Chapter 11
Emerging Technologies in Teaching, Research, and Learning: GIS Technology and Methods in Education

Colbert Mutiso Jackson
University of Eastern Africa, Kenya

Dickson Kinoti Kibetu
Chuka University, Kenya

ABSTRACT
A GIS is a tool for working with geographic information. Therefore, its primary purpose is to maintain data about geographic space. A GIS application deals with spatial information on a computer. GIS software presents earth features on a computer and then uses GIS to visualize, question, analyze, and understand this data about the world and human activity. Often this data is viewed on a map. This chapter shows the relationship between geographical information technology and society and provides educators and policymakers with a basic understanding of GIS, its relevance to teaching and learning, and suggest possible ways for implementing GIS technology in the classroom. This means that GIS has an educational agenda to meet, since this technology presents several opportunities for teachers to implement learner-centered approaches for various subjects.

INTRODUCTION
The acronym GIS stands for geographic information system. A GIS is a tool for working with geographic information, therefore, it is a computerized system. Its primary purpose is to maintain data about geographic space. Just as we use a word processor to write documents and deal with words on a computer, a GIS application deals with spatial information on a computer. GIS software presents earth features on a computer, and then use GIS to visualize, question, analyze, and understand this data about the world and human activity. Often this data is viewed on a map, which provides an advantage over using
spreadsheets or databases, because maps and spatial analysis reveal patterns, point out problems, and show connections that may not be apparent in tables and/or texts. This is known as ‘The Geographic Advantage.’ The Earth’s surface forms the laboratory upon which study through excursions, fieldwork and experimentations give information about spatial forms and processes.

In various ways, the mirrors of society are educational curricular. In the event of technological change, they normally reflect the impact of the opportunities presented by evolving technology and the shifting labor demands of the market in which they operate. The introduction of new technologies for working with digital geographical data has led to technology and/or market led curriculum developments. GIS as one of the 21st Century Tools for Communication, will assist in nurturing student abilities in investigating, evaluating, integrating, creating and analyzing issues and information at various scales and locations (“Partnership for 21st Century Skills,” 2004). GIS helps develop multifaceted skills in the students. It also develops many skills, including individual and team work, through events (Kidman & Palmer, 2006). GIS technology and methods have revolutionized decision making in society. Most educators consider GIS to be one of the most promising means for implementing educational reform (Barstow 1994). Therefore, using GIS in education will prepare students for the digital era.

GIS has broad applicability. All of the key issues of our time have a geographic component and can be better understood and solved with GIS. Therefore, schools are increasingly beginning to use GIS for teaching and learning in not just Geography, but also in other subjects. GIS is becoming an increasingly a teaching tool for guiding contextually empowered student learning. GIS allows the teacher to apply learner-centered approaches to delivering the curriculum. By using GIS data, effective and engaged learning can be achieved. GIS not only builds in the student curriculum-related knowledge, but also develops critical thinking skills in collecting, maintaining, editing, analyzing, querying, and displaying diverse sets of spatial data. This means GIS has an emerging educational agenda to meet. With the increasing availability of cheaper GIS software and data, the time is ripe to bring GIS enabled teaching and learning approaches into the classroom.

BACKGROUND

The application of contemporary technologies in teaching accelerates the attainment of educational goals, and this is why GIS may be regarded as a technique with the likelihood of enabling problem-based learning (PBL) and inquiry-based learning (IBL). However, despite its soaring didactic advantages in teaching, the application of GIS in teaching is lacking in many countries of the world, and especially in the developing world.

A large amount of the information in today’s era of dynamic education systems calls for an appropriate consciousness of the physical characteristics of the world. GIS is a very important tool able to uplift students’ ability to understand and conceptualize this kind of information. The studies showing the gains of the application of GIS in education has risen in recent times.

GIS education takes place in both formal and informal teaching environments. More effort need to be put in teaching with GIS at the elementary and secondary level where GIS is increasingly applied to learn concepts and skills in agriculture, geography, history, biological science, business studies, chemistry, and mathematics, and other disciplines. Some of the phenomena learners are taught in these subjects occupy space; hence their patterns of distribution can be visualized using GIS. Presently, GIS dominates at the university level. In the 1980s very few secondary schools in some Western European countries
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