LIS EDUCATION VERSUS TRAINING: a surveying perspective

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Abstract

There is the ever increasing need for data to be captured, manipulated and displayed as fast as possible in a form for people to understand and use. The technology of land information systems is attempting to do that. This technology has largely been developed within computer science departments. The handling of land information is done by geographers, planners, environmental engineers and many other disciplines. The overall management of land information, from the data collection phase to the use of the information, logically lies with the professional surveyor.

To have intelligent use of information systems future LIS professionals, present-day students, will require university education. Not only must they be trained in the technology but they must know how to adapt, how to assess accuracies and how to find the optimum solution for a given application.

A university course in LIS must include both the technology and management aspects of LIS. The basics behind the technology, the applications and the social aspects, must all be addressed. This will enable true LIS education for the demanding need of our information age.

If the opportunity is grasped, it may well lead to that expanded professional role of surveyors in society that has been the subject of so much introspective analysis of the last decade and more.

Introduction

In this paper I will use the terms land information and geographic information systems as synonymous. A geographic information system, by definition, has data attached to a geographical locator. Such a locator is not necessary in a land information system although they usually do have them. Spatial information system is an all-encompassing term, which neatly separates such information systems from management information systems. The latter are the text information systems which have no map type data display or structure.

Confusion also arises as to land information management versus land information systems. Land information systems is the technology. This is the knowledge of how the data is in the system. It can mean an in depth understanding of how specific data types are coded and understood by the computer. This is where computer science is essential. Land information management is the whole picture: a knowledge of the system, enough of how it works so that effective use can be made of it, enough so that the accuracies and limitations are known and can be adjusted for.

For most people, it seems, the various facets in land information systems (LIS) are self-taught. There are few curricula available that offer courses sufficient to give a thorough background in this area. Where should such courses be taught? Do we want LIS education or LIS training?

Education or Training?

College courses can train in the technology, which is an acquired skill, but rarely do they go into essential professional and managerial functions. This is the difference between training and education. One can be trained in

the technology, but its effective use lies in the creativity and understanding of the individual. A thorough understanding requires a thorough education. Education can be thought of as training in a way of thinking. Universities are for education. Therefore LIS education lies with the universities.

Is a person working in the field of LIS a professional? What is a professional person? Generally, a professional is thought of as having a university education (Personally, I do not accept this definition.). Therefore a socially sanctioned professional in LIS must have a university degree. Should this be in LIS? Or can other disciplines encompass the subject?

What University Department is the Home for LIS Education?

Which departments in the university could claim LIS? Let's look at familiar departments which seem appropriate:

(a) A geographic information system implies, by its name, that it should be in a geography department. Some university departments of geography have woken up to the idea that they can have quantitative and qualitative data that can be manipulated by this new technology. However, geography departments often shy away from the computational and computer aspects of information systems that require a fairly rigorous quantitative background to understand them. Geography departments, therefore, are very much involved in the application of land information systems, as they are primary users of land data.

(b) Computer science departments are involved in the development of hardware and software, often with little regard for the application of their technology.

(c) Typical land and resource management programs, whether they are in planning or environmental studies types of departments, mainly deal with public policies, valuation and economics. They are involved in the social (benefit and problem) aspects of LIS.

For education in land information systems a little of all of the above disciplines is needed. Any course which hopes to educate the professional in LIS must contain significant parts of each of the subjects of geography, computer science and land management. The degree to which a course is tailored towards the analytical mind determines the 'systems' aspect. The degree to which the professional and social elements are taught governs the 'management' aspect. It will be difficult in any one degree programme to include sufficient of both areas. A solution is to provide interdisciplinary courses, say, geography and computer science, survey engineering and land management.

Another logical home for information systems whose primary focus is in the manipulation of land data, and which require precise positioning of that data, is in the realm of the surveyor and in a true surveying department. Surveying does, already, include elements of all of the above disciplines. Surveyors' "basic training gives them a valuable balance between technology and management".[1] As Koo states "computers and information technology has influenced land surveying more than most other engineering sciences".[2]

Surveyors must therefore remember their roots and broaden their present data collection role into land management.[3] The surveyor has traditionally gathered the data for management decisions. It makes sense that the management information be gathered in the way most effective for input

into a land information system. To do this requires a knowledge of the questions that will be asked of the system (output) and the way in which the data can be gathered (input).

It is the knowledge of these two ends of a land information system that a surveyor has. By putting the two ends together the surveyor moves from a mere collector of data to the realm of management. It is not only a problem of where to put the land boundaries, but the economic, ecological and political consequences of what to do with the land unit. This is land management.

Basis for LIS Curriculum

I am not going to list courses that should be taught, rather the ideals behind LIS education.

To use the technology for land information systems we must go to the fundamentals of learning about and managing land resources in addition to training in the technology itself.[4] We must not be technology driven. It is easy to be forced into concentrating on the technology: instructors can get caught up with the transient technologies, students want to learn about the instrumentation and methodologies that they think will make them more marketable. New technology is exciting. Canadian universities that teach LIS technology in their survey engineering departments include Calgary, New Brunswick and Laval.

