SAS).

Broad statistical summary may be enlisted in the table as follows:

S. No.	Course Name		Duration		No. of participants		No. of Countries participated	Gender	
	Centre	Description	Start date	End Date	Attended course	Participated in survey		Male	Female
1.	CSSTEAP	RS& GIS	01/07/17	31/03/17	19	18	11	9	9

	-IIRS								
2.	CSSTEAP -PRL	SAS	01/08/2016	30/04/17	12	10	2	0	10
3.	CSSTEAP -SAC	SATMET	01/08/16	30/04/17	13	10	7	4	6
4.	CSSTEAP -IIRS	UAV	12/06/17	23/06/17	21	21	9	19	2
5.	CSSTEAP -IIRS	LiDAR	15/05/17	26/05/17	21	20	9	14	6
6.	CSSTEAP -IIRS	NWP	03/07/17	14/07/17	25	22	12	13	9
7.	IIRS	ITEC	09/01/17	03/03/17	22	21	14	15	6
8.		ITEC-Tajik1	07/06/17	03/07/17	20	20	1	19	1
9.		ITEC-Tajik2	19/07/17	14/08/17	20	20	1	20	0
Total					173	162	(26)	113	49

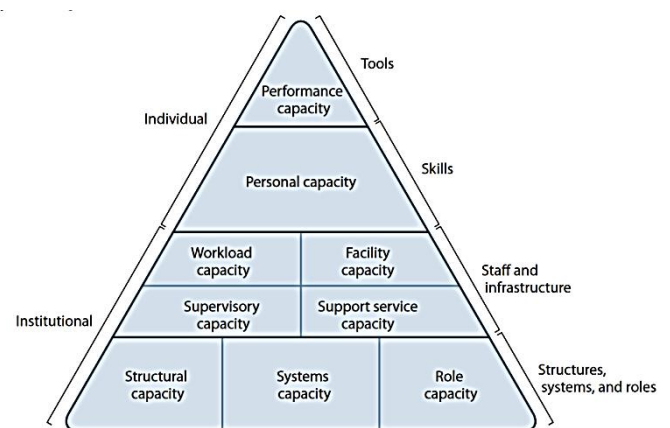
3. TRAINING AND CAPACITY BUILDING

Training is concerned with imparting specific skills for a particular purpose. Training is the sequence of learning a sequence of programmed behaviour. Training is the act of increasing the skills of an employee for doing a particular job. Training is any planned activity to transfer or modify knowledge, skills, and attitudes through learning experiences. Personnel may require training for a variety of reasons, including the need to maintain levels of competence and respond to the demands of changing circumstances and new approaches and technologies. Training by itself cannot solve structural, organizational, or policy problems within an organization, although supportive supervision and the use of motivational strategies can help sustain performance improvement derived from training.

“Training is the process that provides employees with the knowledge and the skills required to operate within the systems and standards set by management.” (Sommerville 2007)

Options range from short courses to long-term placements in academic institutions in the country, in the region, or overseas, and non-classroom based interventions, such as on-the-job training, coaching, and mentoring. All options must be weighed against the immediate operational needs of the program or institution, because facilities may not have enough personnel to operate when staff members go for training. The learning outcomes that must be achieved, along with the training environment, audience characteristics, and the experience of the trainer, all determine the mix of learning methods and media that will achieve maximum effectiveness. Methods and media may include lecture, discussion, case study, role-playing, group exercise, simulation games, brainstorming, and demonstration. If no published training materials—including audio-visual aids—are available, the trainer must develop them.

Development of the training program also includes design of the training evaluation, which is carried out during the course as well as at its conclusion. During the course, trainers monitor learner progress and satisfaction to identify where they may need to make adjustments to the training program. At the end of the course, trainers should collect data on how well the learners achieved the course objectives and how satisfied they were with the training experience. Whenever possible, the trainer should follow up with participants after they return to their work situations to assess the impact of training on performance. Data collected during follow-up can help identify the need for additional training or reinforcement of newly acquired skills, as well as inform review and revision of the training materials.



Source: Adapted from Potter and Brough 2004.

