GEOCOMPUTING EDUCATION: THE HONG KONG EXPERIENCE

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Abstract
This paper aims at reviewing education experiences in Hong Kong on aspects like remote sensing, computer cartography, and G.I.S. Altogether, there are four sections in the paper. The context in which rising concerns on geocomputing education is first laid out. Then, I shall present an overview of educational efforts to disseminate these training at the tertiary level. Following that is an indepth analysis on the problems (both economic and structural) facing educationists here. My concluding section will discuss issues related to the initiation and expansion of geocomputing education in Hong Kong. Their implications and relevance to other developing areas will also be discussed.

Key Words: Cartography, Developing Country, Education, GIS/LIS, Remote Sensing

The advent of a computer age has been evident among Western countries. In the Asian setting, while full computerization in all aspects of life is still something futuristic, the impact of computers on different aspects of work is receiving growing attention. This paper deals with the issue of geocomputing, an area where its development is rapidly gaining ground in Hong Kong.

In this paper, geocomputing education is broadly defined to include formal training in courses related to remote sensing, geographic information systems, computer cartography, and the like under geography and surveying or mapping curricula. The current situation of geocomputing education in Hong Kong will be reviewed.

My discussion is divided into four main parts. The context of the development of geocomputing, curriculum efforts, problems facing, and implication issues will be discussed in turn.

CONTEXT OF DEVELOPMENT

Nowadays, more and more people are convinced that the last decade of this century is already an information age. In specific terms, this is characterized by the tremendous amount of information created and utilized in people's daily lives. Part of the reasons why such a proliferation of knowledge occur is the widespread use of computers: machines which store and manipulate information at tremendous speed. With this current revolution in computer technology, we are just at the beginning of changing our lifestyles to accomodate the impact of computers into our daily lives.

Two evident trends in the computer industry help promote its wide proliferation. One is the rapid decline of cost for the purchase of a computer setup. Nowadays, a IBM-compatible microcomputer with basic peripherals like a mouse and a printer is well within the price range affordable to general users. The old XT and AT models are now replaced by 386 and 486 ones. Machines on Macintosh platform are also cutting their prices to enlarge their market share. These are given even more impetus with the rising performance of microcomputers. In terms of processing speed, storage, analytical abilities, today's micros have well surpassed those of minicomputers of the past. Work hitherto performed on mainframes or minis can comfortably be done on micros.

Here in Hong Kong, the government has been active in persuading our industrialists to follow a "high-tech" approach in renovating Hong Kong's industries, thus paving the way for her to perpetuate its economic lead in Pacific Asia. At the educational front, Hong Kong is on the verge of great expansion in programs related to information technology, both at tertiay institutions and at technical institutes. A recent release by the government indicated that student intake of such programs at government funded institut-ions will rise from the present 1,750 to around 2,700 by the academic year 1994-95 (Ming Pao Daily, 9 May 1991). Likewise, enrollments of related pro-grams at technical institutes were expanded from 1,730 for the year 1990-91 to 3,345 in 1991-92. The trend towards extensive computerization in all walks of life is crystal clear.

Recent infrastructural plans for Hong Kong give a great push for computer-related work in the educational sphere. While regular training in professions like architecture and engineering has

long introduced students to use computer aided design (CAD) techniques, their usage is even more commonplace with the new Port and Airport Development Scheme under implementation by the Hong Kong government. Consultancy firms competing for construction contracts are well aware of the importance of using computer-generated graphics in their proposed designs. A complex geographic database of the territory is needed for use in advanced mapping software. Great needs in terrain modelling work demand degree-holders to receive training along that line. Thus, disciplines like planning, surveying, and to a certain extent geography, have begun to impose such training to their students in anticipation of employment in these areas. A positive macro environment for geocomputing education is thus formed in Hong Kong.

CURRICULUM EFFORTS

Extensive changes in curriculum emphasis on microcomputing in geography have been made within the last five years or so. When Yeh (1986) wrote his article on the use of microcomputing in geography, such a direction was still something under planning. Today, among almost all well-established geography departments in developed parts of the world, a lab devoted to computer applications is considered to be a regular facility. To most people within the geography community, the ability to use micro-computers is added to the list of basic skills one should possess such as literacy, numeracy, and graphicy.

