

Developments in distance learning education at ITC - criteria and constraints for flexible GIS education -

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Introduction

Education and research in GIS cannot escape from the global developments in GIS itself, ICT in general and new emerging ways of education. The International Institute for Aerospace Surveys and Earth Sciences (ITC), being an international institute with a core focus on education (research and consulting) in the design, use, management, application of geoinformation and remote sensing, has therefore to accommodate and adapt its education to these new trends. More flexible ways of transferring the knowledge and skills, and providing mechanisms to update these where needed, require more than adopting new education forms alone. With a mission of using international education for human resource development, institutional strengthening and capacity building in developing countries, ITC's training and education programmes need to offer a broad spectrum of education types, venues, duration and mechanisms. This article will explore these, with a particular eye towards possibilities and constraints for distance education.

ITC's current education is through a variety of courses at the institute itself in the Netherlands (short courses, diploma, professional master, master of science, PhD programmes), as well as through various courses in a number of countries. The latter are either institutionalised at sister institutions (e.g. RECTAS/Nigeria, IGAC/Colombia), at institutions with which ITC has a cooperation agreement (example: Polytechnic of Namibia, CLAS/Bolivia), or through specific shorter courses (refresher courses, contract education, etc.). Recently, also the PRONET/CCE project has offered the possibility of distance learning. In that sense, teaching / learning at distance as well as distance learning is already prepared and conducted by ITC.

Since its establishment in 1950, some 15,000 students have been trained at ITC, with approximately 90% of this group originating from so-called developing countries. Throughout the years ITC has therefore gained experience with how to deal with heterogeneous educational, cultural and academic background of students. This experience and the characteristics of potential ITC students and current ITC alumni is put against targets and experiences of the distance education, such as developed under project PRONET/CCE.

Target groups and profile of students of ITC

With its core business in geoinformation systems and management, ITC's students, main clients and target groups include individuals and organisations in developing countries dealing with geoinformation and remote sensing. Most students are mid-career professionals from mainly two types of organisations and/or projects:

- 1) Geoinformation production organisations dealing with geoinformation regularly and systematically: National Mapping Agencies, Cadastres, Geological Surveys, Agricultural Statistical Bureaux, etc.
- 2) Applications and/or problem oriented projects and organisations dealing with geoinformation mostly on a non-regular basis

The first group has not only based its production and output on a wider range of spatial data acquisition techniques, geoinformation technology, and geoinformation output and visualisation, but also has an obligation to optimise its production processes. Management, optimisation, exchange of information and geoinformation infrastructure therefore play a crucial role in addition to basic techniques of data management, acquisition and storage.

The second group deals more with geoinformation as fundamental data or base input in further analysis or research processes. Geoinformation systems thereby support the process, either directly, indirectly or exploratory. Management and modelling of the spatial data is of importance, but there is less of a standard production process, which needs optimisation. GIS is more an exploratory and research tool than a production management tool.

This complete spectrum of geoinformation handling and management is also reflected in ITC's current educational programmes. Depending on the direction of use and management, the education is different. The following examples of programmes show this:

- GIS as technology -> geoinformatics
- GIS as tool -> natural resources management, urban planning and land administration
- GI management, or perhaps the bridge between technology and tool -> geoinformation management

In addition to the use and management of geoinformation, a distinction is made between the kinds of work in a project or organisation. As a consequence, educationally a distinction is made between so-called professional master and master of science:

- professionals engaged in planning, execution and management of projects, in which methods and techniques for the collection and management of geoinformation are applied -> professional master (PM; 12 months)
- professionals engaged in research and development of methods and techniques involving geoinformation handling for policy advice, planning and management -> master of science (MSc; 18 months)

The difference is sometimes referred to as a master of coursework compared to a master by thesis. In this sense a PM degree is closer to a MSc than it would be to a BSc degree. At the

end of both courses, graduates should be able to work, solve problems and apply appropriate methods and techniques individually.

Practically, all programmes have been built up of individual modules of 3 weeks. This modular system allows students to follow individual topics, which are of their particular interest. Additionally, it has an advantage of offering these individual modules in situ, i.e. at distance, where a particular knowledge is needed, and where time, finances and human resources do not allow and/or do not need a full programme of one or more years. This modular structure thus also allows for in situ distance education. Small parts of a whole course can be given at certain institutions, at times which are appropriate to these institutions. Experience shows that many professionals are not able to leave their jobs for longer periods. To accommodate for these potential students, such a modular system would offer new possibilities.