Capacity Building Framework

In some countries, availability of basic training and continuous professional development programs is limited; therefore, many health workers lack access to formal training opportunities and new ideas and approaches that can improve their work performance. Well-designed in-service training programs can help fill this need.

Training should be put into a context of continuous performance improvement. Changing and improving practices require an environment conducive to work, the appropriate learning resources, and the continuous use of motivational strategies. Training should be based on competencies: the abilities required to do work to the standards expected. At the same time, training alone is unlikely to change overall supply system performance unless the environment and supervisory systems support change and unless individuals are encouraged to maintain changes. Learning requires active involvement. People prefer to learn in different ways—through visual stimuli, verbal interactions, and learning by doing. Therefore, offering a variety of training opportunities and training techniques is usually more effective than using only one approach. Training can be formal or informal, academic or applied, guided or self-directed, or provided in public agencies or private institutions.

Training alone is often not sufficient to change behaviour or improve performance. Improved performance, changed attitudes, and new skills acquired during training may need to be complemented by and maintained through continuing education, supportive supervision, and adequate motivational incentives. In many cases, structural changes, such as workspace improvements and increased access to supplies and equipment may be needed to support improved performance.

Skills are critical to economic growth and social well-being. Although initial vocational training at upper secondary level provides useful skills, in many jobs where demand is fast-growing like in remote sensing and geospatial techniques, such basic vocational training is no longer enough. Indeed, higher level professional, managerial and technical skills are increasingly required.

3.1 Development:

Management development is all those activities and programme when recognized and controlled have substantial influence in changing the capacity of the individual to perform his assignment better and in going so all likely to increase his potential for future assignments. Thus, management development is a combination of various training programme, though some kind of training is necessary, it is the overall development of the competency of managerial personal in the light of the present requirement as well as the future requirement.

Development an activity designed to improve the performance of existing managers and to provide for a planned growth of managers to meet future organizational requirements is management development. Conventional 'training' is required to cover essential work-related skills, techniques and knowledge, and much of this section deals with taking a positive progressive approach to this sort of traditional 'training'.

Importantly however, the most effective way to develop people is quite different from conventional skills training, which let's face it many employees regard quite negatively. They'll do it of course, but they won't enjoy it much because it's about work, not about themselves as people. The most effective way to develop people is instead to enable learning and personal development, with all that this implies.

So, as soon as you've covered the basic work related skills training that is much described in this section focus on enabling learning and development for people as individuals which extends the range of development way outside traditional work skills and knowledge, and creates far more exciting, liberating, motivational opportunities for people and for employers. Rightly organizations are facing great pressure to change these days To facilitate and encourage whole Person development and fulfilment Beyond traditional training.

3.2 Need for Training

Training is a basic necessity for advancement of science and technology in a country. Some of the most important aspects of advancement of scientific and technological advancement of a society is the regular updating of the scientists, technologists and the academicians in the recent advancements in the various fields of science and technology. Space technology is one of the most rapidly advancing branches of science and technology as it has components of electronics, information technology, communication and earth observation. Infact space technology

has been one of the driving force for a number of innovation as well as dual use products which has been actually developed for space use. Some of the important reasons for advance training in space science has been as follows:

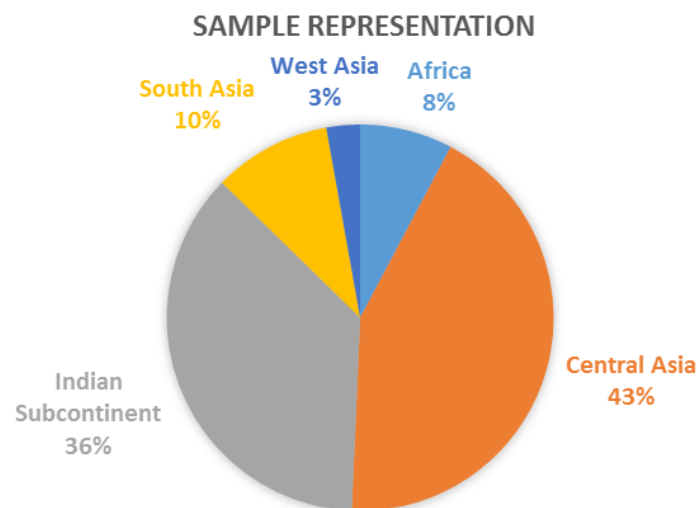
1. Globalization
2. Need of leadership.
3. Increased value placed on intangible assets & human capital.
4. Focus on link to business strategy
5. Customer's services & quality emphasis.
6. New technology.
7. High performances model at work system.
8. Economic changes.
9. Attracting & retaining talent

