

CURRICULUM DEVELOPMENT IN GEOMATICS EDUCATION: NEW CHALLENGES OF DIGITAL TECHNOLOGY

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*PAPER PRESENTED
AT
FIG REGIONAL CONFERENCE,
MARCH 8-11, 2006, ACCRA GHANA*

ABSTRACT

- Digital Revolution has made a great impact on every aspect of the Surveying profession including human capacity development and therefore poses a number of challenges particularly in Developing Countries.
- The first challenge is to expand the curriculum to incorporate new concepts and practice and to develop a systematic procedure for frequent revision of such curriculum as dictated by the new technology.
- The paper has therefore identified five stages of curriculum development and restructuring which are shown to be cyclic and interactive in nature as well as dynamic and continuous.

- Other challenges include training and retraining of staff-administrative, technical and academic and purchase of new and expensive electronic equipment and sophisticated software.
- The capital intensive nature of the new technologies in Geomatics has necessitated the trend towards commercialization of Geomatics education.
- With the advent of the Internet, and e-learning technologies, educational institutions are faced with yet another challenge of developing an interactive curriculum on their websites with obvious advantages associated with Distance Learning.

INTRODUCTION

IMPORTANCE OF CURRICULUM DEVELOPMENT IN MANPOWER DEVELOPMENT

- Any time an institution decides to develop or restructure a curriculum, it is customary to set up a small committee to produce a draft for processing and approval by various higher bodies. Developing or restructuring of curriculum is much more involved than this classical approach.
- The quality of graduates can be judged by the quality of the curriculum, which produces them. A poorly executed curriculum will produce half-baked graduates.

SOME CURRICULUM CHALLENGES OF DIGITAL TECHNOLOGY IN SURVEYING AND MAPPING

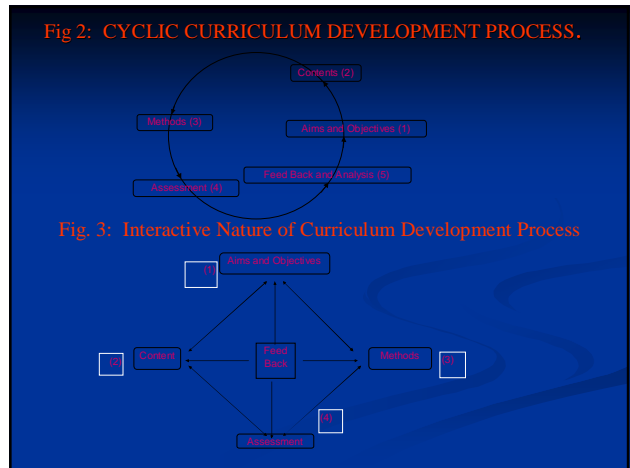
- The adoption of an integrated approach to mapping has in turn necessitated changes in the curriculum of traditional Surveying and Mapping institutions.
- There is the challenge of the educational sector playing a substantial role in providing, maintaining and sustaining technological input and skilled manpower adequate for the industry.
- Other challenges arising from Digital Information Technology include
 - commercialization of some aspects of education,
 - developing a web-based training programme in the new geoinformation technology,
 - lack of fund for the provision of new hardware and software and
 - lack of adequate manpower required for teaching the new and emerging technologies

CURRICULUM DEVELOPMENT AND RESTRUCTURING:

- One of the challenges arising from Digital Technology is the need to adopt a systematic procedure for periodic revision or restructuring of curriculum. This section discusses a five-stage systematic curriculum development/restructuring process which constitutes a solution to this challenge.

STAGES IN CURRICULUM DEVELOPMENT AND RESTRUCTURING

1. Defining the aims and objectives and goals of the proposed curriculum programme based on technological innovation and the needs of the nation for man-power development.
2. Structuring of the curriculum contents of proposed educational programme identified in the above stage 1.
3. Defining implementation methods and strategies for the proposed contents of the curriculum.
4. Identifying techniques for evaluation and assessment of both the students and the programmes and finally
5. Getting a feed back from the current students and from industry where the graduates of the new programmes are employed.



AIMS AND OBJECTIVES OF RESTRUCTURING

The challenge for Restructuring curriculums in surveying and mapping today may be predicated on two major factors :

- The first is the rapid technological innovations in hardware and software and methods for carrying out mapping operations.
- The second is the need to produce the necessary man-power, which will meet the needs of end users or employers.

One important aim of the restructuring is to produce man-power equipped with skills in modern techniques, which will satisfy end users in terms of high efficiency and quality and reduce cost.