These various distinctions in types, durations, modules of ITC's current programmes respond to the key challenges in GIS education as described in Petch's white paper (2000) :

- 1) specification and partitioning of markets
- 2) formation of strategic and operational alliances
- 3) merging of traditional education and commercial education systems

Ad 1) ITC has partitioned its market in developing countries in various kinds of professionals, dealing with geoinformation in a variety of ways. Its programmes have been adapted to this market by offering programmes with different foci, and for different kinds of professionals. This flexibility is necessary to cater for the different needs.

Ad 2) through a number of sister institutions and projects, strategic and operational alliances have been formed. Ideally, diploma's and other degrees obtained at one of these institutions should offer direct entry at ITC or other postgraduate education dealing with GIS and/or remote sensing.

Ad 3) the modular system at ITC has offered additional possibilities of giving modules at distance, and adding to traditional long-term education. If one were to focus on increasing institutional capacity of a particular institute, a comprehensive package of education and human resources development can be given.

Pre-entry courses and Core modules

The heterogeneity of students and target groups of ITC is reflected in various ways:

- Academically. Differences in entry level require entry requirements at ITC, which are a BSc degree or comparable experience. This comparison is based on references such as IAC and UNESCO's handbooks, but most evaluations are still based on experience with previous students from particular organisations, or direct links to particular projects. In addition, most ITC students are mid-career professionals, with in some cases ten years or more between the end of their formal education and the start of the ITC programme.

- Educationally. Educational systems and cultures are very different. Whereas Western European and North American educational systems prepare students from primary school to work mostly through individual study, this is often not the case in most developing countries. Distance learning curricula tend to presume this focus on individual capacity building as well, while ignoring the importance of classroom teaching and peer support.
- Culturally and Language-wise. How to deal with cultural differences is described by Ten Dam (1994). Oriental culture has for example not produced students, who learn by being critical and asking many questions, whereas Arab and African cultures are more accustomed to western critical and discussion types of learning. In addition, the effects of teaching and learning a foreign language, for example, have been described by Jochems (1991). Not only is learning and teaching in a foreign language lowering study results, also an increased workload for both students and teachers may be expected. This experience is important when developing distance learning material.

Responding to this heterogeneity, which could also be expected in a distance learning audience, the current programmes at ITC have started the following 2 courses and modules:

1) pre-entry / preliminary courses

Mainly focusing on English and computer skills. Basic English is formally evaluated through TOEFL tests, but reliability of the test results does not always seem equal. Where to draw the line remains difficult. What is a basic level of English that one would need to know in order to learn from English manuals or operate and manage the rapidly changing technology?

2) core modules

With a new educational structure which started in 1999, every programme has made provision for core modules "principles of GIS" and "principles of RS". A handbook was developed as background teaching material for these core modules.

Refresher courses and alumni networks

Since 1993, refresher courses came into existence to provide alumni with the possibility of receiving so-called refresher courses in the most recent developments of new technologies, methods and techniques after their studies at ITC. Several of these courses have been given since then. The importance of these courses is not only the update in new technology, but also strengthening a network of professionals, scientists and researchers in GIS. Peer support is necessary for continuous professional development.

Partly as a result of these refresher courses, to date some 21 alumni associations have been established throughout the world:

Asia / Pacific : Bangladesh, India, Indonesia, Korea, Malaysia, Nepal (2), Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam

Latin America : Argentina, Ecuador, Peru

Africa : Ghana, Kenya, Uganda

Europe: Bulgaria

PRONET/CCE

ITC is one of the partners in the EU supported project PRONET/CCE- a pilot project which involves the design, development and demonstration of an integrated training and support services system. Target groups of PRONET/CCE are professionals, researchers and students in Central Europe, in the areas of environmental sciences and remote sensing. The PRONET/CCE network offers a combination of on-line web based training services over the Internet with tutoring support, information database services and communication facilities between professionals.

From an educational point of view, the following design criteria and considerations were of importance in order to enable "virtual students" to learn from the offered courses:

(Adapted from Cullen/Kelleher, 1995 and ARTICULATE, 1995)

- initiatives (of distance learning) can only be successful if there is a strong 'local' organisation at the level of individual sites
- it is crucial to balance 'self-learning' with teaching, tutoring, peer learning, monitoring and other forms of learner support
- successful pilots combine distance teaching, distance learning with periodic face-to-face interactions in the form of meetings and residentials and critical face-to-face teaching interventions in the form of on-line animation and support
- It is important to use technology to extend and support already existing socio-institutional and pedagogic arrangements rather than replace them.
- technology should not only be used in a transmissive way (for example, lecturing through video conferencing) but also interactively (for example, peer discussion assisted by experts through video conferencing)
- On-line conferencing is only successful to the extent that (1) there is some integration between face-to-face and on-line learning, and (2) on-line activities are mediated by appropriate functions of management, moderation and animation.

