

Geomatic Engineering Education at the University of Mines and Technology (UMaT), Ghana

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Key words:

SUMMARY

This paper is about Geomatics education and how this is being developed at the University of Mines and Technology (UMaT) (formerly The Western University College of the Kwame Nkrumah University of Science and Technology (WUC-KNUST)). The evolution and development of Geomatics training in the UMaT and the current status of the programmes that have been developed so far are discussed. The start of the growth, planned direction, expected results and impact on the Geomatics profession in Ghana are explored. The challenges facing Geomatics education at UMaT are discussed and current industries employing our graduates are explored.

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1. INTRODUCTION

The term Geomatics is an acronym formed by “geo” meaning Earth, Information and “automatics” (Gagnon et al, 1988) meaning information automation. Geomatics is thus an integrated approach to the acquisition, analysis, storage, distribution, management and application of spatially referenced data.

Various surveying or mapping disciplines are involved in various levels of Geo-Information Systems with other disciplines such as Computer Science, Information Technology, Planning, Geography, Environmental Studies and Mathematics. Geomatics has become a necessary technological tool in almost all [science-based courses and some art-based] courses all over the globe.

Geomatics education is multi-disciplinary, covering a wide range of activities such as Planning, Land Administration, Land Surveying, Geodetic Surveying, Engineering Surveying and Mapping. New technologies such as Geographic Information Systems (GIS), Digital mapping and Global Positioning Systems (GPS) have also boosted geomatics education. This paper seeks to highlight surveying and mapping education at UMaT and its impact on the mining industries in Ghana.

1.1 The Genesis of Geomatics at UMaT

The Diploma in Mine Surveying programme that was mounted by the then Tarkwa School of Mines (TSM) needed to be certificated by a University. Previously this was being done by the City and Guilds Institution of London. When the TSM became affiliated to KNUST in 1976, the then TSM became the KNUST School of Mines (KNUSTSM) and certification of the Diploma in Mine Surevying was done by the KNUST..

In 2000, the University council and the Institute of Mining and Mineral Engineering (IMME) proposed the merger of the two Schools of Mines, namely; KNUSTSM and the School of Mines, Kumasi. These changes also brought about the reorganization of the departments at Tarkwa to reflect current trends. As a result, the Mine Surveying section of the Department of Geology and Survey was upgraded to become the Department of Geomatic Engineering to reflect the current changes in the surveying profession. Hitherto our students with Mine Surveying certificates found it difficult to obtain jobs outside the mining industries as most establishments were of the view that the graduates were being trained to work in only mining establishments. The name change will greatly enhance the chances of graduates in Geomatic Engineering obtaining jobs in other sectors of the economy.

1.2 Justification

Ghana, like all developing countries requires surveyors in almost all the sectors of its economy to push forward its infrastructural developmental agenda. In line with the vision of the WUC, the Diploma programme in Mine Surveying was upgraded to the BSc programme in Geomatic Engineering.

Rapid advancement in Computer Science and Information Technology and Instrumentation have brought in their wake great improvements in surveying and mapping techniques. The surveying industry is becoming a fully-automated and IT-based profession in which spatial data will be at the 'heart' of the profession. The Geomatic Engineering Department of the UMaT cannot afford to be left out of this development.

The advent of Geographic Information Systems, Global Positioning Systems and Remote Sensing has made the geomatician a multi-disciplinary professional. It has therefore become necessary to train such professionals to help in the developmental agenda of the country for sustainable development.

1.3 Objectives

In order to achieve the above, it is necessary to provide:

- A broad based, analytical and intellectually developed geomatician, who is capable of working under rapidly changing environments.
- A high knowledge of skills in the application of the necessary technologies, methodologies and equipment that may be required.
- Good management and entrepreneurial skills.
- Professionals who are knowledgeable in some advanced key areas and possess key research skills.
- Professionals who are confident, sound and can prove themselves in any field that may require the services of the geomatician.

