

**FORMAL AND INFORMAL EDUCATION IN GEOINFORMATICS:  
The Experience At The University Of The West Indies.**

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**ABSTRACT**

The use of geoinformatics in natural resource management is on the rise in the Caribbean. This is due to the perceived cost effective benefits accruable from the use of the related technologies. The Department of Surveying and Land Information (formerly the Department of Land Surveying) of the University of the West Indies was established in 1983 primarily to meet the needs of the region for land measurement scientists. Since then the undergraduate program has developed to the point where electives are offered in the final year allowing students to specialize in various areas of geoinformatics such as digital mapping, remote sensing, land information system and (digital and analytical) photogrammetry. In addition the year 1 Cartography course has been expanded, since 1994, into two 2-credit courses enabling the formal incorporation of electronic publishing techniques and CAD. Most undergraduate students choose to do several of the geoinformatics electives, and recently many of the final year projects have been GIS related. As an incentive the Faculty of Engineering has, since 1993, awarded a prize to the final year Surveying student obtaining the "highest average mark in a combination of Information Technology related courses".

This paper gives a review of the development of formal and informal education in geoinformatics during the twelve (12) year history of the department. It points out the change in the curricular emphasis from the traditional surveying and mapping sciences to more geoinformation oriented courses. This is in response to the changing needs and demands for GIS specialists in organizations using or intending to use GIS. This change in the emphasis of the department has led to the development of postgraduate courses in GIS, as well as in Planning and Development. The entry requirements are necessarily broad and are intended to attract student from disciplines other than surveying.

Problems experienced in course program delivery to date include a lack of adequate computing resources and an unstable staff situation. These are currently being addressed through funding from the Inter American Development Bank. Future plans of the Department include the establishment of a GIS laboratory for teaching, continuing education and research to aid in the development of indigenous solutions to the problems of geoinformation users in the region.

**1. INTRODUCTION**

The University of the West Indies (UWI) serves, and is financially supported by, sixteen (16) countries in the Caribbean region with its main campuses in three of these (see figure 1). The Mona, Jamaica campus was the first to be established, in 1948, in order to serve the British territories in the Caribbean on behalf of the University of London. The second campus was established at St. Augustine, Trinidad in 1960, and the third in Barbados in 1963. Since 1962 the UWI has been a degree granting institution in its own right.

The Faculty of Engineering which began 1961 currently houses five (5) departments, including the department of Surveying and Land Information, which together offer a total of seven (7) Bachelor of Science degree programs.

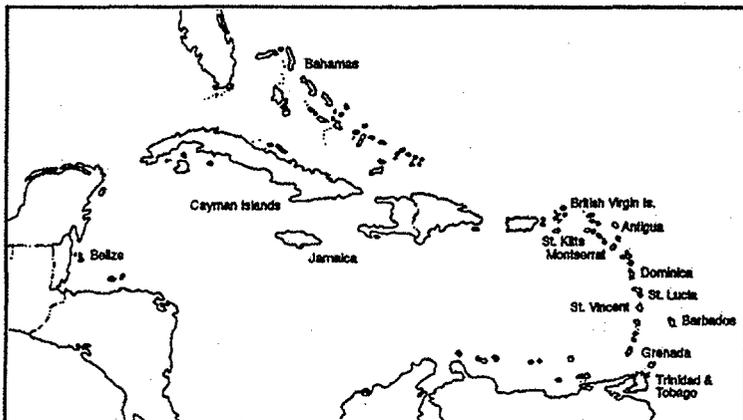


Figure 1. Diagram Showing Countries Supporting The University of the West Indies.

The Department of Surveying and Land Information (formerly the Department of Land Surveying) of the University of the West Indies was established in 1983 primarily to meet the needs of the region for land measurement scientists. It has since been pointed out that because of the small and limited land area of the countries of the West Indies, and because ultimately the results of surveying are used for land/resource administration/development, the department must not lose its focus. As one colleague says 'land in the Caribbean context must be placed in intensive care' [1]. Coastal erosion, rising sea levels and increasing population result in pressures being placed on the limited land supply. The regional survey professional must therefore not only be trained in science of measurement and data collection, but also in land-, and land information management.

Since the time of its inception the undergraduate degree program has developed to the point where electives are offered in the final year allowing students to specialize in various areas of geoinformatics such as digital mapping, remote sensing, land information system and (digital and analytical) photogrammetry. In addition the first year Cartography course has been expanded, since 1994, into two 2-credit courses enabling the formal incorporation of electronic publishing techniques and CAD. Most undergraduate students choose to do several of the geoinformatics electives, and recently many of the final year projects have been GIS related. To date there have been over one hundred (100) graduates, with more than 20% of the final year reports of these graduates dealing with GIS or GIS related topics [2]. Although the department was set up to train surveyors for the entire region most of the graduates have been from Trinidad & Tobago.