As a result, the design of a learning technology system should start with a good understanding and a realistic knowledge of the setting, the learners and the learning content and skills. This implies:

- an in-depth analysis of the environment and the setting;
- the identification of stakeholders (user institutions, organisations, user communities, end users),
- the representation of stakeholders in the development process and the determination of the ways in which they will be involved
- a realistic analysis of learning and training needs related to the development of the area or institution, background of people, their employment situation and prospects.

The teaching itself would need to take into account:

- the learning interfaces, i.e. the types of learning, the interaction possibilities and patterns, possible group dynamics, role of teachers and teaching
- the delivery systems, e.g. type and content of curriculum, ways of communication, assessments
- possibilities of technical configuration, such as (video-) conferencing, multimedia, face-to-face learning
- specification and arrangement of educational services, such as information services, advice, guidance and coaching, training events, animation, motivation, evaluation, educational management.

Challenges to overcome - access to Internet and experience with ICT

As mentioned in the previous paragraph, distance learning would need to take pedagogical and technical issues into account, including availability and access to technological devices and communication media. As most of ITC's students originate from developing countries, there are two main hurdles to overcome:

- 1) availability and access to these technologies in these countries is relatively small. A brief note on how will follow hereafter.
- 2) knowledge and experience of (potential) students - mid-career professionals - with these technologies is often limited.

The book on Web Cartography, edited by Kraak & Brown of ITC's division of Geoinformatics, Cartography and Visualisation, scheduled for publication in Autumn 2000, describes the developments and prospects of cartography through and/or using the Internet. Referring to a number of sources, it is recognised that the use and potential of Internet as a medium for (geoinformation) business and education is growing exponentially. At the same time, however, it is noted that the number of internet users, and consequently the number of people having access to internet, expressed as a total percentage of the total world population, is still rather small, even in the coming 5 years. Figures show that this still only amounts to some 5.7%, and that the diffusion of Internet is still largely biased towards the USA. This is an important conclusion in relation to ITC's main market, being foremost institutions and organisations in developing countries. Whereas most of the world population is living in the regions Asia-Pacific, Middle-East and Africa, South and Central America, the percentage of internet users in these regions is far below average, with an absolute minimum for Africa, which less than 1 % of the its population.

References on numbers, percentages, and map users can be found on <http://kartoweb.itc.nl/webcartography/webbook/> (operational in August 2000)

In addition to Internet technology, access to other forms of telematics technology, such as video conferencing, in most developing countries is still rather limited.

Conclusions: Potentials for distance learning and education at distance

It is within ITC's mission to support organisations in developing countries. Education and human resources development cannot be given in isolation. Therefore, distance learning as a tool for capacity building in developing countries will always need to be part of a general strategy of human resources development within an organisation. Such an organisation must have the basic technical infrastructure to communicate through hardware and Internet, the human resources infrastructure to act peer review and feedback, and the strategic infrastructure to have a vision for the future. As said in the paragraph on PRONET/CCE, initiatives (of distance learning) can only be successful if there is a strong 'local' organisation at the level of individual sites, or in other words, if the initiative is embedded in a more general strategy of human resources development of an organisation.

Courses at distance learning could in the long run be accredited to such an extent that it would offer entry into further courses at ITC or elsewhere. These links for further career development and opportunities are important if one were to start these kinds of courses.

The ITC network of alumni offers the possibilities of peer review, peer learning and face to face interventions. With access to internet still being limited in large parts of the world, real time communication from large distances may not always be possible or fruitful. Immediate application or relevance of the courseware within a certain context or environment has often proven to be more appropriate and successful.

The contact with lecturers (face-to face animation and motivation) remains important, because feedback and evaluation remain critical factors in any learning trajectory. In addition to the ITC alumni network, one could think of formation of 'working groups' as a reasonable substitute, when direct contact with lecturers is impossible due to distance.

Embedding any education in organisational and societal culture is critical for success. Assuming a critical behaviour of a distant student in a society and educational system which is not on the outset critical may prove a wrong starting point, and may have adverse effects. Rather offer a variety of learning and teaching methods from which students can choose.

Language is still an important factor.

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