Part of the reasons to explain such changes concern with great strides that have been made in geographic methodology since the 1980s. One is the use of computers to generate maps which were hitherto hand-drawn, a tedious job for any cartographer. Another is the use of remote sensing, digital image processing in particular, in the acquisition of remotely sensed data for subsequent classification and interpretation. Thirdly, the rise of geographic information systems technology, in which both geographers and computer specialists do play a part, rapidly and extensively revolutionize spatial data handling and modelling. I shall subsume these areas under the heading "geocomputing" in the following discussion.

Apparently, geocomputing requires large amount of capital input, both in hardware and software acquisition and in "humanware" recruit. Outside private businesses, only tertiary educational institutions can afford such setups. Such training is offered in two streams: within geography or land surveying departments. In the former category, geography departments at the University of Hong Kong, the Chinese University of Hong Kong, and Hong Kong Baptist College all offer some levels of training at both undergraduate and graduate levels. In the latter category, the Hong Kong Polytechnic's Center of Land and Engineering Surveying is the principal training base.

Each of the four departments/center possess some kind of hardware setup which is different from others. For the case of the University of Hong Kong, the Department of Geography and Geology houses a remote sensing lab and another computer-aided cartography unit. They are equipped basically with 286 and 386 machines for students' usage. Software available include ORSER (for remote sensing), ATLAS*GRAPHICS (for computer cartography), AutoCAD (for graphics drawing), IDRISI (for G.I.S.), etc. Peripherals like printers, plotters, scanners, and digitizers are also available.

As the second oldest geography department in the territory, the Chinese University of Hong Kong's equipment are all located in their remote sensing lab. Again, several 286 and 386 machines are available for student usage. A recent addition is an engineering workstation for staff's research purposes. A host of software is available: IDRISI, SPANS, pcARC/INFO (for G.I.S.), ATLAS*GRAPHICS (for computer cartography), and a couple of remote sensing software. Input and output devices of all kinds are available too.

The Hong Kong Baptist College setup is located as a G.I.S. unit within the Cartography Lab. Within the unit, there are five IBM PS/2 machines, each attached with a digitizing tablet. The whole setup is networked to the College's system, thus access to software can be obtained in many more locations. Since its inception in 1990, the list of purchased software has been expanding rapidly. A partial list include ATLAS*GRAPHICS and SURFER (for computer cartography), DRAGON (for remote sensing), and IDRISI (for G.I.S.). Future considerations may include VGA-ERDAS, pcARC/INFO or SPANS. Similar to other counterparts, usual input and output devices are installed.

Comparatively speaking, the Center of Land and Engineering Surveying of the Hong Kong Polytechnic possesses most high-end equipment and resources. This is no surprise, for all purchases there represent the sole effort of the center to promote geocomputing activities. Of particular relevance to this discussion are their Digital Cartography Lab and Geo-informatics Lab. The former consists of around 30 PCs and numerous peripherals like digitizers, printers, and plotters. The latter is even more impressive. It is equipped with five HP color graphics workstations, linked up by a large server that has one gigabytes of hard disk storage. They are used for advanced teaching, research, and consultancy purposes. The two principal software for land or geographic information systems analyses are ARC/INFO and GENAMAP. A Calcomp 9500 digitizer is also available for high precision digitizing of large sheets.

The above is an overview on facilities. A few words can be said on the specific curricula being offered to help train students in the field of geocomputing. At the undergraduate level, the three geography departments offer introductory courses on remote sensing and geographic information systems. Computer cartography is usually taught within other methodological courses. In fact, these course offerings are usually introduced as electives in senior years. For graduate work at the two university departments, no related course is offered in the strictest sense. However, students may enrol at the M.Phil (a research-oriented master degree) or Ph.D. levels and work with a faculty member who teaches and does research in that area. In a nutshell, the geocomputing education efforts at geography departments are still "sidelines" to major teaching focuses with the exception of undertaking a higher research degree.

Outside geography departments, there are two channels for such training at a more professional level. One is the adoption of land information systems training in one of the units in the M.Sc. in Urban Planning at the University of Hong Kong, primarily based on the use of pc ARC/INFO. This represents a small effort when compared to the Center of Land and Engineering Surveying at the Hong Kong Polytechnic. It concentrates in offering specific degrees closely assoicated with geocomputing. At the time of writing, it offers a B.Sc. degree in Surveying and Geo-informatics and a part-time modular M.Sc. degree in Land Information Systems. The latter is designed to be a re-orientation and continuing professional development program for land surveyors, planners, engineers, landscape architects, and other people who were past graduates in the pre-G.I.S. curricula era (Brimicombe, 1990, p.643). Besides such offerings, there are also a couple of research M.Phil. degree students in residence. In fact, the present curriculum is positive step towards establishing a spatial information discipline being taught and integrated alongside with traditional land surveying.