The Department in its pivotal role as the regional centre for training and education in geoinformatics, has hosted conferences, workshops and professional development programs in this area as well as supporting other continuing engineering education courses. In this way the informal training requirements of the region are being met.

This paper gives a review of the development of formal and informal education in geoinformatics during the twelve (12) year history of the department. It points out the change in the curricular emphasis from the traditional surveying and mapping sciences to more geoinformation oriented courses. The following section discusses the fundamental

distinctions between our approaches to formal and informal training, the development of a geoinformatics curriculum and the problems faced.

## 2. FORMAL vs INFORMAL EDUCATION/TRAINING

Education and Training in any discipline can be roughly divided into the study of systems, concepts, and algorithms. The distinction can be made clear with an example: Generalization as a concept aims to achieve geographically accurate representations of map features, and of an area in general, on scale reduction. Because of the complexity of this process one of several algorithms e.g. the Nth point or the Douglas-Peucker line simplification algorithm may be used to implement the concept in a particular system such as Arc/INFO.

Formal and informal study/instruction can be differentiated based on:

1. The relative emphasis placed on systems, concepts and algorithms,
2. The duration of the period of study, and
3. The type of certification awarded on completion.

The emphasis in formal study is on concepts and algorithms, with systems being used mainly in laboratory sessions to support teaching. The duration of these courses is not normally less than six (6) months and they lead to the award of a diploma or degree. Informal education on the other hand is mainly system specific with only enough concepts being taught so as to allow one to comfortably use particular systems. The duration of these courses is not normally greater than one month and only a certificate of participation is awarded, if any. Informal instruction can take the form of professional development courses, conferences, workshops and tutorials, or system vendor supplied training.

Formal education in geoinformatics at the department of Surveying and Land Information is conducted at both the graduate and undergraduate levels.

## 3. THE CURRICULUM

This discussion will be divided according to the definition of formal and informal education made in the previous section.

### 3.1 Formal Education

Currently, geoinformatics education at the department of Surveying and Land Information takes place at both the undergraduate and the graduate levels.

The B.Sc. (Land surveying) degree program from its inception had an emphasis on the measurement sciences. Although all aspects of the mapping sciences were taught the use of computers was limited to programming/number crunching and so elements of information management were covered. However in 1991 concepts of Land Information Systems (LIS) were first formally incorporated in the undergraduate program. Since then a compulsory three credit course in LIS has been developed and is offered to students in their third year. It is also offered as an elective for students of other departments, including departments of other faculties.

Until 1992 the undergraduate program was rigid. No electives were offered and students were expected to register for all courses offered in a particular year. Coinciding generally with the decision of the university in 1990 to adopt a semester instead of a year system, courses in informatics from the department of Mathematics and Computer Science have been incorporated in the B.Sc. program. These include a compulsory course in Information Systems Development and electives in Database Management Systems, and File Design Implementation.

To reflect further the information technology focus of the department new courses have been developed and previous one have been modified. Of particular interest is the development of a new course in Digital Mapping, and the expansion of the former 3 credit Cartography course into two 2 credit courses allowing formal instruction in CAD and desktop mapping techniques. The 2 credit Cartography courses are taught in the first year (semesters 1 and 2) and thus support the presentation of results survey work conducted in fulfilling the requirements of other courses. Remote Sensing and Photogrammetry are taught separately but the importance of these systems for data collection in the support of integrated mapping and geoinformation production systems is maintained throughout. Reflecting the department's new emphasis on geoinformatics, and as an incentive, the Faculty of Engineering has since 1993 awarded

a prize to the final year Surveying student obtaining the "highest average mark in a combination of Information Technology related courses".

At the graduate level formal education is in the form of a one year Advanced Diploma, or an 18 month M.Sc., in Geographic Information Systems. The first batch of students were admitted in 1992 and the second in 1994. The entry requirements for both courses are as follows:

- A Bachelor's degree in Land Surveying, Engineering, Computer Science, Agriculture or Geography which include Mathematics and Computer Science at levels equivalent to the respective courses in the B.Sc. (Land Surveying) degree at the University of the West Indies. Candidates not thus qualified may be admitted to qualifying examinations., OR
- An equivalent qualification acceptable to the Faculty of Engineering.

Additionally a Diploma in GIS may be used for entry into the M.Sc. program [3].

The three core courses in these programs are:

1. Geographic information Systems I,
2. Geographic information Systems II, and
3. Data Acquisition

Because of the modular structure the courses above will also be offered as electives to students of the M.Sc program in Planning and Development which is due to begin September 1995. Relevant modules can also be taken by MPhil and Ph.D. students as well.