4. CHALLENGES IN MULTI-CULTURAL AND MULTI-LINGUAL GROUPS

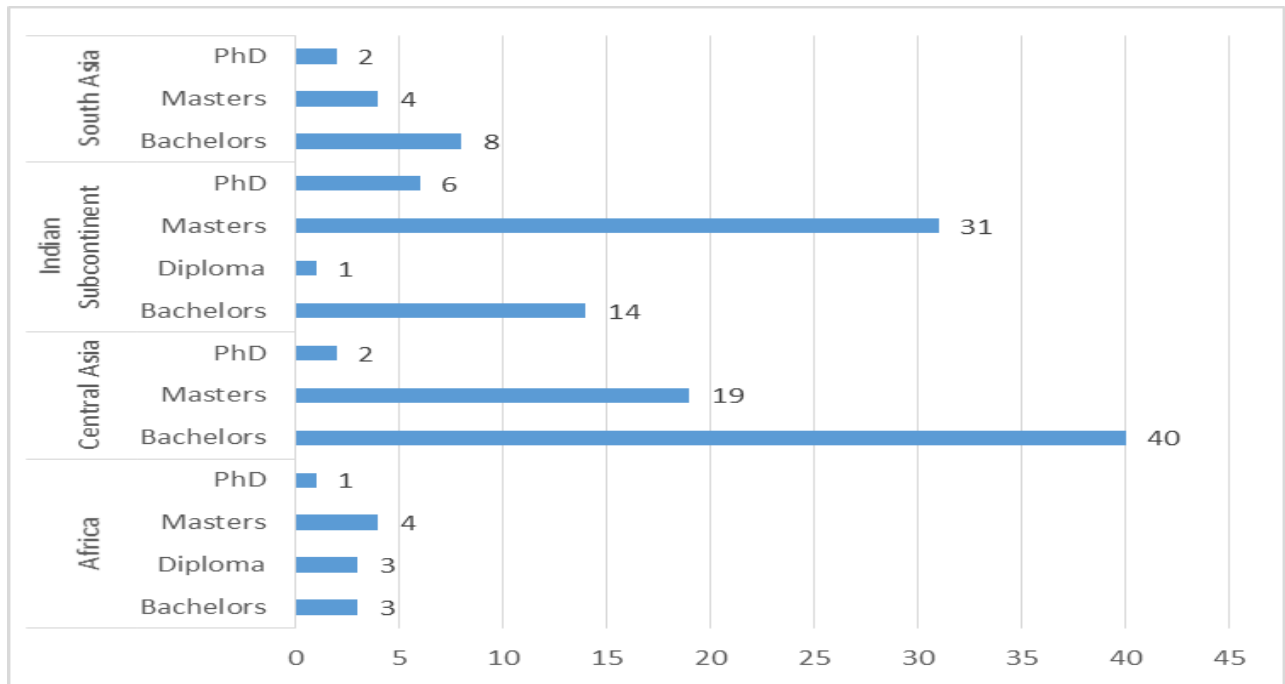
One of the most important challenges in any training both long term as well as short term is the smooth transfer of knowledge and information from teacher or instructor to the student/ trainee. Since there are numerous languages in the region and in many of the countries whose citizens are trained at IIRS the medium of instruction is English. So one of the important challenge is the language or medium of instruction.