Such an attempt is a timely complement to the establishment of the Land Information Center in the Hong Kong government. According to Chan (1990) and other subsequent information updates, the Center is designed to fulfill three objectives:

1. To provide a land database on a unique geographical reference framework for efficient decision-making and land administration;
2. To speed up the updating and processing of land data; and,
3. To establish a core system to integrate other land-related systems to facilitate exchange and sharing of land data.

Its present task is to transform over two thousand map sheets at 1:1000 scales into digital form, via scanning and subsequent vectorization procedures. The expected date of completion is now targeted at 1994 from which the public will be able to purchase geographic data in digital form. Surely, the overall trend is now set to incorporate full scale automation on spatial data handling.

Surely, large capital input and cost-effective system design considerations are important to the success of the Land Information Center. Equally significant is the coordination from the education sector. Full-scale training of qualified staff from management to technician levels is urgently needed so that Hong Kong's pace of advancement along this line will not be hampered. From this angle, the efforts now being implemented are in the right direction and deserve full support, both from public and private sectors.

PROBLEMS FACING

Although Hong Kong is relatively

developed within Asian settings, the provision of geocomputing education is not without problems. The following is an attempt to elucidate the issue.

The problem easiest to be identified is money. Hong Kong's economic success lies in its past manufacturing and recent financial roles in Pacific Asia. High technology is still a "foreign" term for Hong Kong. In fact, among the Four Little Dragons in Asia, Hong Kong is the least developed in high technology. Therefore, both the quality and quantity of this development do not commensurate with its economic status. For any innovation, its initial startup cost is high. This is particularly burdensome in the education sector. The money for hardware is not an one-time expenditure. Maintenance cost should also be counted, perhaps as a recurrent expenditure. Likewise, added towards the purchase cost of software are the upgrade and license renewal fees. In most cases, a lab for such setups require at least the hiring of a technician to take over mundane daily maintenace of the system. A lab director should devote full attention to management decisions and planning instead. Therefore, justifications of such heavy spending must be given for asking approval. Within the geography department route, such requests have to compete against other equally appealling ones. When budgets are tight, the success of getting large funds really hinges upon the full understanding and support by heads of departments.

Another problem is the shortage of knowledgeable staff in geocomputing. Given the paucity of local training in the past, people who knows about the technology are usually trained overseas and are recent holders of higher degrees. Scarcity plus high demand will likely lead to higher pay requests, thus inducing the cost issue again. Given the fact that such expertise is still in rising demand in North America and elsewhere, together with the uncertainty of Hong Kong's political future beyond the year 1997, the outflow of such personnel is a likely prediction. In terms of seniority, most of these personnel are junior staff, thus weaken their arguments and say in more aggressive plans. In a nutshell, the "humanware" issue is a greater hurdle to overcome.

The third problem to face concerns with technology diffusion. Hong Kong's geographic situation is excellent for being a trade intermediary for China and other southeast Asian countries. However, in terms of high technology, Hong Kong's location is, at best, mediocre. Without doubt, the mecca of computer technology is either the United States or Japan. Even for Japan, Hong Kong is three to four hours flying time away. For an industry such as computer technology, new products appears on the market with great speed. Technology may diffuse contagiously (i.e. innovations are spread out faster with shorter distances). However, in most cases, it is transferred elsewhere in a hierarchical fashion. In other words, places of similar development levels will have greater contact probabilities for new inventions. Therefore, the likelihood of quicker adoption of new products is greater there. Luckily, as English is commonly used in Hong Kong, contacts with the U.S. is not a problem. However, distance and cost factors may partially constrain Hong Kong's adoption of the latest innovation in the shortest possible time. If educationists in the field is not fully alert on the latest developments across the Pacific, the lag problem in technology sophistication will persist.