### 3.2 Informal Education

Informal education in geoinformatics at the U.W.I. began in 1988 with a seminar entitled *Land Information Management: Problems and Perceptions*. Another conference on geoinformatics was held in December of 1990 in which invited speakers from Canada were present. In September 1991 the then Department of Land Surveying launched what was meant to be the first of a series of short courses on GIS. The idea was to offer modular informal instruction in geoinformatics to meet the short term need of persons charged with managing national or enterprise-wide GIS initiatives. Several levels of courses were envisaged with the introductory level courses or equivalent being prerequisites for the higher level courses. Since the first course in 1991 numerous other courses, mainly at the introductory level, have been conducted in Trinidad as well as other countries in the Caribbean. The administration of the courses is done by the Continuing Engineering Education Office of the Faculty of Engineering.

Several one week courses on GIS using *Arc/INFO* are to be conducted in May 1995. The PC version of the software will be used. There are plans to offer two short courses/seminars in August 1995 on remote sensing & digital photogrammetry in the Caribbean context and their integration with GIS. The systems to be used for these seminars/courses have not yet been finalized. It is however expected that a 10 user site license for Idrisi for Windows will be most suitable based on its price and functionality. These seminars/courses will coincide with the visit of an external professor, made possible under an Inter American Development Bank (IADB) loan scheme for the development of the University.

### 4. PROBLEMS FACED

Many of the problems faced by the Department of Surveying and Land Information in carrying out its mandate for education in geoinformatics can be traced to the prevailing financial situation at the University. Two main problems are: 1) The inadequacy of laboratory and laboratory equipment, and 2) An unstable staff situation.

The teaching of courses in geoinformatics does not require specialized labs or laboratory equipment as is the case with traditional (pre 1990's) mapping sciences. Instead costly, specialized equipment is replaced by low cost, ubiquitous, general purpose computer hardware and specialized *software*. Cost of software can vary between free, for public domain software, to expensive for full featured commercial software. Many commercial vendors would even offer their software to qualifying educational institutions for 'free', although the annual maintenance could be significant. Even though annual maintenance contracts are standard in the computer industry the UWI has approached such 'open ended

agreements' with much trepidation. Partly because of this there is currently no modern well equipped computer lab for the teaching of courses in cartography, remote sensing or GIS.

In the department, with an annual undergraduate intake approximately 15 students, there are currently only 5 personal computers (two 486's and three 386's) to support teaching. Most of the software is loaded the two recent machines. As such there is little disk space left for data files or for temporary program files. Problems often result. The department currently has more software than available computers to run them, included upgraded versions of software (e.g. KORK DMS) which can no longer run on the older machines. There is constant uninstalling and reinstalling of programs to ensure that students have access to the software required for assignments. Because of the limited computing resources, assignments are normally given to be done in groups. To ease the situation some lecturers make their (personally bought) computers accessible to students and are flexible with submission dates. Provision has been made under the IADB scheme to develop a GIS lab. This involves the physical expansion of the departmental building, started in May 1995, and the procurement of the necessary equipment. Although the building would be completed by November it is now not clear when the laboratory equipment will be acquired.

The Department currently has allocation for seven full time members of academic staff, including one professor. The professor's post has been vacant since August 1994. It was frozen immediately after for 'financial reasons' but is currently being advertised. The former professor was the last of the academic staff that had been with the department since its establishment in 1983. There have been several staff changes over the short history of the department's existence. Difficulty is experienced in attracting well qualified faculty. Because of this the department embarked on a program, in 1988, to employ the best graduate as a Teaching Assistant and seek to have the person pursue graduate studies at overseas universities in the specialist areas of the department. It is hoped that ultimately the department would be run by local faculty and so would be less unstable. However the staff instability problem has been attributed to the University's "inability to attract and retain staff as a result of [an] uncompetitive compensation package." [4]. Furthermore, the salaries of lecturers at the St. Augustine Campus of the University, in which the Department of Surveying and Land Information is located, is significantly lower than in the other campuses. On average the salaries in Barbados are 95% higher, and those in Jamaica 80% higher (as of August) than those in Trinidad & Tobago. Discussions are taking place to find solutions to this problem.

The IADB scheme has provisions for staff training and for visiting professorships. Technical and academic staff have already benefited from training as a result of this scheme. By September the first visiting professor (photogrammetry and remote sensing) would have arrived. In this way the department can ensure that students benefit from exposure to the latest developments in the field of geoinformatics, while at the same time seeking to solve the problem of limited laboratory equipment.

## 5. CONCLUSIONS

This paper has discussed the development of formal and informal education in geoinformatics at the University of the West Indies St. Augustine, Trinidad. Recognizing the regional need for geoinformation production specialists the undergraduate Land Surveying degree program has a high informatics component. In addition graduate Diploma and M.Sc. courses in GIS have been established. Informal education has been mainly in the form of short courses on GIS. Main problems related with the teaching of courses in geoinformatics are: 1) the lack of adequate labs and computer equipment, and 2) an unstable staff situation. Under an IADB arrangement a GIS laboratory is being constructed in the summer of 1995. Staff training and visiting professorships are provided for as well. With these the department will be well on its way to providing high quality education and research to aid in the development of indigenous solutions to the problems of geoinformation users in the region.

## 6. REFERENCES

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