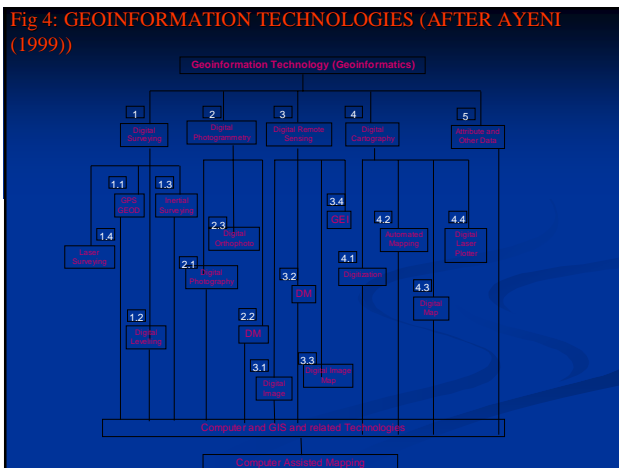
Ayeni (1992) has made a distinction between aims and objectives in curriculum development and restructuring. The aims of a curriculum are meant to indicate the general direction of a training or educational programme, whereas the objectives define the changes in behavior or skills of a graduate of the programme, hence the expression "behavioral objectives".

CURRICULUM CONTENTS FOR GEOMATICS EDUCATION

- One of the challenges of digital revolution is the need to restructure the curriculum and to shed off old and obsolete contents and to incorporate new concepts

FACTORS INFLUENCING CURRICULUM CONTENTS

- the objectives and aims set forth for the curriculum
- the state of the art of the technology at national and international level.
- the professional requirements
- the employer requirements
- the facilities available to the training institution concerned
- the human resources available for the delivery of the contents to the trainees and
- the current curriculum, if any, in the institution



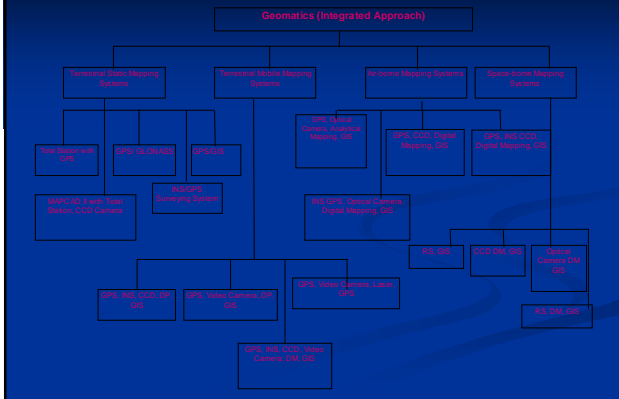
GEOMATICS APPROACH AND CURRICULAR CONTENTS

Geomatics approach for the purpose of this paper simply means integrated approach to modern surveying and mapping.

Four examples of systems, which can generate the contents for a revised curriculum are as follows:

- Terrestrial Static Mapping Systems such as, Total Station, GIS, GLONASS, INS, CCD camera, video camera and GPS
- Terrestrial Mobile mapping systems represent any combinations of new technologies carried on board a ground mobile vehicle to achieve the same result as above.
- Air-Borne Mapping Systems as GPS, receivers, INS, video camera and CCD or optical camera, carried on board an Aircraft.
- Space-Borne Mapping systems make use of artificial satellites as carriers for data acquisition systems

Fig 5: GEOMATICS: INTEGRATED APPROACH TO GEOINFORMATION (AFTER AYENI (1999))



USERS REQUIREMENTS SURVEY

User requirements survey is therefore very vital before undertaking curriculum restructuring. Users input to curriculum can be obtained through a well-designed questionnaire survey of actual and potential employers.

Questions should include the following;

- “Which of the classical methods are still relevant?
- “Which of the emerging technologies are most relevant and should be incorporated?
- “What should be the behavioural objectives of the restructured curriculum?”

A statistical analysis of the results of such survey will indicate the type of balance, which should be maintained between technological innovations and user’s requirements.

UNDERGRADUATE CURRICULUM STRUCTURE

The curriculum structure for undergraduates can be divided into **five** modules as shown in Table 1.

Modules I and II represent the “Spread”,
 Module III depicts the “Breadth” and
 Modules IV and V describe the “Depth”.

Table 1

MODULE	CURRICULUM CONTENTS	TRIPARTITE CONCEPT
Module I	General Courses	
Module II	Mathematical foundation courses	Spread
Module III	Pseudo-Specialised Courses	Breadth
Module IV	Specialised Courses	
Module V	Specialised Practical Project	Depth

POST GRADUATE CURRICULUM STRUCTURE

For postgraduate programme, the tripartite concept still holds, but the relevant modules are modules II-V. With more emphasis on the “depth” concept for the purpose of research.

The area of “Depth” in modules IV and V will therefore be narrower and deeper than the undergraduate programme; consequently the amount of time devoted to “Depth” will be greater than that of the undergraduate programme.

A postgraduate programme will also pay more attention to research in Geomatics systems in Fig. 5.

IMPLEMENTATION METHODS

The Digital Technology has given rise to new challenges in implementation methods. For example, instead of the classical blackboard and chalk method for teaching, the instructor can use an electronic writing board with the electronic pen on-line with a bank of computers (PCs) for students. There are four categories of computer applications methods for teaching and management of education programme, developed by the University of Idaho.