A fourth problem to tackle is the ambivalence of the nature of geography. In the long run, the excellence in status for geocomputing may be hurt. Is geography an arts, a science, or a social science subject? The debate has lingered for long. From experiences worldwide, geography departments have occupied positions in all the three types of faculties. Locally, the department at the University of Hong Kong is located at the Arts Faculty. On the other hand, Baptist College's and Chinese University's departments are members of the Social Sciences Faculty. The department at National Taiwan University is housed within the Science Faculty instead. In securing large funding for high technology equipment, a geography department located in the Arts or Social Science faculties may encounter problems. This is especially the case when top administrators are unaware of the dual or trine nature of the discipline. Thus, the fight for money is sometimes a long and arduous one. More often than not, a defensive position is usually taken.

Lastly, the fate of geocomputing lies very much on the background of students enrolled in the programs. Within geography enrollments, the usual student intake comes from those who selected an

arts stream in their high school days. Therefore, they were exposed much more to disciplines like history, economics, literature, etc. Very often, these students in the arts stream are neither mathematically inclined or competent. A sense of phobia is commonplace among them on scientific concepts and applications. In a few cases when they have learnt some science subjects (like mathematics, computer science, etc.) in their lower forms, teaching geocomputing is an enjoyment to both teacher and students. On the contrary, a general deficiency in science and technology concepts is often the order of the day.

The above discussion clearly demonstrates the existence of economic and structural reasons which retard early and full-scale import of geocomputing technologies into the curriculum, at least from a geography department's perspective. There is no quick solution to those problems. However, something can still be done and they are presented below.

IMPLICATION ISSUES

Like other developing areas, Hong Kong is advancing into the area of high technology. Its problems are of great value to other areas which aspire to achieve similar statuses in the future. Therefore, several implication issues associated with the initiation and expansion of geocomputing education are listed here for references to educationists both locally and abroad.

Since financial resource is always limited, one must approach funds acquisition with tact. From experience, top administrators in universities, especially those small ones, are more interested to allocate resources to areas where students' marketability will be enhanced. In essence, a "cost-effectiveness" approach is often taken. This does not mean everything requested must be applied in nature. However, when one is able to justify large spending items in that direction, the chances of success may increase. When one is constrained with a tight budget, another consideration is to aspire for "medium" range products instead of the latest models which are often costly. Given teaching institutions are spending on public money, they will never be able to acquire the latest technology as done in private industry. A pramatic way is to follow an incremental approach: prepare carefully designed plans and chart out implementation by phases, with alternatives listed as contingencies. With some luck, what is worth achieving could still be available, although not immediately.

Another point of note is the importance of outside contacts in the expansion of geocomputing education. This include close liaison between the educational party and the government, consultancy firms, and various other agencies which take in students trained with geocomputing knowledge. To these organizations, the current students will be prospective employees in the future. To those students, these organizations are definitely the only employers. Thus, if some kind of internships could be arranged with these organizations, valuable experiences will be gained for the students. This shortens the time for on-the-job training when they are hired in the future. Also, if the level of competence of a department offering geocomputing training has reached a standard where sub-contracting of consultancy work could be done, this may be a source of discounted equipment which is often far superior than those could be purchased with regular limited funds. When infrastructural work of the developing world is on the rise in preparation for economic take-off, opportunities for such collaboration should be wide open. This is encouraging news to those planning geocomputing education in the future.

With regard to constant updates of technology, there is a definite need to keep abreast of these ever changing advancement. If current instructors were once trained overseas, connections with the West should not be any problem. Information about upcoming conferences, workshops, short-term training, and other related activities must be gathered. Also, subscriptions to major journals and magazines should be made. These actions ensure that the latest technology will not be masked because of the distance away from the focus of activities. Participation overseas entail costs. The institutions concerned should be responsible for subsidizing portions of the costs. If financial circumstances allow, experts passing by the territory should be invited to give seminars on topics of current concern. In doing so, constant enrichment on the topics will definitely raise the level of competency in all fields of geocomputing. However, one must be careful of straight adoption of foreign technology without modifications. In the long run, the policy of indigenization should be

followed so that this technology is managed eventually by local people.

From the above, one is able to find that geocomputing education is getting popular in Hong Kong. This is a product of a conducive macro environment. Also, training opportunities come in from diverse sources. Notwithstanding some difficulties, there are still ways to overcome them. As Hong Kong progresses into the 21st century, the extent of computerization penetrates into every sector of the society. Even high schools are now producing computer literate students in early stages. Such a source of potential intake very much favor further development of geocomputing activities. Once the ball has started rolling, worries are few. One needs only to concern whether the direction is correct or not.

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