2. CURRICULUM DESIGN

The curriculum was designed to meet the above objectives and may be classified into six broad areas:

- i. Science – Mathematical Analysis and Algebra, Solid Geometry, Calculus etc
- ii. Language – English in Literature, Communication Skills etc
- iii. Computing – Introduction to Computing, Computer Programming, Computer Applications in Geomatics.
- iv. Technical – Surveying, Surveying Instrumentation, Geodesy, GIS, GPS Remote Sensing etc.
- v. Management courses – Management Skills, Entrepreneurship, and Principles of Economics.

- vi. Mining – Introduction to Mining, Operations Research. Mining Laws and Regulations etc
- vii. Others – Geology of Ghana, Land Law, Law of Contract and Tort, Land Information Systems, Soil and Rock Mechanics etc.

The “backbone” of the degree programme in Geomatic Engineering at UmaT is computing skills and computer applications and for that reason, Computing and Computer Applications are integral parts of the programme and are taken from the first to the fourth years. The candidates admitted to this programme are required to do a minimum of 120 credits to qualify for the award of the BSc degree in Geomatic Engineering (Anon, 2004).

Table 1 shows a classification of the credits allocated to each of the six broad areas described above.

Table 1: Credit distribution for the seven areas identified.

AREA	TOTAL CREDITS ALLOCATED
Sciences	13
Language	6
Computing	4
Technical	66
Mining	9
Management	8
Others	16

Most of the technical courses have computer based applications. Final-year students may opt for projects in the following courses: Geographic Information Systems, Surveying, Global Positioning Systems, Engineering Surveys, Land Administration and Spatial data Infrastructure.

The Geomatic Engineering degree programme at UmaT has been designed for Senior Secondary School (SSS) graduates. For admission, candidates must have passes in three core subjects i.e. English, Mathematics and Integrated Science and passes in the three science subjects i.e. Physics, Chemistry and Mathematics or Physics, Mathematics and Geography.

Students having satisfied the minimum requirements and passed all required courses in addition to the completion of a supervised project in the final year will qualify for the award of the BSc honours degree in Geomatic Engineering if a cumulative weighted average of more than 45.0 is achieved. The first group of students were admitted in the 2000/2001 academic year and graduated on the 26th of June 2004 with the following breakdown in the classes obtained:

Table2: Grade distribution of recent graduates

B.Sc grade obtained	Percentage(%)
First Class Honours	4
Second Class (Upper Division)	71
Second Class (Lower Division)	4
Pass	Nil
Trailing	21

3. PROBLEMS AND SOLUTIONS

3.1 Problems

The problems that have been identified with the Geomatic Engineering programme at the UMaT include:

- Current modifications in courses in the profession
- Teaching facilities and personnel
- Graduate placements in the industry
- Marketing the profession

3.2 Solutions

Some of the strategies adopted to address the problems include

- Undertaking a marketing drive to highlight the programme and creating awareness for services in the geospatial industry. The student association has played a leading role in marketing the profession. The alumni of the Department have also been playing a vital role in getting their superiors educated about Geomatic Engineering. The University and the lecturers in the Geomatic Engineering Department have also been assisting in promoting the programme and making it attractive whenever a seminar or a conference is being held on the UMaT campus.
- Collaborative efforts with other leading universities in geomatics in the world is being pursued by staff in the Department. Local collaborative efforts are underway with some local geomatic companies in the country. It is envisaged that some efforts will also be made in engaging some mining companies to take keen interest in the Department's programmes.
 - Well-qualified staff in the geospatial industry in Ghana, with degrees from leading universities in the world with tremendous field experience are being employed as Lecturers.
 - Funds are being sourced from GETFund and TALIF to obtain up-to-date equipment and software to augment equipment stock of the department.
 - A continuing professional development programme has been put in place. This involves alumni in the industry being invited to share their experiences with the students so as to educate and prepare the students for the realities in industry.