5. MAJOR FINDINGS:

After analysing the questionnaire and quantifying the criterion identified some of the key issues were identified. A total of 142 participants had participated in the survey. Among the 142 participants 43% of the participants were from Central Asia where the dominant language is Russian. 36% of the surveyed participants were from the Indian subcontinent constituting participants from India, Sri Lanka, Nepal, Bhutan and Bangladesh. 10% of the participants were from the South Asia and the Pacific, 8% from Africa and 3% from West Asia.



Distribution of the ethnicity of participants in the survey



Educational Qualifications of the participants region wise

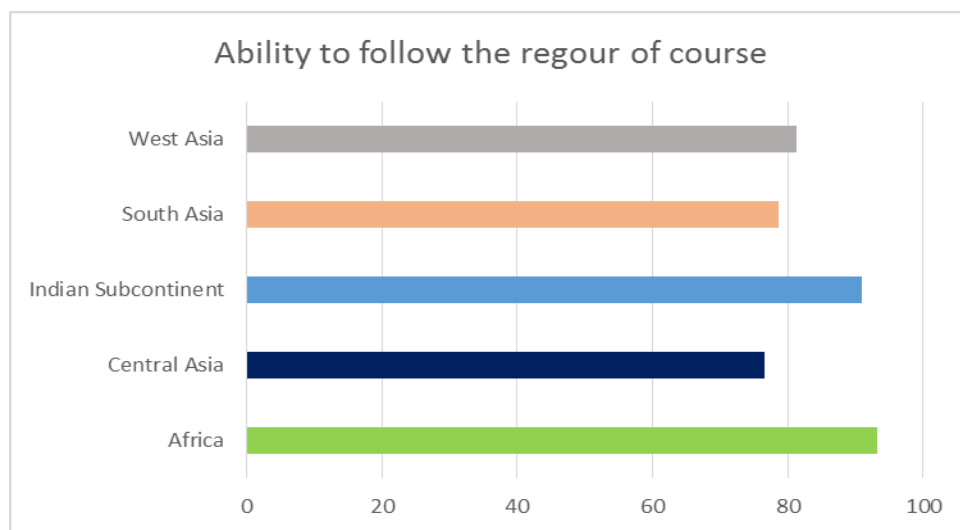
On analysing the highest educational qualification among the regions, the Indian Sub-continent had the maximum number of participants with Masters as well as PhD. Infact the number of candidates with masters were more than the number of Bachelors. But for the central Asian and the South Asia and the Pacific, the people with bachelor’s degree were the dominant population. It has a very interesting trend i.e. most of the people from Indian Sub-continent were from Science background where as those from Central Asian countries were predominantly from technology background. This difference in the educational background has a role in the requirement and perception of the training process among the students.

Another interesting observation is the variation in the medium of instruction in the higher education among the surveyed candidates. It has been observed that the candidates who are coming for short duration courses like 2-4 weeks are less conversant in English as compared to the candidates who come for longer duration courses. This results in the difference in perception and ability to follow the classes in CSSTEAP/IIRS. Fig xx shows the distribution of the candidates from different courses with the dominant medium of instruction in the qualifying degree.