- Computer assisted instruction (CAI): - self teaching and self contained lecture notes.
- Computer managed instruction (CMI): - use of computer for efficient administration of the programme.
- Computer mediated communication (CMC): - use of computer for communication amongst administrators, lectures and students.
- Computer base multimedia (CMB): - use of multimedia devices for instruction.

- Power point presentation using the ultra vision projection with multimedia capability can also facilitate quicker and faster and clearer delivery of lecture notes and capability. Besides the class assignments and tests can be posted as the departmental website for student. Announcement can be made to student through their emails and websites. The digital library and Internet library for electronic books, journals, and proceedings are also new creation of implementation methods arising from Digital Technology.
- Laboratory and field work practical have been made easy with the use of electronic equipment such as Digital Theodolite, Total Stations, Computer Work Station, Global Positioning System, Website Mapping and Electronic or Laser Plotters/Printers, Electronic Field Book and Electronic Writing Pads which have in turn facilitated the teaching of digital cartography, digital surveying digital photogrammetry, digital remote sensing.
- For developing countries the biggest challenge is lack of funds to acquire these modern equipment and software for implementing the new curriculum, and for conducting training and research. The other challenge facing lecturers in developing countries is to teach from well prepared lecture notes and from a wealth of consultancy and experience.

EVALUATION AND ASSESSMENT OF CURRICULUM

Any new or restructured curriculum must be evaluated and assessed frequently so as to maintain the dynamic nature of curriculum development. The result of the evaluation constitutes a vital input into any future curriculum revision or restructuring.

EVALUATION AND ASSESSMENT OF STUDENT PERFORMANCE

This is usually done by way of Quiz, test, examination, term paper, project, seminar, Practical Task, thesis and dissertation, Ayeni (1992, 1997) There are three types of assessment –

1. terminal,
2. periodic and
3. continuous assessment.

The results of the evaluation and assessment over a period of three to four years must be analysed and studied to see if the curriculum contents and the instructional methods and facilities need to change. The first is the “Feed Back” from students.

COURSE EVALUATION

This exercise is meant to allow students evaluate a curriculum as well as the facilities available and the teacher’s ability and capability. This is usually done by students who are requested to complete anonymous questionnaire at the end of the course. The questionnaire must be carefully done to highlight some important features of the course. The diagnosis and analysis of the findings of the completed questionnaire represent the second “Feed Back” which must be ploughed back into future revision of the curriculum.

FEEDBACK FROM INDUSTRY (Evaluation of Graduate’s Performance)

This evaluation is made in the industry where the products (graduates) of the curriculum are employed. This is the third “Feed Back”. The questionnaire survey to be used must be carefully designed and completed by both the graduates produced from the curriculum and by the employers. From the analysis of responses to the questionnaire, the aims and objectives, the adequacy of curriculum contents and instructional methods can be re-evaluated. The three types of “Feed Back” described in this section will make curriculum restructuring easy, systematic and rational.

COMMERCIAL ASPECT OF CURRICULUM DEVELOPMENT AND DISTANCE LEARNING

One of the greatest challenges confronting educational institutions relates to commercialisation of education and training. Ayeni (1999) has observed that geoinformation technology was borne in a commercial environment of Digital Technology and is therefore capital intensive .

In developing curriculum on a commercial basis, some institutions have taken advantage of networking technology and the Internet to create Virtual Universities or Virtual Campus. The Digital Information Technology facilities on the internet such as Hyperlinks, and Network Technology Multimedia Capabilities, email, voicemail, Electronic Bulletin Boards, World Wide Web and the browsing services Home page, chat rooms, internet phone, file transfer services and the search engine have made this possible.

CONCLUSIONS

The major challenges arising from digital revolution is developing or restructuring Geomatics curriculum may be summarised as follows:

- Curriculum development must be a dynamic and cyclic process which may require occasional restructuring given the dynamic and rapidly changing nature of digital revolution.
- The Digital Technology has given birth to Digital Surveying, Digital Photogrammetry, Digital Image Processing in Remote Sensing, Digital Cartography which require capital intensive digital equipment.
- The problem of adopting modern technology to deliver curriculum contents to students poses another challenge
- There is also the challenge of adopting a policy of commercialisation of some aspect of Geomatics curriculum in order to recover part of the huge amount of money for purchasing new digital equipment and software and for training and retraining new and existing staff.

RECOMMENDATIONS

From the foregoing challenges imposed by Digital Technology the following recommendations are made for educational institutions in developing countries where there is need to develop or restructure Geomatics curriculum:

- The new concept of dynamic and cyclic nature of curriculum developing illustrated in figs 1 and 2, which require a revision and restructuring every 4-5 years and every 8-10 years respectively should be adopted.
- Modern technology using digital audio-visual equipment should be utilised for delivery of curriculum contents to the students because it is a faster and more efficient method of delivery model.
- Technical assistance in one form or the other is desirable for the implementation of new Geomatics curriculum where institutions lack the staff and technical know how and funding necessary for the adoption of the new technologies and for training and research.
- A user requirements survey should be conducted as a bottom-up approach to and as an integral part of, curriculum development or restructuring.

THANK YOU