Role of GIS in School Geography

APARNA PANDEY*

Abstract

GIS is a fast developing area with vast potentiality for geography education. Since it is based on inquiry based learning it ignites young minds in exploring the world around them. While GIS is rooted to geography, it's strong linkage to mathematics and statistics help in developing analytical skills. For last more than one decade, the NCERT has made efforts continuously to strengthen school geography curriculum by including GIS at higher secondary stage (NCFSE -2000 and NCF-2005) and by providing in-service training in GIS to geography teachers, regularly from 2008. There is a need to make concerted efforts at all levels to improve its visibility in educational institutions for better application. With adequate training, analysis and interpretation of spatial data it would be much easier and interesting for students and teachers as well.

Introduction

Geographical Information Systems or GIS is a set of computer tools used to capture, store, transform, analyse and display geographical data. There are five elements that are important in GIS: (1) computer hardware (2) GIS software (3) geographic data (4) people and (5) procedures.

In other words it consists of powerful hardware, software, data and a thinking operator along with a powerful technology for storing, analysing, displaying and processing spatially referenced data. Together they provide significant tools for mapping and analysing information about people, places and the environment. Inclusion of this technology in geography education helps and promotes the higher order thinking skills of observation, exploration, questioning, analysis and evaluation.

Geographical Information Systems (GIS) have been listed among the most important developments in the 20th Century (Cook and others 1994). GIS have revolutionised the methods and dimensions of spatial analysis resulting in a dramatic change in the direction of Geography. ... It has also led to significant reforms in geographic education. (Birtain, et al., 1996). GIS are being used extensively by researchers, scientists and civic planners to assist decision making about real world problems. Application of this technology to such concerns as the, agriculture, environment and land use management is occurring on local, regional and

* *Assistant Professor* of Geography, DESS, NCERT, New Delhi 110016

national levels. Recently even the government policies and schemes related to school education mandate school mapping exercise to be done by GIS for planning and implementation of school improvement programme.

The Potential of GIS in School Geography

Geography is the science of our Earth which describes it's physical and cultural patterns and processes. Geography makes us aware of what is around, helps us better understand various spatial phenomena and their interrelationships and gives us systematic information for planning and decision making. GIS empowers geography by providing digital tools that conceptualise and organise geospatial data, model geographic processes, visualise these data and models with advanced computer techniques.

In India GIS was introduced in school geography curriculum in 2000 (NCFSE 2000) which has got more impetus at higher secondary stage in NCF 2005. But unfortunately after more than one decade, Geographical Information Systems (GIS) have not yet been widely introduced at higher secondary level in geography in all States. As far as development of curriculum is concerned, the National Council of Educational Research and Training as a professional institute in the area of school education, strongly feels that curriculum development in India , is not a one time venture but an ongoing process. In fact, curriculum is a device to translate national goals into educational experiences. "If Geography is to make a continuing and distinctive contribution to the education of young people, then curriculum development in geography will need to be a continuing professional activity"(E. Rawling 1987 et al). Geography in the school curriculum has evolved remarkably well in Independent India.

One of the three criteria that devised to rationalise the inclusion of any subject in the school curriculum is whether it is capable of developing student's skills and capabilities (Naish, et al. 1987). In this way, through the inquiry process, geographical investigation using GIS requires that students develop a range of skills and an awareness of when to use them. We should not, however, focus on developing skills merely for geography's own study, but to contribute to 'an education for social competence... not in specialised knowledge' (Piper, K. 1994). With the use of GIS, geography foster skills in social competence by emphasising the importance of encoding information based on spatial characteristics, (Kam, T.S.1996) and by manipulating this information to generate new geographical information to devise recommendation for the resolution of issues (Laurence, et al.1993).

GIS has the potential to facilitate the implementation of constructivist, problem based learning and inquiry-based learning environment at schools. This robust tool allows teachers and students to explore and analyse information in a new way. Application of GIS enables students to do in-depth study of local issues. The proper implementation of GIS instruction can promote geographic skill and interdisciplinary learning in the classroom.

The advantages of GIS seem to be enormous to geography education if harnessed correctly. But unfortunately theory and practice are hard to bring together in real life. Despite its potentials, many schools in India still lack the resources and know-how required to use GIS in geography education.

The potential roles of GIS in school geography are many and diverse. One of the major areas in which GIS can contribute to students' educational experience is through the development of faculties of critical thinking. In particular it can help in developing the ability to analyse, synthesise and evaluate. In that way, students' logical, mathematical, linguistic, spatial and inter -personal intelligence can be enhanced. Logical- mathematical intelligence includes numeracy (the ability to interpret and use numbers and numerical skills) and technological capacity (the ability to understand and use tools which facilitate acquisition, processing and information). Linguistic intelligence includes literacy (the ability to interpret and present information in word form) and graphicacy (the ability to read and use visible symbols). Spatial intelligence important for thinking geographically, includes map literacy (the ability to transform real life into a mental or visual picture, or vice-versa, at multiple scales). Finally, interpersonal intelligence focuses on communication (the ability to transfer effectively to others, through multiple modes of representation), the information and knowledge obtained from variety of sources through investigative process.

A GIS provides methods through which user can explore alternative responses for specific problems and situations. Users will need to define what constitutes a satisfactory answer to their questions. Critical thinking plays a primary role in using GIS effectively. Explorations thus involve profound challenge for learners.