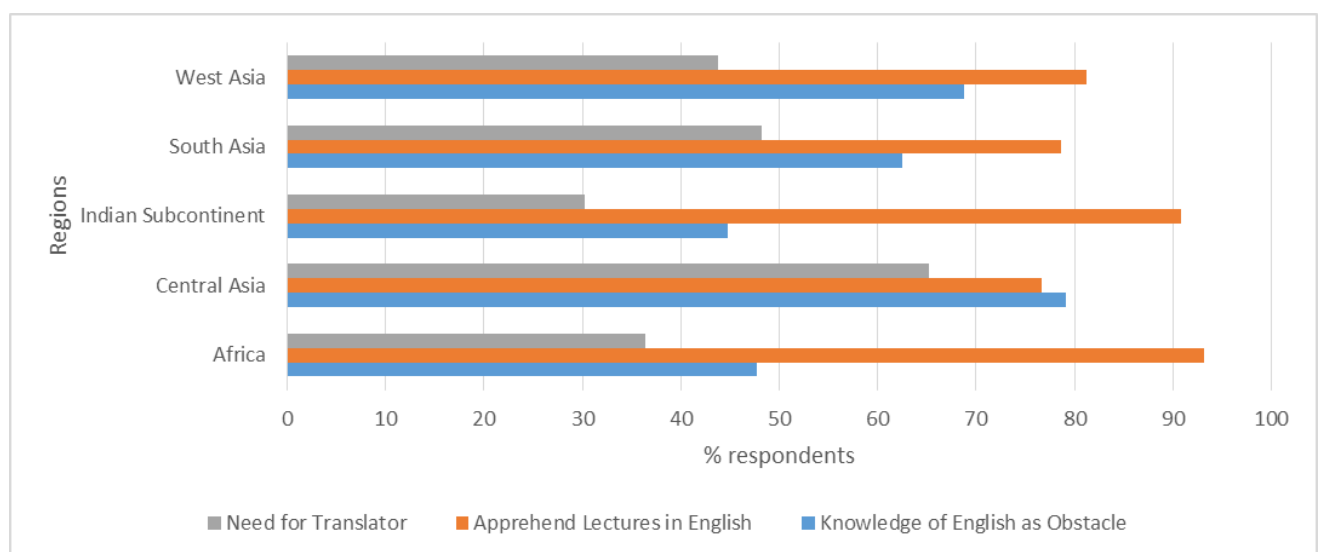
Distribution of candidates and the medium of instruction in qualifying degree

One of the most important query was the ability to follow the rigours of the course at IIRS. It has been observed that more than 75% of the participants could follow the rigour of the course. The candidates of the short course fared less than the participants of the longer course. This is obvious as the candidates of the longer courses like the 9 month PG Diploma of CSSTEAP had the time to acclimatize to the new culture and they also had longer time to interact with the faculty and their fellow participants which enable them to adapt to the standard and level of the course here at IIRS/CSSTEAP. On analysing the performance of the candidates from different regions of the world in this particular regard, it was observed that the participants from the central Asian and South Asian countries fared a little less than the participants from the Indian subcontinent and the African countries in this aspect (i.e. ability to follow the rigour of the course). This may be due to the fact that the medium of higher education in the Indian subcontinent and the African countries is English where as in the south Asian and central Asian countries the medium of instruction is either Russian or the national language of the respective countries. And since the medium of instruction in IIRS/CSSTEAP is English, it is a bit difficult for the participants from non-English speaking countries to follow the rigours of the course.