Courses in the technology are essential, but students must not believe automatically what comes out of their automatic device - EDM or computer. The user should have a knowledge of what the right answer should look like. Let

automation give us speed and precision to 15 decimal places, but we must know what that really means. A person can be trained in the use of the technology, but must have the educational basics to know what they are doing.

Physics is the root of the technology. Mathematics is the language. Understanding technology and how and where to use it, assessing its value and relevance, are some of the prime objectives in LIS education. This can only be done through a balancing of the technology with the basics and with equal emphasis being given to social considerations of LIS. When working out a mathematics or programming assignment, the student has a good idea of when the answer has arrived, so continues working until the solution appears. With, say, a law assignment such is not the case, so it can more easily be put aside without a proper answer. We should try not to let this happen. As much effort must be put into logical analysis of all facets.

The two most important professional attributes (other than professional responsibility) that any person should have are:

i) critical thinking: logical; structured; systematic; analytical; precise.

Students must learn to think around a subject, to question, to have insight into things and to develop initiative. Not only must they have a scientific approach to thinking, but also different approaches gained through a more liberal education. Gracie states "As professionals, we must be able to think at different frequencies on the intellectual spectrum".[5]

ii) effective communication: written; oral.

Anyone working with land information systems will have to deal with people from diverse background: computer science, land use studies, resource management, government and the accredited professions. This requires an ability to converse with people, as well as being able to document one's own work.

The technology in LIS is in the automation of data collection and in the system themselves - the hardware and the software. What automation does not do are the typical managerial functions: acceptance of proposals, contractual arrangements, feasibility studies, responsibility and potential for negligence, dealing with people, both staff and clients. A computer can be used in many functions, but it is just a grown-up calculator. It cannot make decisions; it does not have inductive reasoning, no intuition, no instinct; it does not have the ability to improvise or to create something new, nor to apply old methods to a new application without more input.

The user of the technology, and the manager of the data, still has to analyze, interpret, make decisions and act on those decisions. Thus, the person educated in land information management must have the knowledge and creativity to effectively use the data, as this is something that the technology alone cannot do.

Students of LIS must be trained to lead. Technology can give them the confidence in the tools that they use, so that they can seek further application of the technology with vision—and initiative. They must

understand that their work is a service to society, know the technology of the day, apply it intelligently and build upon it.

LIS at the University of Toronto

The geography department at the University of Toronto has a course in geographic information systems and one in computer cartography. There, the emphasis is on the use of the systems for geographical applications. The computer science department offers a degree in computer science for data management, and also runs courses in graphics, data structures, and information systems analysis and design. However, these are generally not for spatial data. The computer science department is also involved with expert systems, computer vision and artificial intelligence, all of which are on the fringes of LIS.

There is a gap in LIS education: the bridge between the technology and the application. This can be filled by the survey science programme at the University of Toronto. Here we take the basic knowledge of the land and its law and meld this with information systems as a management tool, to enable effective control of the land and its resources.

We want to broaden the outlook of our surveying students. It is a common malady that the surveying profession is seen simply as one where a "bush hog" is bashing in a survey marker. The survey science programme is advancing with the new ideas and technologies that are entering surveying. At the same time the basic background in the essential aspects of the profession are not forgotten. However, to attract students in LIS, we must make the subject known to the public and to high schools. This needs effort on behalf of the surveying profession and the university.

Conclusion

Cooper[6] states that the removal of observing as the surveyors' primary activity gives them the freedom to develop and use other skills:

i) There are those with an analytical bent who can write programs, devise data transfer and processing systems and design survey procedures (LIS).

ii) Those who wish to synthesize, who can take the route of economics and management, can ensure the accuracy, maintenance and proper use of data relating to the land (LIM).

Together, they can inform society about the extent, shape, resources, use and value of the land. This is land information: as such, it is the surveyor who should be educated in land information systems and management.

This is going back to surveyors as they were in the time of the exploration and opening of Canada. Since then they have gradually lost many areas of their profession. It is time to get these prospects back.

The changes that are taking place in the profession of surveying are also changing the focus of the university courses that must lead the way to the future. At the University of Toronto, students are given a good grounding in the basics relevant to surveying; taught the essentials of technology, data collection, analysis and evaluation. They get professional training in the art and science of using land-related information. They are taught the limitations and accuracies of the technology so that they can effectively apply it.

As with most of the other disciplines at a university, there is just not the time to teach everything we think a student ought to know. The emphasis on interdisciplinary studies should be stressed. Education in land

information systems must rely heavily on its basic disciplines - mathematics, computer science, geography, land resources and management.

Such a curriculum in land information systems cannot exist without the technological training and the fundamental understanding of the applications of that technology. It is not a compartmentalized subject and it brings out the universal nature of knowledge. Our education system, unfortunately due to time and logistical constraints, tries to make each subject stand in isolation. This is never so, and LIS education must bring that out.

Let automation give us speed and precision, but we must still know what the result means and how best to use the answers we obtain, to ask better questions, to obtain better answers and to better serve the society that we live in.

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