With GIS both students and teachers can be active learners at the same time. By developing new skills and exploring new understandings of a variety of topics, teachers can model for students the process and value of lifelong learning. Using GIS can also help students and teachers become more concerned as local community members and global citisens. Partnering with others GIS users in the community enacts the community as classroom concept. Students, schools and community all benefit as each pays closer attention to the requirements of the other.

Even in Indian universities GIS has not been included in the first year of undergraduate geography course. In most of the universities like Banaras Hindu University, University of Delhi, University of Pune, Vishwa Bharati University, Shantiniketan, Calcutta University, etc. GIS has been introduced only in the third year of undergraduate geography course. Even in some universities it is included at postgraduate level. Moreover GIS should not be taught as a practical subject but geography is a subject which can be understood better through GIS. Therefore it is crucial to teach geography with GIS instead of about GIS. The purpose and value of providing the links between secondary and higher education is to emphasise the need for continuity in the education system. In other words

a 'start and finish' to the teaching of GIS in geography education not just in schools but also in higher education. GIS undoubtedly provides strong focus for geography as a subject.

Hindrances in GIS Education at School Level

The lack of GIS implementation at higher secondary stage in different states may be due to a number of factors. The following major hindrances have been identified to the implementation of GIS in the schools by Meyer, and et al. (1999) which are also found true especially in the states for which teacher training programmes in GIS were organised by the NCERT:

- The unavailability of appropriate hardware and software.
- Time for teachers to 'master the use of the new technologies , and time within the existing curriculum to introduce a new learning experience.
- The need for training and on-going support and evidence to teachers after training, and timing that support 'relative to the availability of the hardware and software'.
- The lack of curricular connection for GIS application.
- The limitations of teachers' own "spatial literacy" and a pervading "simplistic view of geography" (place, names and regional facts) (Meyer et al. 1997, p.572, Bednarz and Ludwig, 1997, p. 126).

Many school systems hesitate to devote the resources necessary to acquire the advanced software, continually update hardware, and afford the teacher training necessary to provide their students with exposure to the use of GIS. Ample evidence exists to suggest that, in order to learn new technology, teaching strategies, teacher need information, theory, modelling, coaching, support and feedback through sustained, intensive experiential learning opportunities (Fullen, M G and M Mites 1992). Simultaneously teachers must continuously cope with limited resources and availability of time when planning and implementing their lessons.

Capacity Building of Teachers in GIS

During our interaction with different State authorities and teachers on various occasions it is found that most of the teachers teaching at higher secondary level are not exposed to GIS as a part of their college education. Keeping this in view, NCERT had organised quite a few introductory training programmes in GIS for a duration of one week especially for in-service Post Graduate Teachers in geography as master trainers. In the first phase, during 2008, teachers were invited from Kendriya Vidyalaya Sangthan, Navodaya Vidyalaya Samiti and other CBSE affiliated private schools. The programmes were organised in collaboration with the three premier institutes of India i.e. Indian Institute of Remote Sensing, Dehradun, (IIRS), National Remote Sensing Centre, Hyderabad (NRSC), National Atlas and Thematic Mapping Organisation, Kolkata (NATMO). During this period, three programmes were held for three different zones i.e. North, South and East covering all regions of the country. The programme in Kolkata was organised especially for N E Region and Eastern region. The purpose of these

programmes was to remove initial fear of teachers in using modern technology and make them capable in handling the course in GIS effectively in the classroom. The course was designed in such a manner which could easily be grasped by the teachers using hands-on activities. The second phase of the programme was taken especially for the States using NCERT textbooks at Higher Secondary Stage. In this connection during 2009 and 2010 Geography teachers from States like Sikkim, Bihar, Jharkhand, Goa and Kerala were trained by NCERT. More than hundred Post Graduate Teachers in Geography from across the country have been trained in GIS as Master trainers by the NCERT by the year 2010.

It has been observed that some private companies have started teaching software based GIS in schools, just by providing training to teachers and students on how to use a particular software. This trend has been producing GIS technicians without imparting the knowledge of GIS. An understanding of GIS can be developed by proper study, practice and above all, with a logical aptitude in this area. Without proper and precise GIS education, we will produce GIS skilled labourers, but with proper GIS education we may prepare GIS scientists and researchers.

Conclusions

In the world over, Geography has been recognised as a vital discipline at school level. Inclusion of GIS in Geography curriculum and exposure of students to this at school stage may help them use this technology appropriately later in life. The use of GIS to aid the instruction in basic geographic concepts may help in reducing spatial errors which are usually made by individuals in their daily lives. It is crucial that students learn to analyse large quantity of data using computer technology. There is no better discipline for the fulfillment of this goal than geography. By this means students and teachers can work collectively to build a coherent draft of information about their own region.

To take full advantage of GIS for enhancing geographic education at school level, we must create a group of geography teachers as master trainers who specialise in applications of geographic technology. It is believed that geographers have grasped the potential offered by the new technologies to complement and developed core geographical principals and passed these skills on the young people- thus simultaneously keeping the subject vibrant and relevant and ensuring that our students are well prepared for the world they will live in.

As technology brings us all ever closer to each other, it seems only too obvious that there is a need to understand more fully the changing relationships between people, places and the world. We share many parts of existence and need to explore our common ground. GIS may foster a resource rich environment, enhance spatial reasoning and support problem solving in the classroom. Parallel to the use of other Information and Communication Technology (ICT) in education, GIS also provides the students with experience and technical know-how, which may be beneficial for their future job opportunities.

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