4. GRADUATE PLACEMENT

Graduates of the Department have found placements in almost all the sectors of the economy. Table 3 shows percentages distribution of where our graduates have found employment as at August 2004.

Table 3: Areas where our graduates have found employment

Establishment	Percentage employed (%)
Mining	40
Exploration	14
Construction (Road / Building)	7
Ghana Highways Authority	2
Survey Consultancies	14
Irrigation works	2
Others (Involved in postgraduate work)	12

Table 3 shows that the mining industry employs has been the greatest employer of graduates, from UMaT. Graduates have also found employment with other mineral exploration establishments with others joining some private established surveying consultancies. Other vital areas of the economy have realized what the graduates are capable of doing with a few of them having obtained employment and working as surveyors abroad.

The versatility of the program have made it possible for the graduates of the department to fit in all engineering and construction professions that has something to do with measurements.

5. CONCLUSIONS

A general overview of Geomatics education at the UmaT has been provided.

There is no doubt that rapid advancements in IT technology have revolutionised Geomatics education at the UMaT. The new technologies have placed a great demand on curriculum review and update almost on a yearly basis.

The challenges for the programme are enormous, training of lecturers, updates on new technologies and equipment with the necessary current software are always a great challenge to the Department.

Sources of funding are not readily available but it is hoped that most of these problems will be solved as soon as the V-SATT of UMaT (which is currently being fixed) is installed so as to provide the Department with easy connectivity to the internet.

It is hoped that the graduate of this programme will be a refined geomatician who is confident in outlook, skilled, current and adaptable to these rapidly changing technologies.

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BIOGRAPHICAL NOTES

E. E. Duncan holds a BSc degree in Geodetic Engineering from the University of Science and Technology, Kumasi, Ghana and an MSc degree in Topographic Science (Surveying) from the University of Glasgow, UK. He worked on a UNICEF mapping project of the Northern regions of Ghana in 1993 as a Surveyor. In 1996 he joined the University of Mines and Technology where he now lectures in GIS, GPS, Geodesy, Remote Sensing and Least Square Adjustments. He is currently affiliated to the ICES and an academic member of the International Federation of Surveyors (FIG).

Mr. **Stephen Djaba** is the Principal Consultant and Director of Projects and GPS Surveys. He graduated from Kwame Nkrumah University of Science of Science, School of Mines Tarkwa and with Diploma Mine Surveying in 1994. He has acquired GPS training from Royal Melbourne Institute of Technology in 1994. SOKKIA SINGAPORE and SOKKIA SOUTH AFRICA have trained him on GPS application. He has established geodetic transformation parameters from WGS84 to Ghana National Grid. He is currently a Co- Chairman of International Federation of Surveyors (FIG) Commission 1 working Group 3. He is member of Africa Reference System Committee Working on Geodetic framework of Africa.

Mr. Stephen Djaba is a qualified Engineer and Professional Land Surveyor of over ten years experience. . Mr. Djaba is an expert in Geographical Positioning Systems and serves as a consultant to a number of firms undertaking GPS related Surveys. His in-depth knowledge in survey is an asset in the efficient execution of all aspects of engineering survey. He was in charge of most of Offshore Surveys for Stone & Webster at Takoradi Thermal Plant. He also champions the GPS Surveys for the Dualisation of Accra – Kumasi Road. He has been involved in many roads Surveys in the Mines and other place.

Mr. Djaba serves as a resource person for seminars and workshops focused on imparting knowledge on modern trends in survey and Mapping. Over the years, he has developed an integrated approach to the execution of his assignments right from fieldwork through data processing to production of design drawings using Computer Assisted Design Systems. He has full control of using Arc Map for creating Spatial Data Infrastructure database. He has also assisted as Geodetic Engineer and Road Engineer in creating the GIS database for

Department of feeder roads. He was the Team Leader for the recent roads inventory Survey for Department of Feeder roads in the northern region in ten districts.

Mr. Stephen Djaba's experience spans, provision of ground control using GPS, route location, road survey and pipeline survey. .

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