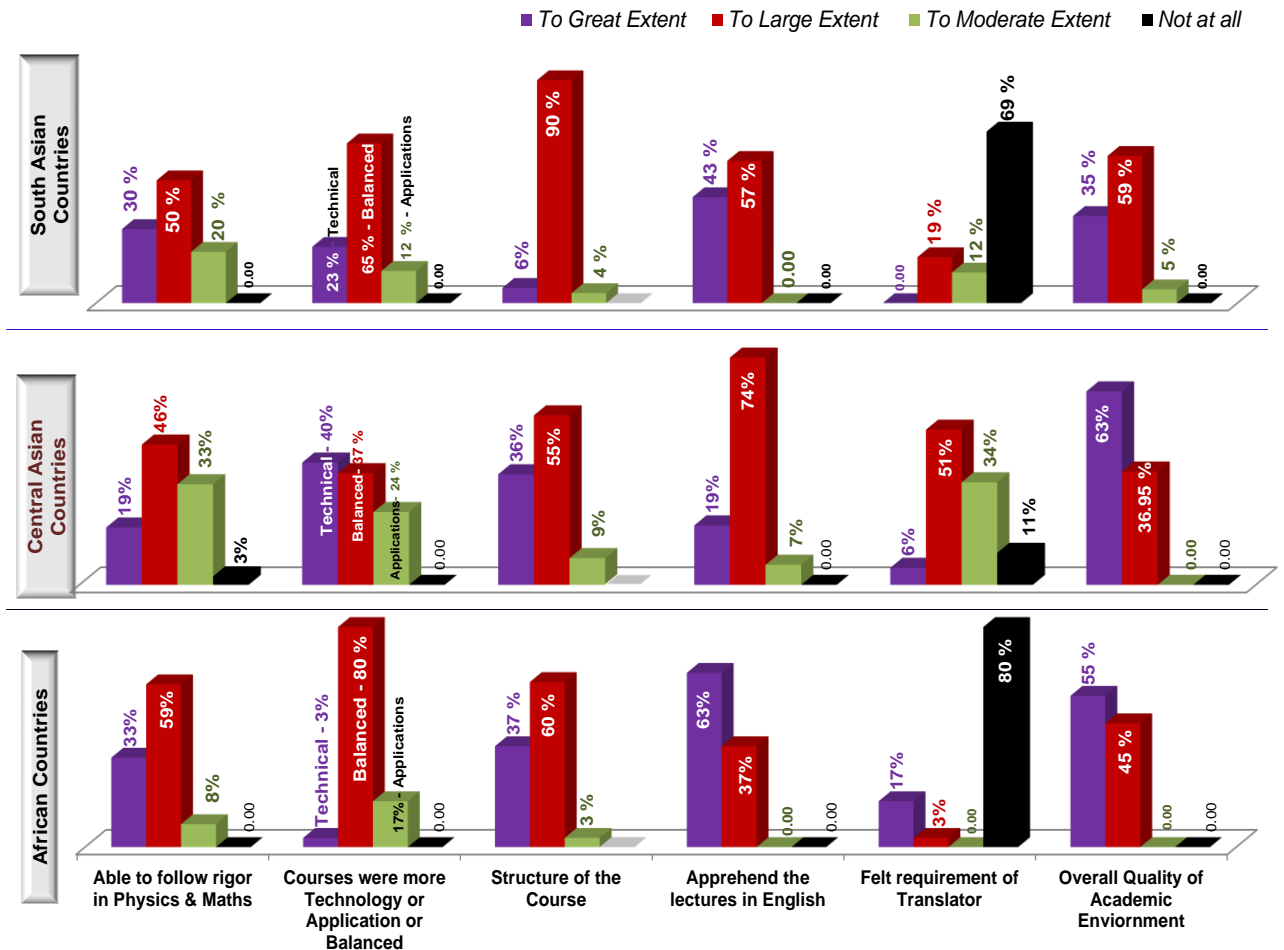
Ability of the candidates to follow the rigours of the course

Since it has been identified that one of the main issues faced by the candidates in the international courses at IIRS/CSSTEAP is the medium of instruction, so a different set of questionnaires were analysed. The issues analysed were whether knowledge of English was an obstacle; were the participants able to apprehend the lectures in English and finally whether there was a need for a translator.



Issues faced by the candidates in knowledge and need for interpreter

It was observed that in the short courses a presence of a translator was beneficial as well as economical viable as a single translator could be employed for the entire class (with records as on May, 2017).



Continent wise performance of the different participants in the International Courses at IIRS

If we observe the overall feedback of the different international courses at IIRS, most of the participants have graded the course to be technical and useful. Furthermore most of the participants have shown keen interest of coming back to IIRS/ CSSTEAP for future courses. Although many of the participants have flagged the requirement of a translator especially the participants from the south Asian and central Asian countries. While some have also risen concern for providing the course content or some refresher material in advance so that they may revise their concepts for better preparedness in receiving the lectures/ trainings envisaged to be imparted during the tenure of the courses at IIRS.

6. CONCLUSIONS

Our lives are more multidimensional than ever and part of the postmodern adventure is learning to live in a variety of social spaces and to adapt to intense change and transformation. Though an official feedback is also taken regularly but analysis of the responses given by 162 participants from 26 countries during 9 courses (long & short) to this specific questionnaire in the present study highlights the fact that the geo-information science pedagogy in growing multi-cultural, multi-ethnic environment may be pursued as an outcome of this new surveying exercise done at IIRS. This enhances further, the dissemination mechanisms in the RS&GIS based training

programmes and quality of education in the students from various foreign countries and multi-ethnic groups. The study and evaluations have helped to identify the gap areas in dissemination of course contents and bring improvements to better strategize the delivery mechanisms in challenges and models in conducting space technology courses with multi-ethnic students groups.

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